





AN ASSESSMENT OF CURRENCY EXPOSURE OF NON-FINANCIAL FIRMS IN ASEAN-4: INSIGHTS USING THE STOCK RETURNS AND CASH FLOW METHODOLOGIES




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ABSTRACT

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This study examines the extent and nature of foreign exchange exposure in 405 listed corporations operating in the ASEAN-4 nations, Indonesia, Malaysia, Singapore, and Thailand. The study period of 23 years, from 1995 to 2017, covers the two major crisis periods, the Asian financial crisis (AFC) of 1997 and the global financial crisis (GFC) of 2008. Our study improves on earlier work by using two alternative assessment methods, i.e., stock returns (SR) and cash flow (CF) methods. We report several interesting and noteworthy results. First, we find that the stock returns approach results in a higher incidence of exchange rate exposure relative to the cash flow method. Specifically, about 65% and 28% of the total ASEAN-4 firms had significant exposure to all currencies under the stock returns and cash flow methods, respectively. Second, we find the sample firms to have predominant exposure to the US dollar, signifying the important role played by the United States (US) as the major trading partner of the ASEAN-4. Third, when evaluating time-varying exposure, we find that the incidence of the exchange rate exposure is event-specific. Most of our sample firms were highly exposed to exchange rates during the mid-points of the AFC and the GFC.

Contribution/Originality: The main contribution of the paper lies in its two alternative approaches to foreign exchange risk measurement, which are the stock returns (SR) and cash flow (CF) methods, with special emphasis given to the small and open economies of ASEAN-4 countries.

1. INTRODUCTION

In an open economy system, the foreign exchange rate plays a significant role in international transactions. The foreign exchange rate is defined as the price of one currency denominated in another currency. After the collapse of the Bretton Woods System in the 1970s, most developed countries around the globe decided to let their domestic currencies float against several foreign currencies to some extent. This switching regime, from the fixed-

rate system of the Bretton Woods to floating exchange rates, injected new energy into foreign exchange markets. Even though currency risk has become a key risk for firms undertaking cross-border transactions, multinational corporations (MNCs) with diverse foreign operations are not immune from currency risk.

This paper, which assesses currency exposure in the Association of Southeast Asian Nations (ASEAN) region, was motivated by several justifications. First, ASEAN countries have the characteristics of small and open economies. The small and open economy hypothesis suggests that any increase in the degree of openness among small economies will increase the sensitivity toward exchange rate fluctuations (Bodnar & Gentry, 1993). In terms of trade openness of ASEAN countries, notably ASEAN-4 countries registered a very high foreign trade (import and export) percentage per gross domestic product (GDP). According to the World Bank's data, in 2018, the foreign trade ratio (FTR) for Indonesia was 43% of GDP, Malaysia's was 130%, Singapore's was 325%, and Thailand's was 120%. In comparison, the developed nations of the United States and the United Kingdom reported 27% and 67%, respectively. The soaring percentages of ASEAN's share in the world trade have positioned the ASEAN nations as rising competitors of leading global economic powers (Muller & Verschoor, 2006).

Second, this study contributes to the existing literature on ASEAN markets through an assessment covering two significant financial crises, which are the Asian financial crisis (AFC) of 1997 and the global financial crisis (GFC) of 2008. The spread of market contagion during the Asian crisis of 1997, stemming from persistent exchange rate volatilities, began after the Thailand authority abandoned the de facto US dollar peg in July 1997. This had rapidly spread negative spill-over effects into the neighboring countries, such as Malaysia, Singapore, Thailand, and the Philippines. The domino effect was inevitable since most ASEAN countries have almost identical economic fundamentals. The impact of the Asian crisis in 1997 had far-reaching implications. Thailand and Indonesia experienced their lowest negative rates ever recorded, i.e., -5.51% and -7.01%, respectively, while Singapore, on the other hand, was the least impacted by the crisis. The weak economic situation was aggravated by sizeable foreign capital flights that disrupted supply chains and created huge deteriorations in the balance sheet items (Mishkin, 1999). Aside from the AFC, the ASEAN-4 countries were also affected during the GFC, which originated in the US. The impact, however, was much less than that of the AFC. Although the impact of the crisis on the ASEAN-4 economies was not as direct and significant compared to Europe and the northern hemisphere of developed nations, it nevertheless enhanced the volatility of exchange rates in Asia Pacific (Ahmed, Rhee, & Wong, 2012). Given that the epicenter of the crisis was in the United States and the United States Dollar (USD) is the major trading currency among ASEAN countries, it is not unusual for the ASEAN region to be susceptible to the foreign currency shocks during a crisis. In addition, the economic downturn of the US and other western economies strongly affected the export of ASEAN goods. Thus, it is expected that the GFC had a huge influence on the extent of currency exposure of ASEAN-4 firms.

Third, from the methodological perspective, limited studies have focused on measuring the extent of currency exposure from two different approaches, namely stock returns and cash flow, particularly in the context of ASEAN firms. The cash flow method provides valuable information for managers on the direction and degree of exposure resulting from the firm's operating cash flow. Such information is beneficial for both corporate planning and risk management strategies. Managers will be provided with the knowledge of how much the firm's cash inflows and outflows change for a given currency movement over time. Regarding the stock returns approach, the information on the extent of exposure is important for investors and investment portfolio managers. An investor can shield his equity position by taking an off-balance-sheet hedging procedure, i.e., through financial derivatives. Foreign exchange exposure is also beneficial for a portfolio manager in protecting the underlying assets from the currency exposure through a diversification process.

Given the above, the main objective of this study is to gauge the extent and time-variant nature of the exchange rate exposure for non-financial firms in Malaysia, Thailand, Indonesia and Singapore. Following the main objective of the study, we refine it into the following sub-objectives:

1. Examine the variation of currency exposure of ASEAN-4 firms.
2. Examine the variation of currency exposure by country and currency.
3. Examine the time-variant nature of currency exposure under different episodes of the Asian financial crisis and the global financial crisis.

This study enriches the existing literature in several ways. First, the study evidences the prevalence of currency exposure among ASEAN-4 non-financial corporations. Second, it establishes that the USD remains the major source of currency risk. Third, it was found that the extent of currency exposure of ASEAN-4 firms is event-specific regarding the two significant financial crises. Interestingly, the pegged exchange rate system adopted by the Malaysian government during the AFC had a negligible impact in reducing the severity of currency exposure. Finally, the extent of currency exposure is more prevalent under the stock returns (SR) approach relative to the cash flow (CF) approach. The dominance of the SR approach is indicative of the flexibility and forward-looking expectations inherent to the method, while the CF method concentrates only on past information. In efficient markets, expectations could be rapidly embedded into equity returns, whereas such an effect is beyond the CF approach. The future expectations element of the SR approach captures long-term exposure, which is complex and challenging to detect and manage. Thus, timely and enhanced disclosure of financial reporting would improve the detection of currency exposure underlying both approaches.

This paper is divided into five parts. The following section undertakes a comprehensive review of the previous literature's summary and key findings. In section 3, the characteristics of the data and the models used in the study are discussed in-depth. In section 4, all the estimated results are presented. The findings are combined, and emphasis is given to the significance of currency exposure in relation to ASEAN-4 firm values. Section 5 presents the concluding remarks helpful in drawing out essential lessons and implications for market players and policy consideration.

2. LITERATURE REVIEW

2.1. Stock Returns and Cash Flow Approaches

Fundamentally, there is a strong link between exchange rate movement and stock market behavior. This co-movement between exchange rate and firm value becomes a salient factor under the international asset pricing paradigm (Bartram & Bodnar, 2012; Bartram, 2019). Classical economics argues that exchange rate variability can be an important source of unsystematic risk on international trading firms contingent upon an investment horizon (Hadian & Adaoglu, 2020). According to Adler and Dumas (1984), currency exposure can be defined as the sensitivity of firm value to exchange rate changes. Exchange rate uncertainty strongly influences the current and expected cash flow from foreign operations. Furthermore, such unexpected exchange rate movements not only affect firms' competitiveness both in the local and foreign markets, but it can also influence the relative values of foreign assets and liabilities (Chou, Lin, Hung, & Lin, 2017; Sikarwar & Gupta, 2019). The way that exchange rate movements can create an economic impact on firm value can be explained by various mechanisms. The appreciation and depreciation of domestic (foreign) currency produce opposing results for corporate revenues and input costs subject to the nature of importing and exporting activities (Bartram & Bodnar, 2012; Shapiro & Hanouna, 2020). Throughout this study, exchange rates are reported as local ASEAN-4 currency (domestic) per unit of foreign currency.

The stock returns (SR) approach can be seen as complementary to the cash flow (CF) approach. The stock price is defined as the present value of current and future cash flow, making stock returns a comprehensive measure of a firm's performance. Knowing the extent of stock return exposure against foreign exchange changes allows market participants to manage their equity investment holding and hedging decisions. Such information is beneficial for portfolio managers in creating diversified portfolios. If currency risk is a factor, firm managers could use the information from the SR approach to determine a fair discount rate for future investment opportunities. For firms

that grant compensation in the form of stocks and stock options, the foreign exchange risk information helps them make appropriate adjustments and hedging measures to realize a gain from existing stock options.

The CF information favors those concerned with firm-specific conditions, especially a firm's management, staff and bondholders. This approach gauges the direct effect of changes in the foreign exchange rate on firm denominated cash flow.

According to Bartram (2007), there is a strong theoretical relationship between the firm value (stock returns) and historical cash flow. For instance, in a simple model of perpetual cash flow, stock return exposure should be identical to the cash flow exposure. Therefore, the theoretical structure that relates to the net cash flow and stock returns can be defined as:

$$\frac{d \ln V}{d \ln E} = \frac{d \ln CF}{d \ln E} \quad (1)$$

Where V is firm value, CF is cash flow, and E is foreign currency. The above formula implies that any change in firm value relative to changes in the foreign exchange rate should be identical to the changes in the net cash flow over changes in the foreign currencies. However, in reality, Equation 1 is not easily maintained. The identification of exposure between the cash flow and stock returns approaches may differ for several reasons. First, the cash flow approach places emphasis on the historical cash flow, while the stock returns approach uses current and future cash flows. Thus, stock returns exposure may be beyond those captured in cash flow exposure. Second, the different variations of exposure on future cash flow might be driven by the expectation of investors, future competitive effects, and long-term forecasts. For instance, when an investor incorporates a range of influences of future competitive effects, such effects cannot be detected by the cash flow approach. Third, Martin and Mauer (2005) argue that the lack of sufficient and timely financial information disclosures on the extent and management of foreign exchange risk increases stock returns exposure. Due to these factors, the stock returns approach should provide better evidence of significant exposure. Finally, the cash flow method covers transaction (short-term) exposure, which could be easily identified, measured and hedged through widespread use of foreign currency derivatives. The higher frequency of the publicly available data of the stock returns approach provides a methodological advantage as more exposure can be easily detected (Chortareas, Jiang, & Nankervis, 2011).

2.2. Incidence of Stock Returns Exposure

Research on the incidence of exchange rate exposure to corporate performance has been widely examined in developed economies (Bartov & Bodnar, 1994; Bartov, Bodnar, & Kaul, 1996; Bartram, 2019; Choi & Prasad, 1995; Jorion, 1990; Sikarwar & Gupta, 2019). The measure of exchange rate exposure on stock returns was initiated by Adler and Dumas (1984), who proposed the total exposure model, which embeds both firm-specific and macroeconomic influences. Jorion (1990) introduced the residual exposure model, which proposes the residual market exposure slope (β_M) on the right-hand side of the equation to measure the excess market's reaction to exchange rate movements. However, this traditional measure of currency exposure produced a limited degree of significant exposure, documented by Jorion (1990), where 5% of the total sample of US firms (15 out of 287) had significant exposure to changes in the trade-weighted exchange rate from 1971 to 1987. In the same vein, a strand of literature (Boudt, Neely, Sercu, & Wauters, 2019; Sikarwar & Gupta, 2019) exhibits the small level of exchange exposure of firms in underdeveloped economies, which is mainly attributable to the widespread use of hedging instruments.

There is a growing number of studies that have examined the exchange risk of ASEAN corporations, including Suhaimi and Abdul Wahab (2021); Anisak and Mohamad (2020); Cheng, Chu, Song, and Lai (2017); Abdul-Wahab, Husin, Nordin, Yusoff, and Zainudin (2017); Hendrawan (2017); Bacha, Mohamad, Zain, and Rasid (2013); Bartram and Bodnar (2012); Muller and Verschoor (2006); Dominguez and Tesar (2006). The recent study by Suhaimi and Abdul Wahab (2021) tested the asymmetric property of exchange rate exposure of Malaysian non-financial firms

from 1995–2015. The study found that most sample firms had significant negative exposure to the USD. Anisak and Mohamad (2020) examined the extent of exchange rate exposure of Indonesian listed firms using the multivariate regression with a generalized autoregressive conditional heteroskedasticity (GARCH(1,1)) specification. With a sample of 100 Indonesian firms within a period from January 1994 until November 2015, the study found that 80% of the sample firms had significant exchange rate exposure. The Japanese yen became the main source of foreign exchange risk. Chen and So (2002) examined the incidence of currency exposure surrounding the 1997 Asian financial crisis for selected corporations in the Asia Pacific Region, including Malaysia, Indonesia, Singapore, Thailand, and Japan. They found a higher incidence of exchange exposure among Indonesian and Malaysian firms, where about 50% and 41% of Indonesian and Malaysian firms, respectively, were significantly exposed to all currencies. Next, Muller and Verschoor (2006) conducted a large-scale study involving 3000 Asian trading firms. The study recorded that 25% of the total firms were significantly exposed to the USD. Further, the study found that highly levered firms were more likely to be exposed to exchange rate risk. Bacha et al. (2013) examined the incidence of currency exposure of 158 listed Malaysian firms from 1990 to 2005. They found that 71% of Malaysian firms had significant exposure to the USD, where most of the beta signs were negative, suggesting that Malaysian firms were net importers. In relation to time-varying exposure, the study found higher exposure to the USD during the pegged regime compared to the de-peg period, implying that a managed floating system provides greater market flexibility and minimizes firms' sensitivity to exchange rate risk. Bartram and Bodnar (2012) studied the sensitivity of firm value to changes in the exchange rate for 4404 non-financial firms across 37 countries ranging from developed to developing economies, including the ASEAN-4 countries. For the 12 years from July 1994 to December 2006, the study had interesting findings where the least exposed firms were from developed economies, including the US, Portugal, and Canada. On the other hand, a higher fraction of exposed firms was among developing countries, including ASEAN-4, where Indonesia recorded 35.3% of exposed firms, followed by Thailand (27.6%), Malaysia (15.5%), and Singapore (10.3%). The study argued that the widespread hedging routine among corporations in developed countries significantly contributed to the lower level of exposure. In summary, it is worth noting that most past studies focused on the ASEAN region reported an enhanced level of currency exposure compared to developed economies and, specifically, very significant exposure to the USD. Cheng et al. (2017) argued that the high incidence with the USD was attributable to the lack of risk management against exposure to the USD.

2.3. Incidence of Cash Flow Exposure

Examination of the relationship between changes in exchange rates and operating cash flows is considerably limited. Most studies mainly focus on developed economies, such as the United States (US), the United Kingdom (UK), and Europe (Bartram, 2007; Martin & Mauer, 2003; Martin & Mauer, 2005; Oxelheim & Wihlborg, 1995). Martin and Mauer (2003) examined the currency exposure of financial institutions, and the exposure measurement involved 127 US banks with a minimum of one billion USD in assets from 1988 to 1998. About 88% of domestic banks and 72% of all international banks' cash flows were affected by changes in foreign currency. International banks hedged currency exposure more than domestic banks. Secondly, international banks have more expertise, resources, skills, and organized risk management systems. Overall, long-term exposure was more evident than short-term exposure, underpinned by the fact that short-term exposure can be easily defined and hedged using well-designed financial and operational hedging instruments.

Martin and Mauer (2004) tested the relationship between economies of scale and the extent of hedging activities that have been widely discussed in the literature (Bartov & Bodnar, 1994; He & Ng, 1998). The analysis was conducted on 107 US-based MNCs directly involved with European markets from 1989 to 1998. The methodology used to gauge the exposure was identical to Martin and Mauer (2003). It was found that MNCs with a large concentration of trading activities with Europe had limited European currency exposure (approximately 22%

of the total firms with significant exposure) but displayed a high percentage of significant exposure to changes in the non-Euro currencies (Canadian dollar and Japanese yen). The results imply that the justification for the hedging programme was more feasible for a trading partner with substantial involvement in foreign businesses. Since the samples were corporations with extensive involvement in European trade, the hedging activities for other non-major currencies were less justified and, therefore, the exposure was more likely to be left unhedged.

Li, Moshirian, Wee, and Wu (2009) measured currency risk exposure using the cash flow method for the insurance industry. The sample was 73 non-broker US insurers in the life and non-life industry from 1990 to 2003. The proxy for cash flow used in the study was operating income before depreciation and amortization. The model used in the study was identical to Martin and Mauer (2003). More exposure was documented for domestic insurers. There was an extra willingness for hedging by international insurers, underpinned by the fact that they had to face omnipresent transaction and economic exposure. Small insurers were found to be exposed more than large insurers. Large firms seem to benefit from the economies of scale with hedging activities. The study also showed that long-term exposure was more evident than short-term exposure, which corroborates the finding of Martin and Mauer (2003).

2.4. Comparative Studies: Stock Returns and Cash Flow Methodologies

For a comparative study between the stock returns and cash flow methods, Martin and Mauer (2005) found non-overlapping significant exposure among US banks, with some analyses reporting a high incidence of cash flow exposure, while others displayed stock returns exposure. Specifically, between 1989 and 1998, when banks had significant cash flow exposure, about 70%–100% of them showed no exposure based on the stock returns approach. In contrast, about 25% of the banks had significant stock returns exposure to the pound, while cash flow exposure was non-existent. The authors argue that the expansion of banking operations in dealing with the pound sterling (GBP) might not be captured by the cash flow approach. In addition, the inadequacy of financial information disclosure to the public may have affected the sensitivity of stock returns to exchange rate changes. The analysis for the cash flow approach replicated the study by Martin and Mauer (2003), while the model under the stock returns approaches followed the two-factor regression model proposed by Jorion (1990).

The subsequent comparative study of corporate cash flow and stock price exposure was conducted by Bartram (2007). The estimation involved 6917 non-financial corporations in the US from 1976 to 2000. The study concluded that the stock returns approach is better at capturing the exposure; 13.2% of the total firms had significant exposure, while only 5.6% of the total firms had a significant exposure under the cash flow method. In conclusion, evidence from past studies shows mixed findings in identifying exposure under the stock returns and the cash flow approaches.

3. METHODOLOGY

3.1. Data and Variables

Two approaches were used in the study: first is the cash flow approach and second is the stock returns method. Given the distinct features of these two approaches, the analysis involved different data types. The information was extracted from the Datastream package and individual firm's annual reports were used for operating cash flow. Several variables were considered as the proxies for the firms' historical cash flow, such as earnings before interest, taxes, depreciation and amortization (EBITDA) (Martin & Mauer, 2003), net cash flow (combination of cash flow from operating, investment and financing activities) (Bartram, 2008), and profit after tax plus depreciation and amortization (Shapiro & Hanouna, 2020). Given these alternatives, profit after tax plus depreciation and amortization (PATDA) proposed by Shapiro and Hanouna (2020) was selected as the proxy for operating cash flow. This decision was made due to the limitation in the data where some data for other proxies, such as net cash flow and EBITDA were not sufficiently available for the analysis. The information on the stock price of individual firms

was extracted from the Datastream package. For the market indices, the data were gathered from the corresponding ASEAN stock exchanges, namely the Stock Exchange of Thailand (SET), Singapore Exchange (SGX), Indonesia Stock Exchange (IDX), and Bursa Malaysia.

For the exchange rate factors, several foreign currencies that are commonly used in ASEAN trade, such as the US dollar (USD), the Great British pound (GBP), the Japanese yen (JPY), and the European euro (EUR) were included in the analysis. All foreign currencies were in nominal form. As the impact of the USD, Japanese Yen, and British pound have been tested in many studies (Bacha et al., 2013; Parsley & Popper, 2006), this study took a new perspective in measuring the potential currency exposure of ASEAN corporations by incorporating the Euro currency into the model. As a proxy for the Euro currency prior to its official issuance in 1999, the German currency (Deutschemark) was employed as a viable substitute, as proposed by Parsley and Popper (2006). In order to put these two series (Euro and Deutschemark) into a single time series, the series of the local currency against the Deutschemark from January 1995 until December 1998 were combined with the local currency against the Euro from January 1999 until December 2017. The stock market data were monthly (i.e., 264 months), while the historical cash flow data were annual (22 years).

3.2. Selection of Sample Firms of ASEAN-4 Countries

The procedure for selecting sample firms was based on several criteria. First, only firms that were continuously listed over the study period were considered. The rationale for selecting listed firms was to ease the filtering process where each stock was examined and excluded when there were elements of suspension, insolvency, and trading halts. Second, these listed firms were filtered based on the availability of the financial data comprising monthly stock returns and annual operating cash flows from 1995 until 2017. This procedure is crucial since it reduces the problem of missing and unbalanced data that tends to affect the generalization of the outcomes. For corporations that did not deal with manufacturing activities, such as the financial sector, Hsiao and Han (2012) argue that the financial sector has distinct financial structures compared to the non-financial sectors. Thus, these firms were excluded from the sample since they do not directly deal with export and import activities. The selected firms were then screened based on their involvement in international trading (Jorion, 1990). Foreign sales information was elicited from the firms' geographical or segmental business information in the consolidated annual reports. For the final sample, the study compiled 405 firms that met the selection criteria. So far, there is no specific rule of thumb in determining the appropriate number of firms needed to represent one country. However, for the cross-country study, we followed the figure commonly used in many studies, such as Parsley and Popper (2006) and Kiyamaz (2003), which took approximately 100 sample firms for each country.

3.3. Overall Exposure

In examining overall exposure, all individual firms were pooled together. This part of overall exposure is useful to serve our first and second research objectives at the aggregate level. The panel analysis was performed where the cross-sections (different firms) and the time series (observation period) were combined (Abdul-Wahab, 2018; Ibrahim, Bacha, Ibrahim, & Abdul Wahab, 2020). The estimation of the panel model followed the random effects GLS regression model. Some studies used the seemingly unrelated regression (SUR) for panel specification (Bacha et al., 2013; Bodnar & Gentry, 1993). However, the generalized least squares (GLS) is equivalent to the SUR, which deals with the problem of correlation of the error terms (autocorrelation) across the observations (Suhaimi, Abdul Wahab, & Sum, 2019b). The random effects model is represented as follows:

$$R_{it} = \mu_i + \beta_1 USD_{it} + \beta_2 EUR_{it} + \beta_3 GBP_{it} + \beta_4 JPY_{it} + (\alpha_i + v_t + \omega_{it}) \quad (2)$$

R_{it} represents the firm's excess returns where i designates different cross-firms and t denotes the number of periods $t = 1, 2, \dots, 252$ months. β_i represents the average slope for stock returns' sensitivity to changes in particular

currency k . The divergence from the constant can be measured by three components where α_i captures errors between cross-section group, v_t caters for errors across the time series domain, and ω_{it} stands for combined errors.

In terms of the cash flow method, the procedure is very much identical to the stock returns approach where individual firms are stacked together and analyzed using the random effects GLS model as follows:

$$RCF_{it} = \mu_i + \beta_1 USD_{it} + \beta_2 EUR_{it} + \beta_3 GBP_{it} + \beta_4 JPY_{it} + (\alpha_i + v_t + \omega_{it}) \quad (3)$$

RCF_{it} stands for cash flow changes where i refers to a particular firm, and β_k represents the slope for changes in foreign exchange rate k to firm cash flow.

3.4. Firm-Specific Exposure

For the stock returns (SR) approach, the model of the firm-specific exposure follows the work of Adler and Dumas (1984). The measurement of currency exposure under the stock returns approach is different from that of the residual model of Jorion (1990). For the stock returns approach, the excess return was introduced and defined as the difference between the individual stock return and the market return in period t (Bacha et al., 2013). Therefore, the augmented firm-specific exposure can be presented as:

$$R_t = \mu_t + \beta_1 USD_t + \beta_2 GBP_t + \beta_3 EUR_t + \beta_4 JPY_t + e_t \quad (4)$$

where R_t is the excess return for an individual firm at time t (excess return = $R_t - R_{M,t}$), United States dollar (USD), Great Britain pound (GBP), European currency (EUR) and Japanese yen (JPY) represent percentage changes in the nominal exchange rate (domestic/foreign currency), and e_t denotes the error term. To avoid offsetting effects between different currencies, it is relevant to measure the bilateral individual exchange rate instead of the trade-weighted index (TWI) as employed by Jorion (1990). The coefficient β_k represents the slope or coefficient of the changes in the exchange rate k . Equation 4 mimics the specification of Adler and Dumas (1984), but this study uses the excess returns, following Bacha et al. (2013), as a proxy for stock performance compared to the use of original stock returns.

For the cash flow (CF) specification, the method of gauging firm-specific exposure was identical to the stock returns approach. The only difference is in the dependent variable of the model below:

$$RCF_t = \mu_t + \beta_1 USD_t + \beta_2 GBP_t + \beta_3 EUR_t + \beta_4 JPY_t + e_t \quad (5)$$

Return on cash flow (RCF) denotes the changes in operating cash flow scale to total sales in year t [$(RCF_t = CF_t - CF_{t-1})/\text{total sales}_t$] (Bartram, 2008). The coefficient β_k measures the sensitivity of a firm's cash flow to changes in particular exchange rate k . To deal with the heteroscedasticity issue resulting from the violation of the implicit assumption of constant variance of the error term, the GARCH(1,1) specification was added to the mean equation. A special procedure called the Breusch-Pagan Lagrange Multiplier test was used to detect the presence of heteroscedasticity. If we do not reject the null hypothesis that indicates no existence of heteroscedasticity, Equations 4 and 5 will be adopted. If the null hypothesis is rejected, the GARCH(1,1) specification is incorporated into models (4) and (5) (Jongen, Muller, & Verschoor, 2012; Muller & Verschoor, 2006). In order to deal with the multicollinearity problem linked to high interdependencies of exchange rate factors, a special joint coefficient test called Wald test was conducted, as adopted by De Jong, Ligterink, and Macrae (2006) and Bacha et al. (2013). Accordingly, the Wald test involves testing the null hypothesis that all four exchange rate coefficients (USD, GBP, EUR and JPY) are simultaneously equal to zero ($H_0: \beta_{USD} = \beta_{EUR} = \beta_{GBP} = \beta_{JPY} = 0$) for every j currency at the 10% level of significance.

3.5. Time-Varying Exposure

This section explores the varied patterns of currency exposure arising from the different periods of the two financial crises (pre, during, and post). For this, the evaluation of currency exposure involved several dummies to capture the varied exposure trends according to the specific time interval. The examination of the state's dependence on the currency exposure due to the Asian financial crisis (AFC) and global financial crisis (GFC) was

carried out during six different periods (pre-AFC, mid-AFC, post-AFC, pre-GFC, mid-GFC, and post-GFC). Since the impact of these financial crises on the local stock markets was different for each ASEAN-4 country, the time interval for each stage was different for each country, following Ahmed et al. (2012); Bacha et al. (2013); Suhaimi, Abdul Wahab, and Sum (2019a) and Muniandy and Uning (2006) as shown below.

Table 1. The stages of the Asian financial crisis of 1997 and global financial crisis of 2008.

Country	Pre-AFC	Mid-AFC	Post-AFC	Pre-GFC	Mid-GFC	Post-GFC
Indonesia	Jan 95–June 97	July 97–Dec 98	Jan 99–June 2005	July 2005–Dec 2007	Jan 2008–Dec 2009	Jan 2010–Dec 2017
Malaysia	Jan 95–June 97	July 97–Aug 98	Sept 98–June 2005	July 2005–Dec 2007	Jan 2008–Dec 2009	Jan 2010–Dec 2017
Singapore	Jan 95–June 97	July 97–Dec 98	Jan 99–June 2005	July 2005–Dec 2007	Jan 2008–Dec 2009	Jan 2010–Dec 2017
Thailand	Jan 95–June 97	July 97–Dec 98	Jan 99–June 2005	July 2005–Dec 2007	Jan 2008–Dec 2009	Jan 2010–Dec 2017

Note: Pre = before the crisis, Mid = during the crisis, Post = after the crisis, AFC = Asian Financial Crisis, GFC = Global Financial Crisis.

The temporal details shown in Table 1 cover six different sub-periods. The pre-crisis stage covers the period from January 1995 to the onset of the Asian financial crisis in June 1997. The time interval for the mid-crisis period is around one to two years, reflected by different phases of economic recovery. During the AFC, the higher currency exposure was expected to be driven by the increased volatility of exchange rate movements. Moreover, since the sample was covered until December 2017, the variation of currency exposure across different phases of the GFC was also highlighted. The assessment method followed that of Parsley and Popper (2006), where dummies were incorporated into Equation 2 for panel specification and into Equation 4 for firm-specific exposure. The details of the specification are as follows:

3.6. Firm-Specific Level

$$R_t = \alpha_t + \beta_1 USD_t + \beta_2 GBP_t + \beta_3 EUR_t + \beta_4 JPY_t + \sum_{j=2}^6 \beta_{j,USD} D_j + \sum_{j=2}^6 \beta_{j,EUR} D_j + \sum_{j=2}^6 \beta_{j,GBP} D_j + \sum_{j=2}^6 \beta_{j,YEN} D_j + e_t \quad (6)$$

Where each D_j is a dummy variable:

$$\begin{aligned} j = 1, & \text{ for pre-AFC (control group)} & j = 4, & D_4 = 1 \text{ for pre-GFC, } D_i = 0 \text{ otherwise} \\ j = 2, & D_2 = 1 \text{ for mid-AFC, } D_i = 0 \text{ otherwise} & j = 5, & D_5 = 1 \text{ for mid-GFC, } D_i = 0 \text{ otherwise} \\ j = 3, & D_3 = 1 \text{ for post-AFC, } D_i = 0 \text{ otherwise} & j = 6, & D_6 = 1 \text{ for post-GFC, } D_i = 0 \text{ otherwise} \end{aligned}$$

3.7. Overall level

The panel specification of the random effects model to capture the time-varying exposure at the aggregate level can be represented as follows:

$$R_{it} = \alpha_i + \beta_1 USD_{it} + \beta_2 GBP_{it} + \beta_3 EUR_{it} + \beta_4 JPY_{it} + \sum_{j=2}^6 \beta_{j,USD} D_j + \sum_{j=2}^6 \beta_{j,EUR} D_j + \sum_{j=2}^6 \beta_{j,GBP} D_j + \sum_{j=2}^6 \beta_{j,YEN} D_j + (\alpha_i + v_t + \omega_{it}) \quad (7)$$

Where each D_j follows the exact specification in Equation 6, R_{it} represents the firm's stock returns where i designates different cross-firms, and t represents the number of periods $t = 1, 2, \dots, 264$ months. β_j represents the average slope for the stock return's sensitivity to changes in a particular currency subject to each time interval.

4. EMPIRICAL FINDINGS

4.1. Descriptive Statistics of Firm Values and Exchange Rate Factors

Table 2 reports the summary statistics of stock returns and cash flow for all sample firms across the whole period of the study. First, the mean for stock returns across all countries is more or less the same, and slightly lower than the cash flow changes. In terms of stock returns volatility, Table 2 shows that the standard deviation of stock returns of Indonesian firms was the highest at 0.169, followed closely by Thailand with a standard deviation of 0.152. Malaysia showed the least volatility with a standard deviation of 0.121, slightly lower than the volatility shown by Singapore firms of 0.145. In terms of operating cash flow statistics, the standard deviation of Indonesia stood at 2.286, Malaysia at 0.773, Thailand at 1.361, and Singapore at 1.092. Higher volatility suggests a greater firm value sensitivity to changes in macroeconomic factors. Given this, it is expected that Indonesian firm values are highly sensitive to currency risk under both methods. However, this expectation needs to be further tested.

Table 2. Descriptive statistics of the stock returns and operating cash flow.

Statistics	Stock returns				Cash Flow			
	Indonesia	Malaysia	Singapore	Thailand	Indonesia	Malaysia	Singapore	Thailand
Mean	-0.006	-0.004	-0.007	0.000	0.026	0.015	0.006	0.016
Median	-0.013	-0.007	-0.009	-0.004	0.007	0.006	0.004	0.001
Maximum	3.571	2.797	1.831	2.899	86.001	14.861	17.332	55.524
Minimum	-1.706	-1.731	-2.701	-2.157	-43.313	-16.919	-16.299	-23.529
Std. Dev.	0.169	0.121	0.145	0.152	2.286	0.773	1.092	1.361
Skewness	0.905	0.951	-0.371	1.019	23.496	0.589	-0.925	25.727
Kurtosis	22.358	28.401	27.216	35.957	1079.814	198.808	96.196	1193.444
Sum	-166.384	-105.093	-153.296	4.682	51.287	34.918	0.006	39.375
Firms	100	107	86	112	100	107	86	112

Note: Std. Dev. = standard deviation of the series.

Source: Datastream.

Table 3 presents the statistics for the nominal exchange rates examined in this study. The volatility of the Indonesian rupiah against all currencies was relatively large compared to the other ASEAN-4 currencies. In contrast, the Singapore dollar had the lowest volatility, ranging from 0.016 to 0.029. The range between the maximum and minimum values of each foreign currency in Singapore was considerably small.

Table 3. Descriptive statistics of exchange rates changes.

Country	Exchange Rate	Mean	Median	Maximum	Minimum	Std. Dev.
Indonesia	IDR/USD	0.007	0.002	0.671	-0.292	0.070
	IDR/EUR	0.009	0.003	0.791	-0.337	0.085
	IDR/GBP	0.006	0.005	0.652	-0.269	0.070
	IDR/100JPY	0.006	0.002	0.842	-0.199	0.078
Malaysia	MYR/USD	0.002	0.000	0.127	-0.125	0.024
	MYR/EUR	0.002	0.001	0.131	-0.138	0.031
	MYR/GBP	0.001	0.001	0.143	-0.122	0.030
	MYR/100JPY	0.001	-0.002	0.181	-0.221	0.038
Singapore	SGD/USD	-0.000	-0.001	0.085	-0.064	0.016
	SGD/EUR	-0.000	0.000	0.074	-0.069	0.024
	SGD/GBP	-0.001	-0.001	0.065	-0.107	0.023
	SGD/100JPY	-0.001	-0.004	0.095	-0.068	0.029
Thailand	BAHT/USD	0.001	-0.001	0.248	-0.120	0.028
	BAHT/EUR	0.001	-0.001	0.150	-0.164	0.033
	BAHT/GBP	0.000	-0.001	0.228	-0.111	0.033
	BAHT/100JPY	0.001	-0.001	0.252	-0.183	0.039

Source: Datastream.

Note: USD = United States dollar, EUR = European currency (Euro), GBP = Great British pound, 100JPY = 100 Japanese yen, IDR = Indonesian rupiah, MYR = Malaysian ringgit, SGD = Singapore dollar, Baht = Thailand baht, X/Y = bilateral exchange rate quotation where the domestic currency is X against the foreign currency Y, Std. Dev. = standard deviation of the series.

This observation implies that the exchange rate returns did not disperse significantly from the mean value. For instance, the maximum value of changes in the Singapore dollar against the US dollar (SGD/USD) was SGD 0.085, while the minimum value was SGD -0.064, which was not far from the mean value. The low dispersion of foreign exchange rate changes in Singapore signals the effectiveness of monetary management in abating large currency fluctuations. This low variation in exchange rate movements suggests that corporate sensitivity to foreign currency fluctuations should be minimal compared to other countries. The extent of hedging activities can also be a crucial factor in undermining the impact of exchange rate uncertainty (Bae, Kim, & Kwon, 2018; Hadian & Adaoglu, 2020; Kim, Chung, Hwang, & Pyun, 2020).

4.2. Overall Exposure

For the overall exposure, the key estimation results of Equation 2 and Equation 3 for the SR and CF approaches are presented, respectively, in Table 4. It shows the extent of exposure of ASEAN-4 firms at the aggregate level. The results are summarized in terms of magnitude, sign, and significance of the aggregate beta estimates. Since the exchange rate is expressed as a direct quotation (local ASEAN currency per unit of foreign currency), a positive beta means that local currency depreciation positively impacts firm value and vice versa. Additional information from Table 4 is as follows: First, the null hypothesis that the betas are zero for all foreign currencies ($B_{USD} = B_{EUR} = B_{GBP} = B_{JPY} = 0$) is rejected at the 10% significance level, as shown by the large F-statistics for all countries, namely Indonesia (F-value = 358.17, p-value < 0.10), Malaysia (F-value = 79.32, p-value < 0.10), Singapore (F-value = 16.16, p-value < 0.10), and Thailand (F-value = 40.48, p-value < 0.10). These results establish the existence of the overall exposure of sample firms across all the countries. The results are economically meaningful, given that these four countries have open economies and strong links with international trade.

In terms of statistical significance, the SR approach captured the significance of the overall exposure better than the CF approach, which is most likely because the future cash flow (stock returns) poses greater uncertainty than changes in the operating cash flow. In terms of hedging, it is easier to hedge the transaction exposure of the operating cash flow (Martin & Mauer, 2005) compared to the unanticipated movements of future cash flow. It was observed that most firms exhibited significant exposure to the USD under both approaches. This finding is not unusual as those ASEAN firms have strong trade relationships with the US. For Indonesia, Malaysia and Thailand, most firms had significant exposure to all currencies, pointing to a low hedging intensity. For Singapore, the insignificance of most beta coefficients (except the USD beta) implies wide use of exchange risk management among Singaporean firms. It appears that Singaporean firms were hedging their currency risks by taking a position in derivatives such as currency swaps, currency forwards, and currency options. Given the enhanced technology and expertise, higher market liquidity, and increased efficiency due to being a financial center, the flow of information is much easier for the Singapore market.

4.3. Firm-Specific Exposure

The results for firm-specific exposure are provided in Table 5. The extent of firm-specific exposure is measured by the frequency of exposure, for which the null hypothesis ($B_i = 0$) was rejected at the 10% significance level. Moreover, the number of firms with statistically significant exposure to all four currencies was evaluated through the Global Wald Test and is presented in the last three columns of Table 5. In general, some patterns of exposure can be discerned. A higher number of exposed firms could be easily detected by the SR approach compared to the CF approach. For the SR approach, 265 of 405 firms were significantly exposed to all four currencies. This number accounted for 65% of the total sample. By comparison, the CF approach shows 114 exposed firms or 28% of the total sample. This result is consistent with the findings of Bartram (2007). The most likely explanation for this finding is that the SR approach captures all future cash flows that are uncertain, yet it is difficult for firms to hedge these. The unanticipated changes, however, show up in higher volatilities of stock returns. In addition, the lack of readily

available public information regarding the degree and management of currency risk makes it difficult for investors to be aware of the potential exchange rate risk on their shares' values. Moreover, in terms of hedging, transaction exposure within the operating cash flow is easier to identify and hedge.

Looking at the individual impact of foreign currencies, as displayed in [Table 5](#), in general, the widespread presence of USD exposure occurs across all countries. In total, under the SR approach, 187 of 405 firms (46%) had significant exposure to the USD [CF: 13% (51 of 405)]. It is no coincidence that the USD had the most impact on ASEAN firms, given that most ASEAN countries have strong trade connections with the US. Ranking the percentage of exposed firms to the USD by country for the SR approach, Thailand leads with 55%, followed closely by Indonesia (54%), Malaysia (40%), and Singapore (33%). Regarding the CF method, Malaysia had 23% of significantly exposed firms, Indonesia 10%, Thailand 8%, and Singapore 8%. For the CF method, it appears that Thailand had the highest fraction of exposed firms to all currencies (based on the Wald test) with 34% compared to other countries (Indonesia 31%, Malaysia 30%, and Singapore 15%). Based on the outcome of the SR approach, Indonesia exhibits the highest portion of exposed firms to all currencies with 82% of the total sample, followed by Thailand (79%), Malaysia (60%), and Singapore (35%). Singaporean firms had the least exposure under both approaches. This finding is indicative of the greater use of hedging among Singaporean firms during the crises. This is unsurprising given the highly developed derivatives market in Singapore. This finding supports the notion that hedging creates added value for firms, as demonstrated by [Hadian and Adaoglu \(2020\)](#); [Kim et al. \(2020\)](#); [Bae et al. \(2018\)](#) and [Luo and Wang \(2018\)](#).

[Figure 1](#) displays the distribution of the mean beta exposure (in absolute terms) for both the SR and CF methods. Under the SR approach, the predominance of USD exposure on the stock returns and operating cash flow points to the fact that the USD remains the primary source of foreign exchange exposure for non-financial corporations in the ASEAN-4. An identical result is shown in [Figure 2](#) of the fraction of firms that show significant exposure. From the angle of CF exposure, [Figures 1](#) and [2](#) display mixed patterns under the distribution of mean absolute betas and percentage of exposed firms. However, both figures confirm that currency exposure is much more widespread under the SR method than the CF approach. The pervasiveness of currency exposure under the SR method against the CF approach corroborates the findings of the panel analyses (as shown in [Table 4](#)).

Table 4. Overall exposure.

SR	B _i	Standard Error	t-value	P> t		CF	β _i	Standard Error	t-value	P> t
Indonesia					Panel B: Cash Flow Approach	Indonesia				
Const.	-0.003	0.001	-2.369	0.018		Const.	-0.009	0.029	-0.290	0.772
IDR/USD	-0.711	0.047	-15.284	0.000		IDR/USD	-0.711	0.323	-2.203	0.028
IDR/EUR	-0.053	0.023	-2.355	0.019		IDR/EUR	-0.634	0.509	-1.244	0.214
IDR/GBP	0.123	0.045	2.704	0.007		IDR/GBP	1.272	0.557	2.282	0.023
IDR/JPY	0.071	0.023	3.078	0.002		IDR/JPY	0.897	0.457	1.963	0.049
<i>F-test:</i>	358.170		<i>Prob> F </i>	0.000		<i>F-test:</i>	1.597		<i>Prob> F </i>	0.173
Malaysia						Malaysia				
Const.	-0.003	0.001	-3.784	0.000		Const.	0.020	0.017	1.176	0.239
MYR/USD	-0.421	0.039	-10.883	0.000		MYR/USD	-0.532	0.194	-2.739	0.006
MYR/EUR	-0.237	0.029	-8.310	0.000		MYR/EUR	-0.076	0.068	-1.119	0.262
MYR/GBP	0.139	0.034	4.116	0.000		MYR/GBP	0.275	0.167	1.649	0.099
MYR/JPY	-0.015	0.021	-0.697	0.486		MYR/JPY	0.186	0.192	0.969	0.333
<i>F-test:</i>	79.322		<i>Prob> F </i>	0.000		<i>F-test:</i>	2.314		<i>Prob> F </i>	0.055
Singapore						Singapore				
Const.	-0.007	0.001	-6.548	0.000		Const.	0.084	0.076	1.098	0.272
SGD/USD	-0.260	0.058	-4.492	0.000		SGD/USD	-3.376	1.571	-2.149	0.032
SGD/EUR	0.061	0.040	1.533	0.125		SGD/EUR	-0.219	0.428	-0.512	0.609
SGD/GBP	0.060	0.042	1.431	0.153		SGD/GBP	0.686	1.170	0.587	0.558
SGD/JPY	-0.186	0.033	-5.701	0.000		SGD/JPY	0.063	0.929	0.068	0.946
<i>F-test:</i>	16.162		<i>Prob> F </i>	0.000	<i>F-test:</i>	1.339		<i>Prob> F </i>	0.253	
Thailand					Thailand					
Const.	-0.000	0.001	-0.091	0.927	Const.	-0.005	0.017	-0.312	0.755	
THB/USD	0.413	0.043	9.513	0.000	THB/USD	-0.606	0.315	-1.923	0.055	
THB/EUR	-0.220	0.036	-6.099	0.000	THB/EUR	-0.182	0.237	-0.769	0.442	
THB/GBP	-0.062	0.042	-1.479	0.139	THB/GBP	0.372	0.238	1.564	0.118	
THB/JPY	0.001	0.026	0.056	0.955	THB/JPY	0.234	0.113	2.065	0.039	
<i>F-test:</i>	40.485		<i>Prob> F </i>	0.000	<i>F-test:</i>	1.570		<i>Prob> F </i>	0.179	

Note: SR = stock returns approach, CF = cash flow approach, B_i is the beta coefficient of regression for currency *i* (beta currency exposure), F-test = F-value statistics, Prob>|F| = probability value associated with F-statistics, t-value = Student *t*-statistics value, P>|t| = probability value associated with Student *t*-statistics, USD = United States dollar, EUR = European currency (Euro), GBP = Great British pound, JPY = Japanese yen, IDR = Indonesian rupiah, MYR = Malaysian ringgit, SGD = Singapore dollar, THB = Thailand baht, Const. = Constant (mean) value, X/Y = bilateral exchange rate quotation with domestic currency X against the foreign currency Y.

Table 5. Firm-specific exposure.

Country	Exposure Type	Frequency of firms rejecting H ₀ : $\beta_j = 0$ at the 10% level of significance														
		USD			EUR			GBP			JPY			Global Wald Test (χ^2) H ₀ : $\beta_j = 0$ for each j		
		Average Beta	f	%	Average Beta	f	%	Average Beta	f	%	Average Beta	f	%	f	%	No. of firms
Indonesia	Cash Flow	0.096	10	10%	0.408	33	33%	-0.415	28	28%	-0.236	10	10%	31	31%	100
	Stock Return	-0.683	54	54%	-0.039	14	14%	0.084	14	14%	0.089	27	27%	82	82%	100
Malaysia	Cash Flow	-0.112	25	23%	-0.027	22	21%	0.079	20	19%	-0.072	8	7%	32	30%	107
	Stock Return	-0.393	43	40%	-0.204	30	28%	0.091	14	13%	-0.021	22	21%	64	60%	107
Singapore	Cash Flow	-0.176	7	8%	-0.010	6	7%	0.172	14	16%	0.129	16	19%	13	15%	86
	Stock Return	-0.203	28	33%	0.047	8	9%	0.054	12	14%	-0.164	20	23%	30	35%	86
Thailand	Cash Flow	-0.012	9	8%	-0.071	18	16%	0.005	10	9%	0.076	21	19%	38	34%	112
	Stock Return	0.439	62	55%	-0.153	21	19%	-0.062	17	15%	0.035	25	22%	89	79%	112
Total	Cash Flow		51	13%		79	20%		72	18%		55	14%	114	28%	405
	Stock Return		187	46%		73	18%		57	14%		94	23%	265	65%	405

Note: f = frequency of exposed firms, % = percentage of exposed firms, Global Wald test with Chi-squared distribution (χ^2) and null hypothesis H₀: $\beta_{USD} = \beta_{EUR} = \beta_{GBP} = \beta_{JPY} = 0$, β_j is the coefficient of regression (beta currency exposure)

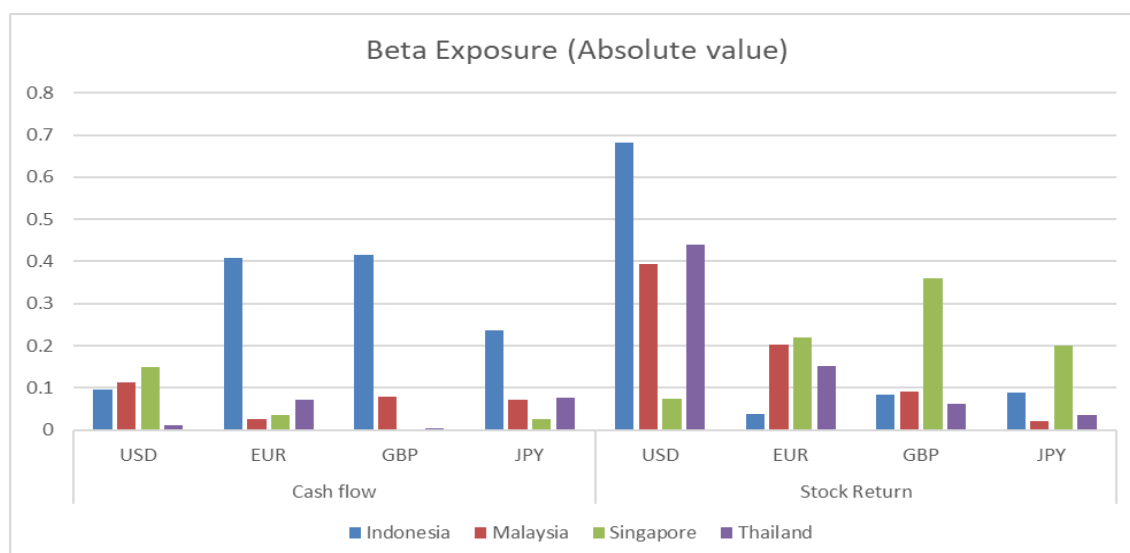


Figure 1. The distribution of absolute mean beta currency exposure between cash flow and stock return methodologies.

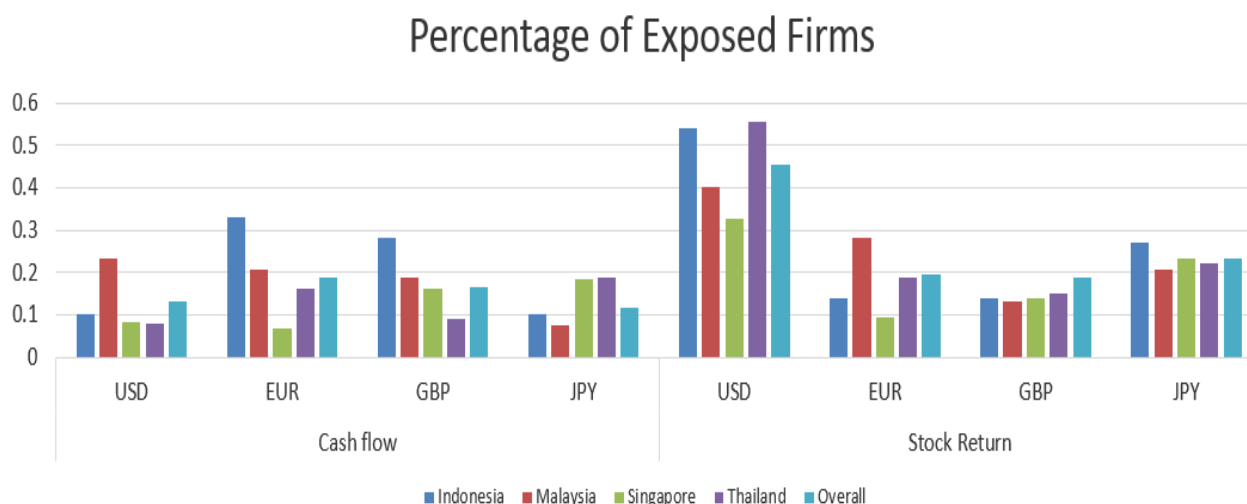


Figure 2. The distribution of the percentage of exposed firms between cash flow and stock return methodologies.

To get some insight into the connection between hedging activities and the extent of currency exposure, Table 6 reports the daily turnover of different foreign exchange derivatives of ASEAN-4 countries for the sample month of April 2016. There is a sharp contrast in the turnover of all foreign exchange (FX) derivatives in Singapore compared to the other countries. Regarding the total turnover in swaps in 2016, Singapore led with USD 248.00 billion, while Malaysia recorded a USD 5.55 billion turnovers in swaps, Thailand recorded USD 5.41 billion, and Indonesia recorded USD 1.75 billion. The same pattern of the significant FX derivatives turnover in Singapore is also shown for outright forward (USD 104.6 billion) and FX options (USD 36.7 billion). The higher exchange exposure of Indonesian, Malaysian and Thai firms is not surprising due to the limited development of FX derivatives markets. To conclude, our analysis shows that the extent of exchange rate exposure has been much more prevalent for firms in countries with less hedging activities than those with vigorous hedging routines. This finding probably reflects the limitations of local derivatives market development rather than hedging resistance among ASEAN firms. The fact that Singapore is a regional financial center accounts for the relatively large market, the cheap and easy availability of these contracts, and the more sophisticated entropot trading that Singapore firms are, means that they hedge more effectively, resulting in lower exchange rate exposure.

Table 6. Foreign exchange derivatives turnover by ASEAN-4 countries & counterparties in April 2016.

Country	Total	Reporting Dealer		Other Financial Institutions		Non-financial Institutions	
		Local	Cross Border	Local	Cross Border	Local	Cross Border
Outright Forward							
Indonesia	425	6	157	8	7	235	13
Malaysia	1.075	43	256	95	81	425	174
Singapore	104.675	2.363	39.453	2.211	57.417	1.573	1.657
Thailand	1.015	4	51	128	23	797	12
FX Swaps							
Indonesia	1.754	872	679	32	11	159	0.216
Malaysia	5.549	1.875	1.897	1.004	437	211	124
Singapore	248.002	18.369	188.260	12.093	24.577	2.319	2.383
Thailand	5.413	2.768	1.473	782	229	131	30
FX Options							
Indonesia	6	0	3	NA	NA	3	NA
Malaysia	142	20	26	25	1	64	6
Singapore	36.777	656	18.800	423	12.114	3.116	1.668
Thailand	31	1	1	NA	NA	28	NA
Total							
Indonesia	2.185	878	839	40	18	397	13
Malaysia	6.766	1.938	2.179	1.124	519	700	304
Singapore	389.454	21.388	246.513	14.727	94.108	7.008	5.708
Thailand	6.459	2.773	1.525	910	252	956	42

Source: Triennial Central Bank Survey, Foreign Exchange and Derivatives Market Activities in April 2016, Bank of International Settlement (BIS). All values are daily averages denominated in US dollars (Millions). FX = foreign exchange, NA = not available.

4.4. Time-Varying Exposure

This section examines the third research objective, which is to examine the time-variant nature of currency exposure under the different stages of the financial crises. Table 7 provides aggregate information on the variation of exposure subjects to the Asian financial crisis (AFC) of 1997 and the global financial crisis (GFC) of 2008. From the F-statistics in Table 7, there is sufficient statistical evidence of variation in exchange rate exposure across the different sub-periods. Note that the p-values of the F-statistics are less than the 10% level, signifying rejection of the joint null hypothesis of beta exposure that is equal to zero for all periods. To examine the significance of exchange rate exposure during a particular period, one might refer to the significance of the interactive time dummy. A small p-value of less than 10% indicates rejection of the null hypothesis that the coefficient of the interactive dummy is equal to zero. During the AFC, all countries exhibited significant exposure to the USD, with the largest USD beta being for Indonesia ($B = 2.11$), followed by Thailand ($B = 1.57$), Singapore ($B = -1.34$), and Malaysia ($B = 0.89$). This result meets our *a priori* expectation that enhanced variability of exchange rates had adversely impacted firm value during the AFC.

Moreover, there is a high incidence of exchange rate exposure during the post-AFC period. Accordingly, it can be seen that Malaysia, Singapore, and Thailand exhibit significant interactive USD dummies, with Malaysia recording a USD beta of -1.90, Singapore at -1.34, and Thailand at 1.47. For Malaysia, the post-AFC period coincides with the hard peg period. The high level of exchange exposure during the hard peg period raises the question of the efficacy of the pegged regime. During the pre-GFC period, most sample firms were not highly exposed to exchange risk. During the GFC, however, most sample firms were highly exposed to the USD, EUR and GBP. For a comprehensive understanding of the severity of currency risk during the AFC and GFC at the firm level, we refer to Table 8, which contains information on the proportion of exposed firms and the magnitude of exchange rate exposure for each sub-period. According to Table 8, foreign currency exposure was prominent in the midst of both the AFC and the GFC. Approximately 91 out of 405 firms (23%) had substantial USD exposure during the AFC, with exposure to the EUR at 22%, GBP at 20%, and JPY at 29%.

Table 7. Random effects GLS model with AFC and GFC dummies.

Variable	Indonesia	Malaysia	Singapore	Thailand
C	-0.001 (0.294)	-0.002 (0.001)	-0.006 (0.000)	0.001 (0.316)
USD	-1.545 (0.003)	0.085 (0.815)	0.946 (0.045)	-0.423 (0.544)
EUR	0.887 (0.000)	-0.048 (0.661)	0.493 (0.000)	-0.234 (0.148)
GBP	-0.418 (0.021)	-0.561 (0.000)	0.149 (0.311)	-0.077 (0.680)
JPY	-0.342 (0.000)	-0.203 (0.002)	-0.354 (0.000)	0.097 (0.190)
MID_AFC*USD	2.114 (0.000)	0.897 (0.026)	-1.342 (0.008)	1.575 (0.027)
MID_AFC*EUR	-0.149 (0.411)	-0.909 (0.000)	0.034 (0.852)	0.249 (0.166)
MID_AFC*GBP	-0.755 (0.003)	-0.292 (0.168)	-0.723 (0.005)	-0.783 (0.000)
MID_AFC*JPY	-0.428 (0.000)	-0.103 (0.252)	-0.701 (0.000)	-0.483 (0.000)
POST_AFC*USD	0.684 (0.208)	-1.904* (0.000)	-1.335 (0.006)	1.474 (0.037)
POST_AFC*EUR	-0.979 (0.000)	-0.139* (0.270)	-0.511 (0.000)	0.064 (0.723)
POST_AFC*GBP	0.595 (0.003)	0.903* (0.000)	-0.325 (0.059)	-0.008 (0.969)
POST_AFC*JPY	0.511 (0.000)	0.121* (0.120)	0.698 (0.000)	-0.126 (0.177)
PRE_GFC*USD	0.181 (0.751)	-0.471 (0.281)	-0.315 (0.542)	1.178 (0.101)
PRE_GFC*EUR	-1.321 (0.000)	-0.129 (0.590)	-0.336 (0.309)	-0.525 (0.082)
PRE_GFC*GBP	1.157 (0.000)	0.837 (0.000)	0.603 (0.009)	-0.068 (0.793)
PRE_GFC*JPY	0.640 (0.000)	0.602 (0.000)	-0.201 (0.219)	0.368 (0.010)
MID_GFC*USD	0.365 (0.518)	0.389 (0.312)	-2.884 (0.000)	0.521 (0.467)
MID_GFC*EUR	-1.723 (0.000)	0.308 (0.031)	-1.737 (0.000)	-0.041 (0.843)
MID_GFC*GBP	1.232 (0.000)	0.659 (0.000)	-0.707 (0.000)	0.175 (0.442)
MID_GFC*JPY	1.043 (0.000)	0.192 (0.065)	0.111 (0.446)	0.181 (0.198)
POST_GFC*USD	0.410 (0.453)	-0.312 (0.400)	-0.523 (0.279)	0.577 (0.414)
POST_GFC*EUR	-0.922 (0.000)	0.015 (0.905)	-0.507 (0.001)	0.101 (0.568)
POST_GFC*GBP	0.756 (0.000)	0.717 (0.000)	0.203 (0.218)	0.159 (0.424)
POST_GFC*JPY	0.618 (0.000)	0.200 (0.012)	0.196 (0.090)	0.049 (0.584)
F-statistics value	73.882	36.584	19.993	14.162
Probability (F-statistics)	(0.000)	(0.000)	(0.000)	(0.000)

Note: USD = United States dollar, EUR = European currency (Euro), GBP = Great Britain pound, JPY = Japanese yen. AFC = Asian Financial Crisis, GFC = Global Financial Crisis. PRE = before the crisis, MID = during the crisis, POST = after the crisis. * For Malaysia, the post-AFC period refers to the peg period. The values in parentheses represent the p-values of the beta parameters.

During the GFC, around 22% of all firms were highly exposed to the USD, 29% to the EUR, 2% to the GBP, and 20% to the Japanese Yen. The Asian crisis-related uncertainty raised the degree of exchange risk. The notable increase in exchange exposure in the mid-AFC sub-period suggests that this single event significantly impacted the firms' value sensitivity to currency movements.

All nations show a similar pattern as many firms had significant exposure to all currencies during the AFC. Indonesia has the most significant beta USD exposure in terms of the absolute term, with a value of 1.746, followed by Singapore ($B_{USD} = 1.381$), Thailand ($B_{USD} = 1.331$) and Malaysia ($B_{USD} = 0.936$). Since the ASEAN-4 nations have had a high foreign trade ratio (FTR) for the past 20 years, a significant effect on the exchange rate exposure of the ASEAN-4 firms during the AFC is not unusual. Interestingly, despite having a lower FTR than Malaysia and Singapore, Indonesian firms were vulnerable to currency fluctuations throughout the crisis. This study suggests that Indonesian companies are hedging less often.

Interestingly, in the post-AFC period, there was a noticeable spike in currency exposure. For the absolute term of the USD beta, Malaysia led with a beta of 1.737, followed by Thailand (1.250), Singapore (1.088), and Indonesia (0.430). In the same vein, looking at the trend of the percentage of exposed firms, most ASEAN-4 firms had significant exposure to the USD.

During the post-AFC period, 23% or 91 of 405 firms were heavily exposed to the USD. In the same period, around 15% of all Indonesian firms were heavily exposed to the USD, 36% of Malaysian firms, 16% of Singaporean firms, and 25% of Thai firms. Seeing so many ASEAN-4 firms exposed to the USD post-AFC is fascinating. The results of the firm-specific study strikingly confirm the findings of the panel analysis. As previously stated, the increased degree of exposure following the AFC is attributed to the persistent absence of risk management practices. To substantiate the argument, we refer to the results in [Table 9](#), where it can be clearly seen that the total foreign exchange derivatives turnover declined from 1998 to 2001 for all countries except Malaysia. Between 1998 and 2001, Indonesia reported a reduction in total foreign exchange derivatives from \$1 billion to \$0.52 billion, Singapore from \$83.72 billion to \$68.94 billion, and Thailand from \$2.22 billion to \$1.30 billion. During the crisis (1998), there was a substantial turnover of total foreign currency (FX) derivatives across all nations. The substantial daily turnover of FX derivatives during the AFC suggests that the advent of the crisis compelled firms to implement adequate hedging measures to mitigate the risk of incurring substantial losses from unforeseen fluctuations in exchange rates. In 1998, the daily turnover of FX futures increased significantly in all countries, with Singapore recording USD 83.72 billion, Thailand USD 2.22 billion, Malaysia USD 0.80 billion, and Indonesia USD 1 billion. However, the daily turnover of FX futures declined following the crisis, suggesting a return to a more relaxed approach to exchange risk management immediately after the AFC.

Table 8. Time-varying exposure.

	Crisis Period	USD			EUR			GBP			JPY			No. of firms
		f	%	Mean Beta	f	%	Mean	f	%	Mean Beta	f	%	Mean Beta	
Country		{1}	{2}	USD	{3}	{4}	Beta EUR	{5}	{6}	GBP	{7}	{8}	JPY	
Indonesia	Pre-AFC	22	22%	-1.580	39	39%	0.877	19	19%	-0.410	34	34%	-0.329	100
	Mid-AFC	15	15%	1.746	28	28%	-0.237	10	10%	-0.762	34	34%	-0.442	100
	Post-AFC	15	15%	0.430	41	41%	-0.969	16	16%	0.587	31	31%	0.497	100
	Pre-GFC	18	18%	-0.099	22	22%	-1.175	20	20%	1.149	31	31%	0.626	100
	Mid-GFC	14	14%	0.041	31	31%	-1.713	18	18%	1.224	33	33%	1.029	100
	Post-GFC	15	15%	0.193	31	31%	-0.912	14	14%	0.748	33	33%	0.604	100
Malaysia	Pre-AFC	16	15%	0.017	12	11%	-0.019	31	29%	-0.554	11	10%	-0.207	107
	Mid-AFC	23	21%	0.936	31	29%	-0.935	26	24%	-0.241	20	19%	-0.139	107
	Post-AFC (Peg)	38	36%	-1.737	10	9%	-0.154	17	16%	0.877	5	5%	0.129	107
	Pre-GFC	25	23%	-0.450	19	18%	-0.072	34	32%	0.745	15	14%	0.641	107
	Mid-GFC	19	18%	0.434	31	29%	0.251	28	26%	0.644	21	20%	0.189	107
	Post-GFC	17	16%	-0.278	16	15%	-0.017	16	15%	0.726	30	28%	0.204	107
Singapore	Pre-AFC	8	9%	0.697	32	37%	0.537	14	16%	0.046	9	10%	-0.243	86
	Mid-AFC	21	24%	-1.381	10	12%	0.043	21	24%	-0.611	32	37%	-0.829	86
	Post-AFC	14	16%	-1.088	16	19%	-0.445	6	7%	-0.230	15	17%	0.548	86
	Pre-GFC	6	7%	0.116	9	10%	-0.123	13	15%	0.399	14	16%	-0.312	86
	Mid-GFC	27	31%	-2.793	31	36%	-1.552	13	15%	-0.549	7	8%	-0.055	86
	Post-GFC	6	7%	-0.299	14	16%	-0.627	8	9%	0.245	6	7%	0.099	86
Thailand	Pre-AFC	25	22%	-0.223	24	1%	-0.181	25	22%	-0.096	21	19%	0.099	112
	Mid-AFC	32	29%	1.331	19	17%	0.181	22	20%	-0.735	30	27%	-0.486	112
	Post-AFC	28	25%	1.250	20	18%	-0.003	18	16%	-0.003	19	17%	-0.115	112
	Pre-GFC	27	24%	0.948	25	22%	-0.593	25	22%	-0.009	23	21%	0.358	112
	Mid-GFC	30	27%	0.268	26	23%	-0.119	21	19%	0.198	20	18%	0.180	112
	Post-GFC	32	29%	0.331	20	18%	0.056	23	21%	0.186	21	19%	0.051	112
Total	Pre-AFC	71	18%		107	26%		89	22%		75	19%		405
	Mid-AFC	91	22%		88	22%		79	20%		116	29%		405
	Post-AFC	95	23%		87	21%		57	14%		70	17%		405
	Pre-GFC	76	19%		75	19%		92	23%		83	20%		405
	Mid-GFC	90	22%		119	29%		9	2%		81	20%		405
	Post-GFC	70	17%		81	20%		5	1%		90	22%		405

Note: f = frequency of exposed firms, % = percentage of exposed firms. All regressions are made following the Newey–West routine to produce robust standard errors from autocorrelation and heteroscedasticity problems. USD = United States dollar, EUR = European currency (Euro), GBP = Great British pound, JPY = Japanese yen. AFC = Asian financial crisis, GFC = global financial crisis. Pre = before the crisis, Mid = during the crisis, Post = after the crisis.

Table 9. Daily averages of FX derivatives turnover from 1995–2016.

Country	1995	1998	2001	2004	2007	2010	2013	2016
Outright Forward								
Indonesia	...	0.08	0.21	0.11	0.51	0.25	0.21	0.42
Malaysia	...	0.06	0.23	0.32	0.36	0.66	2.82	1.07
Singapore	2.97	4.41	8.49	10.61	25.20	36.47	61.70	104.67
Thailand	...	0.19	0.13	0.40	0.68	0.97	1.58	1.01
FX Swaps								
Indonesia	...	0.73	0.31	1.21	0.61	0.90	1.38	1.75
Malaysia	...	0.74	0.55	0.50	1.39	2.43	3.02	5.55
Singapore	58.19	74.71	57.69	72.13	116.11	122.00	172.79	248.00
Thailand	...	1.96	1.17	1.33	4.11	3.28	5.84	5.41
FX Options								
Indonesia	...	0.18	...	0.01	0.12	0.00	0.02	0.01
Malaysia	...	0.00	0.11	0.03	0.03	0.08	0.18	0.14
Singapore	1.20	4.61	2.77	8.01	10.06	15.94	43.45	36.78
Thailand	...	0.07	0.00	0.01	0.04	0.09	0.13	0.03
Total								
Indonesia	-	1.00	0.52	1.33	1.25	1.14	1.61	2.19
Malaysia	-	0.80	0.89	0.84	1.78	3.17	6.02	6.77
Singapore	62.36	83.72	68.94	90.75	151.38	174.41	277.94	389.45
Thailand	-	2.22	1.30	1.74	4.83	4.34	7.55	6.46

Source: Triennial Central Bank Survey, Foreign Exchange and Derivatives Market Activities in April 2016, Bank of International Settlement (BIS). All values are stated in billions of US dollars. FX = foreign exchange.

ASEAN-4 firm valuations were also vulnerable to currency changes in the midst of the GFC since ASEAN-4 exports were impacted to some degree by the crisis. According to Table 8, 22% of the sample of ASEAN-4 firms had considerable USD exposure, 29% had significant EUR exposure, 2% had significant GBP exposure, and 20% had significant JPY exposure. Finally, our time-varying study reveals numerous surprising patterns. First, there is no indication that the level of foreign currency exposure decreased during the data period. Second, some peaks correspond to both financial crises. Third, Malaysia reported significant USD exposure after the AFC, which presents a fascinating case study. During the Asian crisis, Malaysia used unconventional regulations to defend the foreign currency market against speculative assaults. These were the imposition of capital control (one-year moratorium on capital outflow) and a fixed exchange system where MYR was pegged to the USD at MYR3.80/USD in 1998. Some argue that a peg system could provide a hospitable environment for international activities and give firms less incentive to hedge their foreign transactions. Nevertheless, pegging a local currency against a single foreign currency cannot deter fluctuations against other currencies. Thus, firms remain susceptible to currency changes, even under a pegged exchange rate system. By contrast, firms operating under a floating system might be accustomed to hedging practices, causing hedging costs to be less expensive than firms operating under a fixed system. The decision to peg the MYR against the USD caused negative spillover effects on net importers; their import costs increased given the devalued rate of the peg. In addition, controlling the price of many imported goods limits a firm's flexibility to pass the cost on to end users. Given this, the peg prevented the Malaysian ringgit from further significant fluctuations to some extent, and this strategy impacted firms' profitability and severely distorted their competitiveness. Apart from that, poor governance, weak financial liberalization, and a weak banking system caused inefficiency in the asset allocation of the borrowed funds. The complacency during the pegged regime contributed to the enhanced level of exchange risk, as reported in Table 8. In conclusion, the results from our study do not support the notion that the fixed exchange regime could bring stability to foreign exchange markets. These findings corroborate the finding of Bacha et al. (2013). The monetary decision to de-peg in July 2005 brought greater flexibility in foreign exchange movements and a degree of exchange risk minimization. This is shown by the lower number of exposed firms and the small size of beta exposure in the post-AFC period. It seems that the absence of government intervention in the foreign exchange market reduced the exchange risk to some extent. By allowing the exchange rates to move in accordance with the supply and demand

forces, many of the rigidities and distortions were removed. Further, the subsequent managed floating system assisted the government by providing the policy flexibility in monitoring foreign exchange movements and partially absorbing potential shocks.

4.5. Robustness Check

For the robustness check, a separate test was conducted to examine the influence of changes in the price level to the extent of currency exposure. This robustness procedure is crucial to examine whether the results estimated in the previous models are consistent with the real setting. In order to assess the potential influence of purchasing power, the nominal exchange rates were adjusted with the changes in the relative consumer price index between the two countries following the procedure explained by Shapiro and Hanouna (2020) as follows:

$$e'_t = e_t * \frac{P_f}{P_h} \quad (8)$$

Where e' is the real exchange rate and e_t is the nominal exchange rate, P_f is the consumer price index for a foreign country at time t , and P_h is the local consumer price index at time t .

Table 10 presents the estimations of nominal and real exchange exposure at the aggregate level using the random effects GLS model for both the stock returns and cash flow methods. Panel A provides the beta estimates under the SR approach, whilst Panel B exhibits the beta estimates for the CF approach. From the SR perspective, in general, there is remarkable consistency in terms of beta estimates under the nominal specification and the beta estimates under the real rates. In terms of beta magnitude, the figures are almost identical, with considerably small differences. There is also consistency in terms of beta sign across all currencies. It appears that the beta shows the statistical significance and has identical signs under both nominal and real specifications. In the context of the significance of beta, the betas found to be significant under the nominal specification were also found to be statistically significant under the real setting. In short, the results are robust because the properties of real exchange exposure mirror the nominal exchange rate. This implies a negligible impact of changes in the inflation-adjusted exchange rate on the extent of currency exposure of ASEAN-4 firms.

5. CONCLUDING REMARKS

Understanding the incidence of exchange rate exposure is crucial for firm valuation and risk management. This study evaluated the incidence of foreign exchange exposure for ASEAN-4 non-financial corporations. Our results suggest several implications as follows:

1. Based on the ASEAN 4 countries, currency risk is more prevalent in an open economy environment, especially for firms that are widely engaged in international businesses. When decomposed by country, it seems that Singapore showed the least level of currency exposure compared to other countries. It appears that Singapore firms devoted considerable resources to hedging into their currency exposure as a matter of routine. By comparison, Indonesian, Malaysian and Thai firms may be less likely to have the skills, resources and organizational support systems to conduct effective exchange risk management programs (Chen & So, 2002).
2. When decomposed by currency, most firms were significantly exposed to the USD in both the SR and CF approaches. Thus, companies should pay attention to managing risk associated with changes in the USD. As such, a comprehensive hedging program should be designed and executed across all currencies that the firm will be dealing with and not only focus on the major currencies.

Table 10. Random effects GLS model under nominal and real settings.

Country	Variables	Nominal Exchange Rate Exposure			Real Exchange Rate Exposure		
		B _i	t-value	P> t	B _i	t-value	P> t
Panel A: Stock Returns Approach							
Indonesia	Const.	-0.003	-2.369	0.017	-0.006	-5.248	0.000
	IDR/USD	-0.711	-15.284	0.000	-0.755	-16.087	0.000
	IDR/EUR	-0.053	-2.355	0.018	-0.049	-2.236	0.025
	IDR/GBP	0.123	2.704	0.006	0.107	2.339	0.019
	IDR/JPY	0.071	3.078	0.002	0.075	3.324	0.000
	F-test:	358.173	Prob> F	0.000	389.249	Prob> F	0.000
Malaysia	Const.	-0.003	-3.783	0.000	-0.002	-3.073	0.002
	MYR/USD	-0.421	-10.883	0.000	-0.478	-12.344	0.000
	MYR/EUR	-0.237	-8.310	0.000	0.052	17.659	0.000
	MYR/GBP	0.139	4.116	0.000	-0.024	-0.837	0.402
	MYR/JPY	-0.015	-0.697	0.485	0.032	1.529	0.126
	F-test:	79.321	Prob> F	0.000	135.839	Prob> F	0.000
Singapore	Const.	-0.007	-6.548	0.000	-0.007	-6.589	0.000
	SGD/USD	-0.260	-4.492	0.152	-0.187	-3.362	0.000
	SGD/EUR	0.061	1.533	0.911	0.081	2.107	0.035
	SGD/GBP	0.059	1.431	0.149	0.082	2.022	0.043
	SGD/JPY	-0.186	-5.701	0.157	-0.161	-5.059	0.000
	F-test:	16.162	Prob> F	0.000	12.616	Prob> F	0.000
Thailand	Const.	-0.000	-0.091	0.927	0.000	0.240	0.810
	THB/USD	0.413	9.513	0.000	0.419	9.808	0.000
	THB/EUR	-0.220	-6.099	0.000	-0.135	-7.446	0.000
	THB/GBP	-0.062	-1.479	0.139	-0.095	-2.559	0.010
	THB/JPY	0.002	0.056	0.955	-0.015	-0.612	0.540
	F-test:	40.485	Prob> F	0.000	42.709	Prob> F	0.000
Panel B: Cash Flow Approach							
Indonesia	Const.	0.897	1.963	0.049	-0.355	-0.701	0.483
	IDR/USD	-0.009	-0.290	0.771	0.018	0.315	0.752
	IDR/EUR	-0.711	-2.203	0.027	0.452	0.557	0.577
	IDR/GBP	-0.634	-1.243	0.213	0.017	0.038	0.970
	IDR/JPY	1.272	2.282	0.022	0.009	0.014	0.988
	F-test:	1.597	Prob> F	0.172	0.219	Prob> F	0.928
Malaysia	Const.	0.186	0.969	0.332	0.142	0.761	0.446
	MYR/USD	0.020	1.176	0.239	0.022	1.305	0.192
	MYR/EUR	-0.532	-2.739	0.006	-0.579	-2.829	0.004
	MYR/GBP	-0.076	-1.119	0.262	-0.021	-0.904	0.365
	MYR/JPY	0.275	1.649	0.099	0.266	1.569	0.116
	F-test:	2.314	Prob> F	0.055	2.289	Prob> F	0.057
Singapore	Const.	0.063	0.068	0.946	0.049	0.054	0.957
	SGD/USD	0.084	1.098	0.272	0.099	1.216	0.224
	SGD/EUR	-3.376	-2.149	0.031	-3.527	-2.311	0.020
	SGD/GBP	-0.219	-0.512	0.609	-0.216	-0.401	0.688
	SGD/JPY	0.686	0.587	0.557	0.905	0.771	0.440
	F-test:	1.339	Prob> F	0.252	1.604	Prob> F	0.170
Thailand	Const.	0.234	2.065	0.039	0.299	2.215	0.026
	THB/USD	-0.005	-0.312	0.754	0.007	0.371	0.710
	THB/EUR	-0.606	-1.923	0.054	-0.668	-2.196	0.028
	THB/GBP	-0.182	-0.769	0.441	-0.141	-1.151	0.249
	THB/JPY	0.372	1.564	0.117	0.427	1.967	0.049
	F-test:	1.570	Prob> F	0.179	1.964	Prob> F	0.097

Note: SR = stock returns approach, CF = cash flow approach, B_i is the beta coefficient of regression for currency *i* (beta currency exposure), F-test = F-value statistics, Prob>|F| = probability value associated with F-statistics, t-value = Student *t*-statistics value, P>|t| = probability value associated with Student *t*-statistics, USD = United States dollar, EUR = European currency (Euro), GBP = Great British pound, JPY = Japanese yen, IDR = Indonesian rupiah, MYR = Malaysian ringgit, SGD = Singapore dollar, THB = Thailand baht, Const. = constant (mean) value, X/Y = bilateral exchange rate quotation with domestic currency X against the foreign currency Y.

3. There was significant currency exposure in the mid-AFC and mid-GFC windows. This infers that when exchange exposure was evaluated by sub-period, the extent of currency exposure of ASEAN-4 firms is actually event-specific. Further, there was a rising number of exposed firms during the post-AFC sub-period. This finding substantiates the argument that the hedging programme that had been initiated during the mid-AFC period and was left unhedged during the post-AFC period window. It appears that the implementation of short-term exchange

risk management procedures cannot cater to the dynamic nature of exchange rate movements, and this limited hedging exercise has invariably increased the level of currency exposure. Interestingly, the enhanced level of exchange risk during the post-AFC window coincided with the hard peg system in Malaysia. This finding dispels the notion that exchange risk is reduced with hard pegs. The Malaysian currency's volatility simply mirrored the USD's. Thus, there is merit to the argument that a free foreign exchange market with a flexible system is perceived as a suitable system for small open economies. Greater market freedom would allow better flexibility in currency movements, thereby avoiding the build-up of misalignment and vulnerability to speculative attacks.

4. The higher incidence of exchange exposure under the SR approach could be explained by the comprehensiveness of the SR approach in its valuation relative to the CF method. This has consequences for the issue of the cost of equity capital. If the risk of exchange rate changes is systematic, such additional currency risk will contribute to the overall systematic beta of the capital asset pricing model. As such, it increases the risk premium of a stock, requiring a higher return for holding the stock. In order to reduce currency risk faced by shareholders, firms should increase the frequency of information released to investors.

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