ASSESSING ASYMMETRIC EXCHANGE RATE EXPOSURE OF MALAYSIAN NON-FINANCIAL FIRMS

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ABSTRACT

The paper aims to assess the level of asymmetric currency exposure of Malaysian non-financial firms. Existing studies of currency exposure of Malaysian corporations ignored the commingling effect of positive and negative signs of exchange rate changes, causing bias in estimation. To address the specification gap, the study gauges the extent of asymmetric currency exposure of 207 non-financial Malaysian firms from 1995-2016. The panel analysis is employed to assess the overall exposure of the sample firms while firm-level analysis involves regression analysis with GARCH (1,1) specification. The asymmetric analysis shows high percentage of the sample firms are having significant exposure to the USD depreciation; signifying large proportion of import base firms among the Malaysian sample firms. The level of currency exposure is also found to be event-specific where higher composition of firms had significant exposure during the Asian financial crisis 1997. Net importer seems to be in favor during foreign currency depreciation and vice versa for net exporters. Given this, an intuitively plausible strategy for net importer might be to put vigorous hedging activities during the appreciation of the USD to offset the adverse impact of escalating imported price. Stringent risk management program also should be closely monitored especially during the middle of financial crisis.

Keywords: Asymmetric Currency Exposure, Financial Crises, Malaysian Non-Financial Firms.

INTRODUCTION

The abolishment of the Bretton Woods system in early 1970s marked the major role of exchange rate movements as a source of risk to international corporations. With the development of the international investment and trade, currency movements have become more integral towards the cash flows of multinational companies. Currency exposure is defined as the sensitivity of firm cash flow to exchange rate movements. In the real world, such unexpected movements of exchange rate have the capacity to affect not only the firm competitiveness both in the local and foreign market, but it can also influence the relative values of foreign assets and liabilities (Sikarwar & Gupta, 2019). There are three types of exchange rate exposure, namely the transaction exposure, economic exposure, and translation exposure (Madura, 2021). Transaction exposure surfaces when there's unanticipated effect of foreign currency changes towards committed cash flows. On the other hand, economic exposure rises when there's impact of future currency movements on future cash flows. Economic exposure covers both transactional (contractual cash flow) and the present value of certain future cash flows (operating exposure component). In other dimension of exposure, translation exposure belongs to the effect of foreign exchange changes on accounting items (assets and liabilities) when foreign subsidiary tries to consolidate its foreign income with parent firm. The translation (accounting) exposure could be higher when there's abrupt change in exchange rate value during consolidation process. These

diverse exposure types show that a non-multinational firm will still be affected by the economic exposure despite its non-involvement with international trade.

In line with the acknowledged importance and substantial theoretical prediction of foreign exchange exposure, numerous studies have been highlighted to measure the size of exchange rate exposure within various market segments (Bartram, 2019; Wan Suhaimi et al., 2019a; Bacha et al., 2013; Bartram & Bodnar, 2012; Dewenter et al., 2005; Muller & Verschoor, 2007; Parsley & Popper, 2006; Yip & Nguyen, 2012). Another traditional conjecture in the financial market is the relatively more volatile currency in developing markets, which simultaneously signals higher exposure in the markets compared to developed countries.

Bacha, et al., (2013) showed that 71% of the listed nonfinancial corporations in the Malaysian market were significantly sensitive to currency changes, in contrary to the 5% of significantly exposed firms in the U.S by Jorion (1990). Extensive study by Bartram & Bodnar (2012) on the currency exposure level in 37 countries only showed modest level of currency exposure. A natural conclusion for the small exposure level in developed market is the existence of various hedging tools and advanced derivative practice. On the other hand, the developing countries are less involved with hedging practice (Cheng et al., 2017).

The hedging position of one firm can be an important source for examining the corporate profitability level (Bartram, 2019; Kim et al., 2020). The hedging strategy can be divided into two types, which are financial and operational hedging (Berger & Chapman, 2017; Kuzmina & Kutsenova, 2018). Our preliminary analysis on the practice of derivative hedging among 207 sample Malaysian firms illustrates the modest level of the hedging practice. As seem in Table 1, majority of the sample firms consists of unhedged firms while a small proportion of the firms employ the currency hedging derivatives to hedge their business. The contradictions between the low exposure findings by past literature and the low hedging derivative practice in the developing markets have given rise to more rigorous analyses to get a clearer picture on the true nature of currency risk under volatile market and open economic setting (Wahab et al., 2017; Ibrahim, 2008). Majority of previous works in unveiling the extent of sensitivity of firm value to exchange rate changes focused on symmetric measure where the positive and negative foreign currency changes are assumed to have the same implication on firm value. However, Clark & Mefteh (2011) asserted the way firm value reacts to appreciation/depreciation of exchange rate could be different.

Asymmetric exposure is also a crucial consideration as it elevates firms' incentive to resort in risk management undertakings and increases underinvestment cost for small firms (Hu et al., 2006). Despite the importance of asymmetric exposure in currency movement, Bartram & Bodnar (2012) claimed that most studies mainly focused on the linear currency exposure and failed to account for possible asymmetric exposure. These shortcomings necessitate further study to answer the underlying questions: to what extend the exchange rate exposure exerts economically meaningful effect on the developing countries? Furthermore, the findings are deemed as helpful for the investors and the financial market towards the advancement of the market.

The study selects Malaysia as the experimental setting mostly due to its economic openness that is heavily dependent on the global economy. The country is actively involved with international trade which can increase firm's susceptibility to currency risk (Tiwary, 2019). The enhanced degree of economy openness of Malaysia can be captured from trade-to-GDP ratio of 134% in comparison to other developed economies such as the United States (28%), United Kingdom (56%) and Japan (36%). Malaysia has also been showing rapid financial expansion partly due to its friendly trading destination and open foreign policies dating back to the credit

boom in the 1990s (Muniandy & Uning, 2006). The country's heavy foreign trade activities rank Malaysia among the top 20 global trading nations (Bacha, et al., 2013).

Table 1
COMPOSITION OF HEDGED AND UNHEDGED SAMPLE FIRMS IN MALAYSIA, 1995-2016

Year	Hedged Firms		Unhedged Firms	
	No. of Firms	%	No. of Firms	%
1995	11	5.3140	196	94.6859
1996	11	5.3140	196	94.6859
1997	11	5.3140	196	94.6859
1998	11	5.3140	196	94.6859
1999	11	5.3140	196	94.6859
2000	15	7.2464	192	92.7536
2001	21	10.1449	186	89.8551
2002	38	18.3575	169	81.6425
2003	51	24.6377	156	75.3623
2004	55	26.5701	152	73.4299
2005	64	30.9179	143	69.0821
2006	65	31.4009	142	68.5990
2007	68	32.8502	139	67.1498
2008	67	32.3672	140	67.6329
2009	67	32.3672	140	67.6329
2010	71	34.2995	136	65.7005
2011	72	34.7826	135	65.2174
2012	69	33.3333	138	66.6667
2013	72	34.7826	135	65.2174
2014	71	34.2995	136	65.7005
2015	72	34.7826	135	65.2174
2016	70	33.8164	137	66.1836

Preliminary analysis on the sample firms shows majority of the samples in this study are net importers, in parallel with the assertion by Bacha, et al., (2013) of the import-base nature of Malaysian trades. Our analysis shows 137 out of 207 firms (66.18%) firms are net importers due to relatively higher trade payable amounts than trade receivable amounts in their financial reports. Apart from extensive trading activities of the country, Malaysia experienced two significant financial crises namely Asian financial crisis (AFC) in 1997 and Global Financial Crisis (GFC) in 2008. Currencies of the ASEAN countries including Malaysia were badly attacked during the Asian financial crisis, leading to closer regional cooperation in political, economic, and monetary aspects among its members (Hadian & Adaoglu, 2020; Wan Suhaimi et al., 2019b). Subsequently, Malaysia experienced changes in exchange rate regimes by abandoning its managed float regime in response to the AFC and went to adopt fixed exchange rate against the US dollar.Pegging the Ringgit to the USD was meant to shield against the speculative attacks on ringgit during the crisis, before the peg being lifted in July 2005 (Wan Suhaimi et al., 2019b; Muniandy & Uning, 2006). Even though the peg was meant to stabilise

the Ringgit from further fluctuations, the move was not favourable for importers due to the pegged payable amount despite the possibility of undervalued imported price. The study considers interesting periodical events of the 2008 GFC, 1997 AFC and the exchange rate regimes shifts as time-varying factors. Time-variation is believed to play crucial role in the study of foreign currency exposure. Detailed explanation and description of the crises are provided in Table 2.

Table 2
FINANCIAL CRISES TIMELINE

Crisis	Date	Denotation	Description
Middle AFC	July 1997 – June 1998	MA (Middle AFC)	The East Asia crisis set off after the announcement of managed-floating baht by the Bank of Thailand.
Peg MYR	July 1998 – July 2005 (Muniandy& Uning (2006)	P	Period after the Asian financial crisis where the Ringgit was peg to US dollar.
De-peg	August 2005 – August 2008	DP	Period after the Ringgit was unpeg from the US dollar and before the GFC outbreak
Middle GFC	September 2008 – March 2009	MG (Middle GFC)	The global financial crisis arose from the downturn of the U.S. housing sector.
Post GFC	April 2009 – December 2016 (Bourkhis & Nabi (2013)	PG (Post GFC)	Period after the global financial crisis

As currency exposure is indeed one uncertainty that affects the MNC's cash flow and the economy at large, numerous researches have been conducted to tackle the issue through various approaches. Following a few methodological approaches proposed by Dewenter, et al. (2005), this study addresses the currency exposure by incorporating the asymmetric and time-variation aspects of the exposure. Utilizing the Malaysian market, this study strives to answer three questions: whether the asymmetric exposure in Malaysian market will provide different findings from the symmetric exposure analysis. Secondly, the study examines time variant nature of exchange rate exposure under varied financial episodes covering financial crises and exchange regime switch from peg system to managed floating system.

Thirdly, the study further investigates asymmetric time-varying effect of currency exposure in relatively to the mainstream symmetric exposure study. The significant financial events exhibited in Table 2 accentuate the relevant different time periods included in the study. This paper enriches the existing literature by providing a fresh asymmetric exposure analysis focusing on emerging economy. Secondly, the paper also contributes by measuring the currency exposure levels under asymmetric specification across five sub-periods covering exchange regime shifts and financial crises.

This paper is divided into five sections. Section 2 presents the previous literature and synthesises the key findings. Subsequently, Section 3 explains the data source and methodologies. Section 4 displays the results and discussions. The final part 5 concludes the paper by drawing out the key findings and policy implications.

LITERATURE REVIEW

Previous studies on the relationship between foreign currency changes and firm values had been modestly successful where majority of the efforts have been concentrated to western and developed economies (Muller & Verschoor, 2007; Beckmann & Stix, 2015; Adler & Dumas, 1984; Jorion & Jin, 2006; Bartram & Bodnar, 2007; Bodnar & Gentry, 1993). Starting from the seminal paper of Adler & Dumas (1984), the study had prompted various studies on currency exposure to establish the relationship between the stock returns and currency fluctuations.

The study only considered the effect of currency changes towards the firm values as a single comprehensive measure that summarized the susceptibility of firm value to foreign currency changes. Through this, Adler & Dumas (1984) suggested that the assessment of currency exposure could be done under regression framework. Evolution was further incorporated into the study of currency exposure. Jorion (1990) revolutionized the total exposure model through the inclusion of the market index to form the 2-factor residual exposure model.

Market index was included to contain the potential effect of market changes and ensured the effect of currency movement exclusively represented the currency movement without the effect from the market condition. Nevertheless, the residual model reported minimal level of exposure where about only 5% of 287 U.S. firms were found to have significant exposure from 1981 till 1987. The insignificant finding could be explained from misspecification problem where the study used trade weighted index as a proxy for exchange rate which potentially affected by offsetting effect within the weighted index. Besides that, the author suggested that the widespread use of hedging instruments among U.S. firms could potentially minimize the real level of exchange rate exposure.

Some studies found that hedging creates added value to firm (Hadian & Adaoglu, 2020; Kim et al., 2020; Bae et al., 2018; Luo & Wang, 2018; Hendrawan, 2017; Bhagawan & Lukose, 2014; Chaudhry et al., 2014; Clark & Judge, 2009; Belghitar et al., 2013). For instance, Bhagawan & Lukose (2014) conducted a study on the usage of foreign exchange derivatives and foreign currency debts among the Indian non-financial firms and the study found that these two financial instruments assisted in minimizing exchange rate exposure. In studies done by Hadian & Adaoglu (2020), they found that FCD hedging did increase Malaysian firm value. Kim, et al. (2020) discovered the effectiveness of foreign debt in reducing foreign exchange risk of manufacturing companies in Korea. In the same vein, Bae, et al. (2018) concluded that foreign currency derivatives work well in risk minimization among Korean firms. Hendrawan (2017) reported positive effect of forward hedging on selected Indonesian firms from January 2006 till December 2016. Luo & Wang (2018) found that Chinese corporations which engaged in foreign exchange derivatives tend to have higher firm value from 2000-2013.

Further, the study discovered that operational hedging through family ownership helps in mitigating currency risk. Antithetically, some studies reported insignificant role of hedging in reducing exchange rate risk such as Ayturk, et al. (2016). The study examined the incidence of exchange rate exposure of Turkish firms from year 2007 till 2013 and reported that foreign currency derivatives did not give significant impact to the level of currency exposure as well as firm value.

Another study of Espinoza & Hansen (2017) found no statistical evidence of foreign currency hedging (through foreign debt) on the profitability of Chile's firm. Minimal currency exposure level was also recorded in developed countries due to the efficiency and better operational structure in their markets (Allayannis & Ofek, 2001; Bodnar & Wong, 2003; Di Iorio

& Faff, 2002). The low exposure level in the study by Allayannis & Ofek (2001) was also subjected to the widespread use of hedging in the U.S market.

Under emerging economy of Malaysia, several efforts have been taken to gauge the extent of currency exposure of Malaysia firms (Abdul Wahab, 2017; Bacha et al., 2013; Parsley et al., 2006). One of significant references is the study by Bacha, et al. (2013) who investigates the prevalence of currency exposure of 158 non-financial corporations in Malaysia. The study found that there was strong incidence of currency exposure where about 71% of sample firms had significant exposure. The finding meets economic sense as Malaysia adopts open economy where cross border business transactions become norm in daily business activities. Further, majority of sample corporations had significant exposure to the U.S. Dollar (USD) and the Great British pound (GBP) as both countries are among major trading partner of Malaysia. Another study of Muller & Verschoor (2007) conducted large scale study involving 3000 Asian corporations where majority sample firms were significantly exposed to the USD and highly geared firms had greater sensitivity of exchange risk.

A study by Bartram & Bodnar (2012) involving 4404 non-financial firms across 37 developed and emerging countries found that firms from emerging economies were highly sensitive to exchange rate changes compared to corporations from developed economies. The study justified the endogeneity of hedging as one of important factors in influencing the distant level of exposure between developed and developing economies (Ibrahim et al., 2019). Further, firms from Malaysia were having high level of susceptibility to the USD, GBP and Japanese Yen which conforming the findings of Bacha, et al. (2013).

Throughout the years, several methodological changes were applied into the measurement of currency exposure (Cheah et al., 2017). Despite of methodological advancement in currency exposure measurement, there are limited number of efforts concentrated in examining the effect of asymmetry reaction in exchange rate (appreciations and depreciations) to firm value especially to corporations operating within emerging economies (Lily et al., 2020; Clark & Mefteh, 2011; Di Iorio & Faff, 2002; Elahi et al., 2016; Koutmos & Martin, 2003). The asymmetry effect of exchange rates provides further detailed analysis on the true and in-depth understanding on the true nature of exposure subject to underlying business positions.

The asymmetry exposure suggests that the appreciation and depreciation of exchange rate should have different implications on net importer and net exporter. A net importer should be in favor position during the depreciation of foreign currency (cheaper imported cost) while net exporter should be in better position in the event of appreciation of local currency. This asymmetry effect is notably important however has been ignored in most studies producing bias outcomes. Event study method with precaution on the asymmetric reactions of the currency movements was undertaken by Dewenter, et al. (2005) to examine the currency exposure among the U.S multinational firms.

The study only found small significant exposure and attributed the low result to the efficient hedging practice and swift responsiveness to currency movements, rather than methodological weakness. The asymmetric reaction of stock returns to currency fluctuations was also accentuated by Clark & Mefteh (2011). The asymmetric behaviour of currency movements increased firms' awareness to resort in vigorous risk management activities. This was shown by the 18% higher significant exposure towards the Euro-index when asymmetry was considered among 176 French firms, compared to 22% significance level without asymmetry (Clark & Mefteh, 2011). Meanwhile, Bartram & Bodnar (2007) asserted the slow response due to lagged information as weakening the relationship between currency movement and stock return. The

importance of asymmetry effect analysis can also be found in explaining the effect of hedging in minimizing exchange rate exposure.

For instance, Jorion & Jin (2006) incorporated asymmetry effect measuring the effect of Foreign Currency Derivatives (FSD) usage to the level of currency risk. The study found that FCDs were effective in minimizing the overall level of exchange rate risk. However, extra cautions need to be monitored during currency appreciations and depreciations. Clark & Mefteh (2011) found that FCD usage among French firms had significant effect to the upward and downward movements of non-US currencies.

In term of USD, French FCD had significant effect during the depreciation of the USD. From all these discussions, one might see the importance of asymmetry effect in determining the true level of exposure and the ignorance toward such effect might render to bias and spurious outcomes. Ameer (2010) highlighted the role of time variation to affect the expected returns in the international market, in which the change would cause structural changes in investment portfolio. This was showcased in the study by Dewenter, et al. (2005) which avoided many problems encountered in previous works by incorporating the bilateral falls in the Mexican peso and Thai baht. Despite that the event study method as suggested by Dewenter, et al. (2005) had increased measurement power, nevertheless the study found relation between foreign currency and firm value with minimal level of significance.

A closer study by Bacha, et al. (2013) affirmed the time-variant nature of currency exposure in Malaysia market and concluded the significant exposure to USD even during the peg period. The recent study of Abdul-Waheb, et al. (2017) supported the relevancy of event specific method in capturing the true nature of exposure where the study found significant incidence of exposure during the middle of Asian financial crisis and significant effect of derivative use during the turmoil period.

METHODOLOGY

Sample Description

For data collection procedure, most monthly data comprising stock returns, bilateral exchange rate (MYR/USD) and market index (FBM Kuala Lumpur Composite Index, FBMKLCI) are extracted from Bloomberg terminal. The sample firms consist of 1000 listed firms in Bursa Malaysia. In order to maintain a comprehensive data collection, the firms are required to be non-financial firms with sufficient stock returns data from 1995 to 2016. Financial firms are removed due to the less involvement in cross border goods and services trading (Allayannis & Ofek, 2001). The exposure of these financial firms is different from non-financial firms due to different business nature and significant role played by financial institution as market makers in foreign exchange market. With this restriction, the final sample for the study only comprises 207 firms while 793 firms are excluded. The pivotal role of market index (FBM-KLCI) is to control other external macroeconomic conditions from affecting the true level of exposure and will enhance the regression precision.

Method

Overall exchange rate exposure provides an aggregate includes level of exposure from the overall sample firms. The firm level exposure provides specific exposure to individual firms. The varying exposure levels for each firm also emphasize the importance of assessing the individual exposure towards each firm under study. For this purpose, the study conducted a panel analysis

as well as firm-level analysis on the data for both symmetric and asymmetric approaches. We are conducting Fixed effects and Random effects models with critically examine homogeneity assumptions with respect to (i) intercept (Fixed effects) and (ii) residual variance (Random effects) (Abdul Wahab, 2018). It should be noted that all the analyses covering panel and firm specific are conducted using Eviews software with special care.

Panel Model

Panel model allows the pooling of cross sections (firms) and time dimension. The stacking procedure is done through Eviews software. The study uses fixed effects model to measure the overall currency exposure and producing aggregate measurement of exposure for the whole sample firms. The panel regression is run based on the equation (1), (2), (3), and (4) to test the incidence of symmetric, asymmetric and time varying exposure. The analysis serves as a comparison for the firm-level analysis to better gauge the currency exposure level in the Malaysian market.

The symmetric fixed effects model:

$$R_{it} = \alpha_{0i} + \alpha_1 R_{mt} + \beta_{US\$} S_{US\$,t} + \varepsilon_t + \mu_{it} \quad (1)$$

The asymmetric fixed effects model:

$$R_{it} = \alpha_0 + \alpha_1 R_{mt} + \beta_{US\$} S_{US\$,t} + \beta^N_{US\$} S^N_{US\$,t} + \varepsilon_t + \mu_{it} \quad (2)$$

The symmetric time-varying fixed effects model:

$$R_{it} = \alpha_0 + \alpha_1 R_{mt} + \sum_{j=1}^{5} \beta_{US\$} D_j S_{US\$,t}{}_{US\$} + \varepsilon_t + \mu_{it} \quad (3)$$

The asymmetric time-varying fixed effects model:

$$R_{it} = \alpha_{0i} + \alpha_1 R_{mt} + \sum_{j=1}^{5} \beta^P_{j,US\$} D_j S^P_{US\$,t} + \sum_{j=1}^{5} \beta^N_{j,US\$} D_j S^N_{US\$,t} + \mu_{it} \quad (4)$$

For each corporation *i* at time *t*, the denotations are as follows:

R_{it}=monthly returns of firm stock *i* measured as $R_t = \ln \frac{P_t}{P_{t-1}}$

R_{mt}=monthly returns of market index measured as $R_{mt} = \ln \frac{Rm_t}{R_{t-1}}$

$S^P_{US\$,t}$ = Appreciation in monthly USD changes denoted as $S_{US\$,t} = ln \frac{s^P{}_t}{s^P{}_{t-1}}$

$S^N_{US\$,t}$ = Depreciation in monthly USD changes denoted as $S_{US\$,t} = ln \frac{s^N{}_t}{s^N{}_{t-1}}$

D_j=time varying dummy for specific financial crises and exchange rate system;
$D_1 = 1$, middle Asian financial crisis (July 1997- June 1998); 0, otherwise
$D_2 = 1$, peg period (July 1998 – July 2005); 0, otherwise
$D_3 = 1$, de − peg period (August 2005 – August 2008); 0, otherwise
$D_4 = 1$, middle global financial crisis (September 2008 – March 2009); 0, otherwise
$D_5 = 1$, post global financial crisis (April 2009 – December 2016); 0, otherwise

μ_{it}= residual of regression

Currency exposure for firm specific analysis is analyzed under both symmetric and asymmetric models. The residual exposure model by Parsley & Popper (2006) is used for the symmetric analysis, while the asymmetric model is adopted from Clark & Mefteh (2011). Both models rooted from the model introduced by Jorion (1990) to measure foreign currency exposure. The models to measure currency exposure are as follow;

Symmetric Model

For the symmetric model, the study adopted the model introduced by Jorion (1990):

$$R_t = \gamma_0 + \gamma_1 R_{mt} + \beta_{US\$} S_{US\$,t} + \mu_t \quad (5)$$

For each firm at time *t*, the other denotations are as follows:

R_t is monthly return of a firm stock denoted as $R_t = \ln \frac{P_t}{P_{t-1}}$

R_{mt} is monthly return on the market index

$S_{US\$,t}$ is monthly change in the USD denoted as $S_{US\$,t} = ln \frac{s_t}{s_{t-1}}$

To cater with non-constant variance problem of stock returns and foreign currency series, the study adopts the precaution taken by Bacha, et al. (2013) to incorporate a Generalized Autoregressive Conditional Hetero scedasticity (GARCH (1,1) specification into equation (5).

ASYMMETRIC MODEL

The asymmetric effect of exchange rate fluctuation (appreciation and depreciation) is included in equation (6). For a firm at time t under specific j time period, the equation segregated the monthly stock returns based on the direction of their changes (appreciation and depreciation). The asymmetric model allows measurement of coefficients associated with currency movement in upward or downward trend.

$$R_t = \gamma_{0i} + \gamma_1 R_{mt} + \beta^P_{US\$} S^P_{US\$,t} + \beta^N_{US\$} S^N_{US\$,t} + \mu_t \quad (6)$$

Where:

R_t=monthly returns of a stock denoted as $R_t = \ln \frac{P_t}{P_{t-1}}$

R_{mt}=monthly returns on the market index

$S^P_{US\$,t}$ = Appreciation in monthly USD changes denoted as $S_{US\$,t} = ln \frac{{s^P}_t}{{s^P}_{t-1}}$

$S^N_{US\$,t}$ = Depreciation in monthly USD changes denoted as $S_{US\$,t} = ln \frac{{s^N}_t}{{s^N}_{t-1}}$

μ_t= regression residual

Time Varying Exposure Model

Incorporating time-varying factor into equation (5) and (6) give out (7) and (8) respectively, where *j* is the number of time periods included in the study:

i. Symmetric model

$$R_t = \gamma_0 + \gamma_1 R_{mt} + \sum_{j=1}^{5} \beta_{US\$} D_j S_{US\$,t} + \mu_t \quad (7)$$

ii. Asymmetric model

$$R_t = \gamma_0 + \gamma_1 R_{mt} + \sum_{j=1}^{5} \beta_{j,US\$}^{P} D_j S_{US\$,t}^{P} + \sum_{j=1}^{5} \beta_{j,US\$}^{N} D_j S_{US\$,t}^{N} + \mu_t \quad (8)$$

The D_j represents the time dummy variable for specific time period. The peg period is used as the control group due to collinearity issue arising from the inclusion of the period data.

$D_1 = 1$, middle Asian financial crisis (July 1997- June 1998); 0, otherwise
$D_2 = 1$, peg period (July 1998 – July 2005); 0, otherwise
$D_3 = 1$, de − peg period (August 2005 – August 2008); 0, otherwise
$D_4 = 1$, middle global financial crisis (September 2008 – March 2009); 0, otherwise
$D_5 = 1$, post global financial crisis (April 2009 – December 2016); 0, otherwise

RESULTS AND DISCUSSIONS

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

Overall Currency Exposure

Panel A of Table 3 displays the level of currency exposure of -0.0633, implying that 1% increase in the USD causing 6.33% fall of the overall firm performance. The negative coefficient favors the importers where firms are in advantage during the depreciation of the USD due to low USD denominated payables and imported prices. The beta USD is significant for the overall stock returns, a finding that synchronizes with those of an emerging market exhibiting persistence volatility in exchange rate movements. Panel B exhibits the insignificance of the USD appreciations on the stock returns while shows the significance of the USD depreciations. Conforming to Bacha, et al. (2013) and Wahab (2017) assertion of Malaysian importing nature, the results display the sample multinationals are significantly exposed to the USD depreciation with positive sign, implying that the depreciation of the USD will induce profits for importing firms.

Table 3
PANEL ESTIMATION ON SYMMETRIC AND ASYMMETRIC EXCHANGE RATE EXPOSURE

Panel A: Symmetric	
Constant	-0.0036 (0.0000)
Market Index	1.1314 (0.0000)
Currency Exchange	-0.0633 (0.0000)
Panel B: Asymmetric	
Constant	0.0028 (0.0000)
Market Index	1.1309 (0.0000)
Currency Appreciation	0.0135 (0.6474)
Currency Depreciation	0.1539 (0.0002)

Values shown in parentheses represent p-values with significance level of 10%.

Detailed results on the time varying exposure under the symmetric and asymmetric specifications are presented in Table 4. Confirming our priori expectation, it is found that the incidence of exchange rate exposure is highest during the middle of AFC irrespective of the approaches. Further, it is noticeable that the insignificant impact of exchange rate exposure during the middle of GFC. The prevalence of currency exposure during AFC compared to GFC could be explained by several reasons. First, the outbreak of AFC originated within the region with direct impact of speculative activities which devastated the whole economy and financial landscape, causing stock market and currency market to collapse. The crisis expanded to real sector pushing the economy into deep recession with skyrocketed interest rate, massive capital flights due to evaporated investor's confidence and severe unemployment problems. On the other hand, the epicenter of GFC originated from the advanced economy due to extreme stress in housing markets and banking system in the United States. Secondly, the Asian market faced V-shaped recovery through massive financial and structural reforms after Asian crisis. Given this, the Asian countries disseminated large stimulus packages during the GFC and decisively implementation supported domestic demand and laid strong economy foundation. Decisive and precise monetary policy quickly turned economic recovery and expansionary which supported economic growth and liquidity to banking industry during the 2008 crisis.
Values shown in parentheses represent p-values with significance level of 10%.

Table 4
PANEL ESTIMATES OF SYMMETRIC AND ASYMMETRIC TIME-VARYING CURRENCY EXPOSURE

	Symmetric	USD Appreciation	USD Depreciation
Market Index	1.1329 (0.0000)	1.1272 (0.0000)	
Pre-AFC	-0.0538 (0.7824)	-1.0042 (0.0025)	0.4591 (0.0025)
Middle-AFC	0.0941 (00026)	-0.0656 (0.0821)	0.5005 (0.0000)
Peg	-0.0035 (0.0000)	-0.0045 (0.0000)	
De-peg	0.4261 (0.0004)	0.9452 (0.0001)	0.1934 (0.1886)
Middle-GFC	0.0463 (0.6483)	0.0588 (0.6175)	0.0604 (0.7671)
Post-GFC	-0.0035 (0.9208)	0.1799 (0.0001)	-0.3363 (0.0000)

In overall, the symmetric analysis displays highly level of exposure during middle AFC and de-pegs periods. A closer inspection to the asymmetric analyses provides more extensive results with more periods showcasing significant influence towards the currency exposure level among the sample firms. It is also observed that the appreciation of the USD causes significant exposure under whole periods excepting the middle-GFC and peg periods. Collinearity issue prompts the analysis to regard the peg period as the control period and found significant impact of currency exposure depicted under the peg system. The result is in line with the assertion by Bacha, et al. (2013) and Suhaimi, et al. (2019b) that the Malaysian market is still affected during the peg period due to potential under-valuation exchange rate under the pegging system.

Symmetric and Asymmetric Exposure

Firm level currency exposures, as estimated using Eq. (6), are reported in Table 5. The results display that 35.75% of sample firms are experiencing significant currency exposure. This proportion is slightly higher than the values reported by Muller & Verschoor (2007) in which 25% of its Asian sample is significantly affected by currency movement. From the results, 9 corporations have positive significant impact from currency changes, while 65 firms receive significant negative effect from the exposure. Even from the overall sample, higher proportion of the firms respond negatively to currency movement, hence the need for the market to hone its current hedging practice to better facilitates the adverse effect of the currency exposure.

Table 5 also summarizes the evidence on asymmetric exposure to provide the incidence of asymmetric exposure. 34 (16.4251%) firms under the study are having significant exposure to the USD appreciation, while 21 firms (10.1449%) are significantly exposed to the USD depreciation.

Table 5
SYMMETRIC AND ASYMMETRIC CURRENCY EXPOSURE

	Symmetric	**Asymmetric**	
		USD Appreciation	**USD Depreciation**
Mean	-0.2942	-0.0357	0.1224
Median	-0.2758	-0.0339	0.0669
SD	0.4615	0.4901	0.5666
Max	1.1102	1.3871	1.8042
Min	-2.2429	-3.0609	-1.6844
Frequency of Positive Cases (%)	59 (28.50)	95 (45.89)	113 (54.59)
Frequency of Negative Cases (%)	148 (71.49)	112 (54.11)	94 (45.41)
Frequency of Significant Positive Cases at 5% (%)	9 (4.35)	16 (7.73)	12 (5.79)
Frequency of Significant Negative Cases at 10% (%)	65 (31.40)	18 (8.69)	9 (6.28)
Total Frequency of Significant Cases (%)	74 (35.75)	34 (16.43)	21 (10.14)

Values shown in parentheses represent p-values with significance level of 10%.

Only 16 firms significantly benefit from USD appreciation while the remaining 18 firms are potentially consisted of importer firms that are adversely affected by USD strengthening, consistent with finding on tradable sectors by Aguiar (2005). On the other hand, the last column of the Table 5 shows 12 firms are having significant exposure to the USD depreciation, potentially caused by the importing nature of these firms. In overall, the whole samples are in favor of the USD depreciation, confirming the assertion that the samples mainly comprised of importing firms. The net importing firms are generally susceptible to the USD appreciation (with negative exposure) while more firms enjoy greater return when the USD weakens (with positive sign of exposure).

Time-Varying Symmetric Exposure

Time-varying symmetric exposure obtained based on Eq. (7) is displayed in Table 6. The highest frequency of firms having significant exposure during the AFC at 71.49% which is conforming to the finding by Bacha, et al. (2013). The finding is within expectation for AFC as

the financial crisis mainly affected the currency market. Peg period shows the lowest effect with only three percent of significantly affected firms. Aside from the peg period, the analysis provides evidences of relatively high exposure level among the sample nonfinancial corporations in Malaysia under all periods. Similarly, majority of the firms are having significant negative exposure except for the peg and de-peg periods. The disproportionate percentages illustrate the need for the market to acquire hedging practice within its operation as the sample corporations are negatively exposed to the USD fluctuations.

Table 6
TIME-VARYING SYMMETRIC CURRENCY EXPOSURE

	MIDDLE AFC	PEG	DEPEG	MIDDLE GFC	POST GFC	C
Mean	-0.8775	1.8563	0.4831	-0.1107	-0.1193	-0.0019
Median	-0.8465	2.2609	0.5800	-0.0528	-0.0896	-0.0004
Maximum	3.6921	35.6626	16.8796	10.0461	1.2798	0.0159
Minimum	-13.8061	-26.3228	-7.0812	-8.2245	-1.8446	-0.0427
Positive Cases	38	138	138	101	85	98
%	18.36	66.67	66.67	48.79	41.06	47.34
Negative Cases	169	69	69	106	122	109
%	81.64	33.33	33.33	51.21	58.94	52.66
Significantly Positive	21	7	24	18	8	22
%	10.14	3.38	11.59	8.69	3.86	10.63
Significantly Negative	127	4	19	31	28	15
%	61.35	1.93	9.18	14.98	13.53	7.25
Significant Cases at 5%	127	6	30	40	21	29
%	61.35	2.89	14.49	19.32	10.14	14.01
Significant Cases at 10%	148	11	43	49	36	37
%	71.49	5.31	20.77	23.67	17.39	17.87

Time-Varying Asymmetric Exposure

In Table 7, 23.19% of the corporations exhibit significant exposure to the USD appreciation during AFC. The significant amount during the GFC is also found to be high. The low effect of the USD appreciation during the post peg and post GFC periods is partly due to the relatively tranquil markets under the periods. Most of the sample firms are having negative impact from the USD strengthening under pre-AFC, middle-AFC and middle-GFC.

Meanwhile, the highest frequency of firms affected from the USD depreciation during the de-peg period is 16.43%, subsequently followed by middle-AFC period at 14.01%. In fact, most of the firms enjoy positive effect from the USD depreciation under most periods with exception of pre-AFC.

The number during the post GFC period indicates balance percentages between advantaged and disadvantaged firms. As importers are the one to benefit from the depreciating USD, the positive outlook from the USD depreciation across the periods infers that the samples comprised of importing corporations which supported the finding of Wahab (2017). This is shown by our preliminary analyses in which large portion of the samples are import-base firms.

Table 7
TIME-VARYING SYMMETRIC AND ASYMMETRIC CURRENCY EXPOSURE

	USD Appreciation					USD Depreciation				
	Pre-AFC	**Middle AFC**	**De-peg**	**Middle GFC**	**Post GFC**	**Pre AFC**	**Middle AFC**	**De-peg**	**Middle GFC**	**Post GFC**
Mean	-1.104	-0.218	0.601	-0.128	0.051	0.599	0.472	0.541	0.258	-0.098
Median	-1.156	-0.137	0.580	0.029	0.026	0.397	0.491	0.416	0.238	-0.108
Max	17.047	5.902	8.771	6.007	1.701	8.083	3.905	11.446	21.715	7.548
Min	-14.657	-3.364	-6.781	-6.891	-1.667	-9.525	-2.959	-8.978	-13.211	-1.872
Std. Dev.	3.652	0.785	2.259	1.692	0.448	2.726	1.033	2.047	3.223	0.791
(+) Cases	58	66	129	107	117	122	142	136	127	84
%	28.02	31.88	62.32	51.69	56.52	58.94	68.59	65.70	61.35	40.58
(-) Cases	149	141	78	100	90	85	65	71	80	123
%	71.98	68.12	37.68	48.31	43.48	41.06	31.40	34.29	38.65	59.42
Significant at 5%	21	39	11	25	12	10	18	20	16	10
%	10.14	18.84	5.31	12.08	5.79	4.83	8.69	9.66	7.73	4.83
Significant at 10%	22	48	15	35	18	14	29	34	22	12
%	10.63	23.19	7.25	16.91	8.69	6.76	14.01	16.43	10.63	5.79
Significant Positive	8	12	13	10	14	5	20	19	14	6
%	3.86	5.79	6.28	4.83	6.76	2.42	9.66	9.18	6.76	2.89
Significant Negative	14	36	2	25	4	9	9	15	8	6
%	6.76	17.39	0.97	12.08	1.93	4.35	4.35	7.25	3.86	2.89

The results suggest negative sign of currency exposure towards most of the firms. Positive exposure is shown by majority firms from the USD depreciation. Bacha, et al. (2013) mentioned on how positive and negative exposure can be clearly illustrated by the exporting/importing trading position of the firms. In the same essence, these importing firms are also negatively exposed from the USD appreciation. The overall exposure trend indicates the overall importing nature of the firms in Malaysia which experience higher stock returns during the USD depreciation. Antithetically, the time-varying results exhibit the highest incidence of exchange exposure during the middle-AFC covering both symmetric and asymmetric analyses. It is also interesting to note the effect experienced by these firms during the AFC due to the nature of the crisis.

The highly level of currency regardless of symmetric or asymmetric nature of the currency movements, implying the Malaysian sample corporations are relatively more exposed to currency changes. However, the level differs in accordance to respective sub-periods; with large portion of the sample firms (more than 60%) are significantly sensitive to currency movements during the middle-AFC period. Partitioning the exposure into positive and negative signs exhibit a classic trend of import base business. While the significance trend decreases throughout the sub-periods, the relatively high level of exposure during peg period is noteworthy to be explained. Additionally, comparing the high significance level during middle-AFC for both symmetric and asymmetric risk and the low level during middle-GFC, the study concludes the

firm-level and panel analyses would provide different outcomes especially when involving time-variation as connoted by Bacha, et al. (2013), Suhaimi, et al. (2019b), Muller & Verschoor (2007).

CONCLUSION

The study has conducted two-stage analysis where the first stage focuses on overall exposure (panel analysis) while the second stage highlights the firm specific exposure. Both approaches are repeated to effectively capture the symmetric, asymmetric and time varying exposure of nonfinancial corporations of Malaysia. As the sample Malaysian firms depicted minimal use of hedging instruments under highly volatile market (Yazid & Musa, 2006), high level of exposure reported in this study meets our priori expectation. As a record, about one third of our sample corporations are having significant exposure to the USD changes. To be more specific, the study finds that Malaysian sample firms are having negative sign of exposure, signifying the majority of sample firms benefiting from the USD depreciations. Importing firms experience higher profit from lesser payable during USD weakening. The result meets economic sense as our preliminary results analysis has shown 66.18% of our sample firms are net importers. The composition of firms benefited and adversely affected under each sample period illustrate the majority of non-financial firms in Malaysia reacted positively towards the USD depreciation.

Despite of large efforts have been put on investigating time varying currency exposure in the western and developed economies, less attention has been put on developing economies. The study contributes to the literature by providing comprehensive study on asymmetric effect across different episodes of financial crises surrounding the Asian Financial Crisis (AFC) 1997 and Global Financial Crisis (GFC) 2008 as well as exchange regime switch from de facto peg system to managed floating system. Based on thorough analysis, we have learnt that AFC displays highest level of exposure compared to GFC given the fact that the AFC originated within the region and severely affected from direct speculative activities in foreign exchange market. Nevertheless, the study observes that the level of exposure is gradually decreasing over time, signaling the possibility of market advancement and improvement in hedging and risk management activities among multinational corporations in Malaysia. The study also improves the test power of measurement of exchange rate exposure through the incorporation of asymmetry effect across different segments of financial events and exchange rate systems.

In dealing with several methodological limitations in examining the exchange rate exposure, the study would suggest future research to provide more insights on the time-varying and the effect of foreign exchange risk conducts more thoroughly. While the study places more emphasis on single open economy of Malaysia, future studies may focus to other countries who share identical economic fundamentals and facing several financial shocks likewise Malaysia so that more comprehensive results could be produced. Besides non-financial sector, future study can also be concentrated on assessing the potential of currency exposure of financial institutions which have potential impact on financial retail products and operations (Saiti et al., 2017).

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