

Empirical Analysis on Exchange Rate Fluctuation and Sectoral Stock Returns in Malaysia

(Analisis Empirik Terhadap Turun Naik Kadar Pertukaran dan Pulangan Saham Mengikut Sektor di Malaysia)

Norimah Rambeli @ Ramli

Emilda Hashim

Asmawi Hashim

Universiti Pendidikan Sultan Idris

Dayang Affizzah Awang Marikan

Universiti Malaysia Sarawak

Jan M. Podivinsky

University of Southampton

ABSTRACT

The purpose of this study is to observe the impact of the exchange rate fluctuation in Malaysia on sectors stock returns by using an augmented standard capital asset pricing model from October, 1992 to December, 2015. This paper extends previous studies on exchange rate fluctuation for the case of Malaysia by estimating the augmented capital asset pricing model for the price indexes sectors, including financial, plantation, properties, industrial, tin and mining, trade and services, consumer products and construction sector indexes. Moreover, this study also expands the literature by adapting the modelling proposed by Ibrahim (2008) by considering the exchange rate volatility, Asian financial crisis dummy and pegging exchange rate dummy. This analysis is significant because of the importance of exchange rate fluctuation as drivers of sectoral returns. In general this study successfully documented the exchange rate fluctuation scenario in Malaysia. Overall, the result suggests that the exchange rate fluctuation in Malaysia can be categorized as the long memory in the volatility process. The results further suggest the sectors are largely affected by the currency fluctuated.

Keywords: Sector returns; exchange rate returns; exchange rate volatility; exchange rate asymmetric

ABSTRAK

Kajian ini bertujuan untuk meneliti kesan turun-naik kadar pertukaran di Malaysia terhadap pulangan saham mengikut sektor dengan menggunakan model perletakan harga aset modal dari bulan Oktober 1992 hingga Disember 2015. Kajian ini merupakan lanjutan daripada kajian-kajian yang terdahulu dengan menganggarkan model imbuhan perletakan harga aset modal bagi sembilan sektor ekonomi terpilih termasuklah sektor kewangan, pertanian, harta, perindustrian, perlombongan, perdagangan dan perkhidmatan, barangan kepenggunaan dan pembinaan. Seterusnya, kajian ini juga menyumbang kepada kajian lepas dengan mengambilkira model penganggaran yang diperkenalkan oleh Ibrahim (2008) dengan memasukkan pemboleh ubah kemeruapan kadar pertukaran, pemboleh ubah patung krisis kewangan Asia dan pemboleh ubah patung kadar pertukaran tetap. Kajian ini adalah signifikan kerana pemboleh ubah kemeruapan kadar pertukaran merupakan pemangkin kepada pulangan sektoral. Secara keseluruhan, dapatan kajian mencadangkan bahawa kadar pertukaran asing di Malaysia boleh dikategorikan sebagai pemboleh ubah kesan jangka panjang dalam proses kemeruapan. Dapatan kajian seterusnya mencadangkan bahawa kebanyakan harga saham sektor ekonomi di Malaysia amat dipengaruhi oleh turun naik matawang.

Kata kunci: Pulangan sektor; pulangan kadar pertukaran asing; kemeruapan kadar pertukaran asing

INTRODUCTION

The exchange rate fluctuation can be says as exposure in the market value. Moreover, the exposure also can be say as an elasticity of change in the market value of the firm resulting from a unit change in the exchange

rate (Adler & Dumas 1984). While this is the exact definition of exposure that an investor is interested in, if the change in the value of a firm is directly related to the change in a firm's expected cash flows, this definition of exposure will also be the measure that the risk manager of the firm would be interested

in (Dumas 1978). Additionally, as found by Joseph (2002), the exchange rate exposure refers to the degree to which the value of a firm or an industry is affected by exchange rate changes. Also, the exchange rate changes can affect an individual investor who owns a portfolio consisting of securities in different currencies. Moreover, for a multinational company they also can be affected if they have subsidiaries and branches in international location. And, the exporter and importer who only focuses on international trade or indirectly related to foreign trade activity, can also be affected. According to Cushman (1983), Chowdhury (1993), Kroner and Lastrapes (1993), Dominquez and Linda (2001), Norimah and Podivisky (2013), among others, suggested the exchange rate exposure not only disturbing the sector returns of the country, but it's also affecting the international trade (i.e.: exports, imports).

In Malaysia, the borderlessness of financial transactions between countries makes capital market in Malaysia more important as a source of funds (Kaplan & Rodrik 2001). Nonetheless, there are no final conclusion ever made regarding its relationships and the condition comes along with obstacles (Baharumshah, Mohd & Sung 2009). Besides the market index return as a common factor influencing stock returns, sensitivity of stock returns to exchange rate returns and exchange rate volatility are two other factors that investors should consider, in constructing their securities portfolio and before they take any decision on investing in Malaysia (Chee, Hui & Annuar 2004). The standard approach broadly proposed by the previous literature such Adler and Dumas (1984), Dominguez (1998), Lobo (2000), Joseph (2002), Koutmos and Martin (2003), Ibrahim (2008), among others, provides useful information to measure the exposure to exchange rate by estimating the sensitivity of stock returns to exchange rate changes. In addition, because of the potential cash flow cost, it is important to examine how exchange rate changes and exchange rate risk affects stock returns.

In the estimation model, this study extends the earlier literature further by including two types of dummy in the models, pegging exchange rate dummy and 1997/1998 Asian financial crisis dummy. The first dummy variable is PEG_{it} (September, 1998 to August, 2005; 1 and otherwise; 0) for the period where the Malaysia ringgit is pegged to the US dollar. The second dummy variable is CD_{it} (July, 1997 to December, 1999; 1 and otherwise; 0) for time where there crisis has occurred. From these two dummies we assume has created a significant effects on the economics history and thus, we consider these events as structure break in the model. Moreover this article explained in depth the structure of the modelling in the next section. Following the model proposed Ibrahim (2008), this article tried to fulfil the gap by proposing augmented CAPM modelling by adapting the interaction variable between the exchange rate changes and appreciation dummy variable.

The remainder of the paper is organized as follows: In the next section provides some literature review. Section three to five, discussing the methodology part and data descriptions, including a brief explanation of the augmented CAPM modelling in this study, respectively. Moreover section six discussing the empirical findings and its economics interpretation.

LITERATURE REVIEW

To begin, we start this section with the paper written by Koutmos and Martin (2003). This study investigates the impact of first- and second-moment exchange rate exposure on the daily returns of nine U.S sectors from 1992 to 1998. This paper inspired current paper in how the author separates the model into contemporaneous and one-day lagged models. The findings supports, in 17.8% of the cases they detect significant first-moment exposure when contemporaneous exchange rates are used. Furthermore, 25% of the significant exposures are asymmetric. In contrast, for one-day lagged model, they found 42.2% of the cases are significant and 79% are asymmetric. Concerning second-moment exposure, the financial sector is found to be the most sensitive sector when using contemporaneous and one-day lagged models. Based on argument proposes by previous researchers, for instance Bartov and Bodnar (1994), Martin, Madura and Akhigbe (1999) and Di Iorio and Faff (2000) argue that lagged exchange rate changes impact returns. Di Iorio and Faff (2000) found significant evidences indirectly support lagged exchange rate responses to the Australian stock markets.

Moreover, Jayasinghe and Tsui (2008) attempted to address three relevant aspects simultaneously, namely sensitivity of stock returns to exchange rate changes, sensitivity of volatility of stock returns to volatility of changes in foreign exchange market, and the correlation between volatilities of stock returns and exchange rate changes. They employ a bivariate GJR-GARCH model to examine all such aspects of exchange rate exposure of sectoral indexes in Japanese industries. Using sample data for fourteen sectors, they found significant evidence of exposed returns and its asymmetric conditional volatility of exchange rate exposure.

In the related vein, Shapiro (1975), Jorian (1990), Schmidt and Broll (2008) and Aydemir and Demirhan (2009) among others, found that there is exists the relationship between stock price and exchange rates. For instance Aydemir and Demirhan (2009) investigate the relationship between stock price and exchange rates in Turkey using a multivariate framework. Interestingly, this paper using data from 23rd February 2001 to 11th January 2008, where the reason by selecting this period is that exchange rate regime is determined as floating. Thus this idea quite encouraged present paper due to its motivation on analysis data regarding specific time regime. The result

show, during the floating regime in Turkey, there exists a bidirectional causal relationship between the exchange rate and all stock market indices. While the negative causality exists from National 100, services, financials and industrials price indices to the exchange rate, there is a positive causal relationship from technology indices to the exchange rate. In contrast, a negative relationship from the exchange rate to all stock market indices is determined. Ibrahim (2008) investigates exchange rate exposure of sectoral stock returns for the case of Malaysia using an augmented standard market model. The data utilized in the analysis are monthly covering the period January 1994 to December 2004. In general, the results are supportive of significant exposure for the majority of the sectors considered. Based on these finding, there is limited evidence for significant exchange rate exposure during the crisis period.

Furthermore, many studies have been carried out on interest rate in banks stock pricing, such as Hooy, Tan and Nassir (2004). This paper presents the sensitivity of commercial banks stock excess returns to their volatility and financial risk factors, measured by interest rates and exchange rates, across the recent Asian Financial Crisis. In general, they found that there are no significant differences among Malaysia commercial banks in their risk exposure prior to and during the Asian Financial Crisis. We end this section with the article written by Azman-Saini, et al. (2006). This paper studied the relationship between stock price and exchange rates by using a new Granger non-causality test proposed by Toda and Yamamoto (1995). Among the finding of interest, there is a feedback interaction between exchange rates and stock prices for the pre-crisis period. The results also reveal that exchange rates lead stock price for the crisis period. Thus this paper concludes, in a financially liberalized environment, exchange rates stability is important for stock market well-being.

THEORETICAL FRAMEWORK

In line of capital asset pricing model (CAPM) by Sharpe (1964) and Lintner (1965), only market fluctuations should be a relevant instrument to a firm's asset values in equilibrium. Therefore, only changes in the market returns should be systematically related to firm returns. Therefore, the basic model of Capital asset pricing model (CAPM) is as follows:

$$SR_t = \Omega + \beta_m MR_t + \varepsilon_t \quad (1)$$

Where,

- SR_t = the return on firm
- MR_t = the return on the market portfolio
- β_m = the firm's market coefficient
- Ω = constant
- ε_t = error term (the sector i in month t)

According to equation (1), if the CAPM is the true model for asset pricing, thus the coefficient on the change in the market portfolio, β_m , should not be equal to zero. Yet, from model (2), with some augmented for CAPM with the evidence that $\beta_{\Delta S}$ non-zero could be interpreted as proof against the joint hypothesis that the CAPM does not hold. Formally, the measurement for the value of $\beta_{\Delta S}$, resulting from the following two-factor regression specification (Adler & Dumas 1980);

$$SR_t = \Omega + \beta_m MR_t + \beta_{\Delta S} \Delta S_t + \varepsilon_t \quad (2)$$

Where,

- SR_t = the return on firm
- MR_t = the return on the market portfolio
- β_m = the firm's market coefficient
- Ω = constant
- ε_t = error term (the sector i in month t)
- ΔS_t = the change in the exchange rate
- $\beta_{\Delta S}$ = the exchange rate change coefficient

Moreover, this paper expands the previous studies by incorporating the second-moment exposure factor into each model under estimation. We include the second moment exposure based on argument that the volume of international trade and transaction costs could be affected by exchange rate volatility (Adnan Hye, Iran & Hye 2009; Heckerman 1972; Hodder 1982; Kumar 2009; Mahani 2002; Narulita & Titi 2006; Pozo 1992; Sekmen & Saribus 2007; Sercu 1992a, 1992b; Tiwari 2003). Moreover, the study includes the asymmetric exchange rate exposures in the models. Ibrahim (2008) has considered this following model;

$$SR_t = \Omega + \beta_m MR_t + \beta_{\Delta S} \Delta S_t + \beta_D D_t(\Delta S_t) + \beta_{CR} CR_t + \varepsilon_t \quad (3)$$

Where,

- SR_t = the return on firm
- MR_t = the return on the market portfolio
- β_m = the firm's market coefficient
- Ω = constant
- ε_t = error term (the sector i in month t)
- ΔS_t = the change in the exchange rate
- $\beta_{\Delta S}$ = the exchange rate change coefficient
- ΔS_t = the change in the exchange rate variable (asymmetric exposure)
- $D_t(\Delta S_t)$ = the interaction between the exchange rate changes and appreciation dummy variable.
- CR_t = the Asian Financial Crisis dummy variable (the sector i in month t)
- β_D = the exchange rate change coefficient
- β_{CR} = the crisis exchange rate dummy coefficient

Inspired by Ibrahim (2008), the augmented capital asset pricing model in this study is as follows;

$$SR_t = \Omega + \beta_m MR_t + \beta_{\Delta S} \Delta S_t + \beta_D D_t(\Delta S_t) + \beta_{VOL} VOL_t + \beta_{PEG} PEG_t + \beta_{CR} CR_t + \varepsilon_t \quad (4)$$

Where,

- SR_t = the sectoral stock return
- MR_t = the return on the market portfolio
- β_m = the sectoral market coefficient
- Ω = constant
- ε_t = error term (the sector i in month t)
- ΔS_t = the change in the exchange rate
- $\beta_{\Delta S}$ = the exchange rate change coefficient
- ΔS_t = the change in the exchange rate variable (asymmetric exposure)
- $D_t(\Delta S_t)$ = the interaction between the exchange rate changes and appreciation dummy variable.
- CR_t = the Asian Financial Crisis dummy variable (the sector i in month t)
- β_D = the exchange rate change coefficient
- β_{CR} = the crisis exchange rate dummy coefficient
- β_{VOL} = the exchange rate volatility variable, follows GARCH (1,1)
- PEG_t = the pegging exchange rate dummy variable
- β_{VOL} = the sensitivity of sector returns to the exchange rate volatility (second-moment exposures) coefficient
- β_{PEG} = the pegging exchange rate dummy coefficient

METHODOLOGY AND DATA

As pointed out by Bartov and Bodnar (1997), models that include the market portfolio control for market wide factors that highly correlated with exchange rate changes, thus estimate residual ε_t exposure for equation (2), indirectly will solve this problem. Error term ε_t is assumed to be normal independent and identically distributed (iid). However, Baillie and Bollerslev (1989) and Hsieh (1989) claim that the returns on speculative assets are conditionally heteroscedastic. Whereas, the conditional heteroscedasticity known to produce inefficient parameters. To address this problem, the error term ε_t is allowed to follow a GARCH (1, 1) process as follow;

$$\sigma_{\varepsilon t}^2 = \pi_i + \pi_\varepsilon \varepsilon_{t-1}^2 + \pi_\sigma \sigma_{t-1}^2 \quad (5)$$

And,

$$\sigma_{\varepsilon t} = E_{t-1}(\varepsilon_t^2) \text{ is the conditional variance of the sector returns (GARCH 1,1);}$$

While, the exchange rate change (ΔS_t) follows the martingale process. Based on Meese and Rogoff (1982) the best forecast of the exchange rate for time $t + 1$ is the value at the time t . Specially, if S_t is the log exchange rate at level, then the conditional expectation operator for $E_{t-1}(S_t) = S_{t-1}$ is S_{t-1} . Thus, S_t follows a drift less martingale of the form;

$$S_t = S_{t-1} + s_t \quad (6)$$

And,

$$S_{t-1} + s_t = S_t$$

$$s_t = S_t - S_{t-1} \quad (7)$$

Where, s_t is the innovation or unexpected change in the exchange rate used in equations (2) to (4). The conditional variance of s_t is defined as a GARCH (1,1) process given as follows;

Contemporaneous exchange rate GARCH (1,1) model (Bollerslev, Chou & Kroner 1992)

$$\sigma_{\varepsilon t}^2 = \pi_i + \pi_\varepsilon \varepsilon_{t-1}^2 + \pi_\sigma \sigma_{t-1}^2 \quad (8)$$

Where, $\sigma_{\varepsilon t}^2$ is conditional variance of exchange rate regimes and it is follows the GARCH (1,1) process. In the estimation stage, variable in equation (7) and (8) used as predetermined in equation (3) using maximum likelihood method (ML). All variables required, must be transformed to monthly returns. Correlogram graphs shows by autocorrelation and partial autocorrelation (ACF and PACF) of all variables show that there is no autocorrelation in the returns series. Hence, those returns can be used in the regression model using GARCH(1,1) process and lead us to analyse on the first and second moment exchange rate exposures.

The algorithm proposed by equation (1) to (8) is estimated using a two-step procedure. First step, the unexpected exchange rate change (S_t) and conditional variance for exchange rate ($\sigma_{\varepsilon t}^2$) are estimated via maximum likelihood. In the second step, S_t (that is represent by variable (ΔS)) and $\sigma_{\varepsilon t}^2$ (that is represent by variable (VOL)) are used as predetermined variable in the estimation of equation (4). The procedure as explained above is used to test for contemporaneous exchange rate volatility. Finally, we extend further the robustness check by applying the robust standard errors (RSES). This test also called as Huber or White estimator or Sandwich estimators of variance. As state above, heteroskedasticity causes standard error to be biased. The ordinary least square (OLS) assumes that errors are both independent and identically distributed; but, RSES relax either or both of those assumptions. Hence, when heteroskedasticity is present, robust standard errors tend to be more trustworthy.

The data set consist of the monthly prices for the stock indexes in Malaysia, namely financial, plantation, properties, industrial, tin and mining, trade and services, consumer products and construction sector indexes. The data utilized in this study are covering the period October, 1992 to December, 2015. We employ monthly data instead of higher frequency data such as daily or weekly data due to the following reasons. The high frequency data such as daily and weekly data contain too much noise and are subject to the problem of non-synchronous and infrequent trading. Moreover, in essence of our main research objective, this paper is aiming to measure the sensitivity (exposure) of the firm's value

to the rate of change and volatility in the exchange rate (Ibrahim 2008). This we contend cannot be captured by using high frequency data. The reason is the value of the firm does not fluctuate by day or by week according to day-by-day or week-to-week, ups and downs in the market. Accordingly, the use of monthly frequency data is sensible. Note that, this study contain the observations from the crisis period, thus, in order to deal with this, we capture the crisis dummy in the modelling. As stated earlier, all the data are in monthly and due to it closing date. If the data at related date is not available, thus the closer data will be chosen as replacement date. Also, all data is on logarithm form. The returns data for each sector under observation are calculated by:

$$SR_t = LOG(PI_{t-1} - PI_t) \quad (9)$$

EMPIRICAL RESULTS

In this section, the analysis is discussed based on contemporaneous model of eight traded sectors returns, namely financial, plantation, properties, industrial, tin and mining, trade and services, consumer products and construction sector indexes. Following our main objective of this paper, we may note from Table 1 for contemporaneous exchange rate regression model in order to observe the result of interest.

The result suggests for the reliable outcome between contemporaneous exchange rate regression models. Thus this finding directly support for the argument been made by Bartov and Bodnar (1997), Martin et al. (1999) and Di Iorio and Faff (2000). Hence, the result shows in Table 1, remain robust. The similar conclusion also found in the study of Koutmos and Martin (2003), among others. Also, the result further suggests, the exchange rate exposure tends to vary across the sectors. Generally, all model under this study support for the CAPM, when the coefficient Beta (β_m) maintain significant across models and across sectors, with positive sign. These finding indicates that there are exist co movement between the sectors returns and market returns. While, some sectors are riskier than the market portfolio, others tend to be less risky.

From Table 1, the results classify, financial, properties and construction to be more volatile than the market portfolio, when the market portfolio coefficient more than one. These results shows, in comparison, the sectors portfolio are more risky than the market portfolio. These sectors are also expected to be more sensitive to financial shock and more speculative in nature. In contrast, plantation, consumer goods, tin and mining, trade and services and industrial portfolio have market coefficient less than one. Thus these sectors are assumed to be less volatile and are safer than the market portfolio. We may also note from Table 1 that the exchange rate exposure tend to vary across sectors.

In general, results implies for the high sensitivity of seven sectors out of eight sectors to the first moment exposure (i.e exchange rate change/mean equation), namely, financial, plantation, properties, consumer goods, construction, tin and mining and industrial, when coefficient $\beta_{\Delta S}$ and/or β_D is found to be significant. Also from that proportion the result further suggest five out of eight sectors among them are sensitive to asymmetric exposure, namely, financial, plantation, properties, tin and mining and industrial sectors. This is when coefficient of β_D in model (4) is significant. Additionally, five sectors under observation are found to be significant to the second moment exposure (i.e; variance equation), including, financial, plantation, properties, consumer, construction and services. Additionally, it is clear that in all instances, the stock return volatilities are time dependent. Specifically, the level of volatility at time t is a function of its past value as well as past squared errors. We has found, the relevant parameters, π_ϵ and π_σ , are statistically significant throughout the analyses. Furthermore, determination presents by the π_σ in Table 1 is very high, thus this suggesting to the long memory process in the volatility modelling. The implication underlying this result shows that, the studies assessing the impact of exchange rate risk on stock returns should explicitly account for time variation in the conditional variance modelling. Failure to do so will leads to inefficient parameter estimates, as well as biased test statistic (Kamil 2009; Koutmos & Martin 2003; Lobo 2000).

CONCLUSIONS

Generally, the main purpose of this paper is to investigate the impact of first, second and asymmetric moment's exposure of exchange rate on Malaysia's sectoral returns, namely, financial, plantation, properties, industrial, tin and mining, trade and services, consumer products and construction price index. This study successfully document robust negative exposure of financial sector for, contemporaneous models. This result is coherent with some of the previous researcher finding such as Ibrahim (2008) and Lobo (2000), among others, for Malaysia case. This is also consistent with fact that, if the exchange rate volatility affects financial sectors significantly positive, thus it's consistent with the idea that volatility induces greater hedging. Brown (2002) pointed out firms have greater incentive to hedge with greater exchange rate volatility. Therefore, revenue from the sale of currency derivatives by financial institutions should increase, thereby positively impacting cash flows and stock returns.

We also examine positive exposure of construction and properties to exchange rate appreciation. These results mean, like financial sector, the currency depreciation shocks have unfavourable effects on both

TABLE 1. Parameter Estimation result for mean and variance for Contemporaneous Exchange Rate Regression Model.

Sector	Mean Equations										Variance Equations		
	Ω	β_m	$\beta_{\Delta S}$	β_D	β_{VOL}	β_{PEG}	β_{CR}	π_ϵ	π_σ				
Financial (Fin)	0.0036541 (0.00401)	1.1987187 (0.07711)***	2.011051 (0.950614)*	1.885314 (0.464710)*	1.76809 (2.766214)*	0.0031861 (0.0055772)	-0.0067492 (0.0274758)	0.315826 (0.041736)***	0.6758981 (0.043964)***				
Plantation (Plant)	0.024531 (0.00619)**	0.741452 (0.07724)***	0.217144 (0.3431837)	-0.0825053 (0.62017)*	-5.324441 (2.762155)**	-0.0217003 (0.0071013)	-0.0439805 (0.023996)	0.228229 (0.055502)**	0.783916 (0.052170)***				
Properties (Pro)	0.0082703 (0.006529)	1.017797 (0.0714216)***	1.2441672 (0.32170)**	1.4837784 (0.617542)**	-8.38137 (3.12253)***	-0.005116 (0.0072815)	-0.0170266 (0.0155787)	0.257725 (0.02708)***	0.733980 (0.061493)***				
Consumer goods (Cmr)	0.0026543 (0.0068776)	0.7153226 (0.0501362)***	0.212118 (0.42315)*	0.5045542 (0.5580021)	5.849725 (3.156224)*	0.0015969 (0.0080156)	0.0018736 (0.263335)	0.238586 (0.087351)**	0.731701 (0.051357)***				
Constructions (Con)	-0.0008429 (0.0218053)	0.5776657 (0.1081554)***	1.4212354 (0.5493772)*	1.346943 (0.8284616)	10.51686 (5.44693)*	-0.0126172 (0.023279)	0.0172644 (0.0493912)	0.833590 (0.069752)***	0.325665 (0.053126)***				
Tin and Mining (Timm)	0.0055531 (0.0071113)	1.200993 (0.142051)***	0.0216036 (0.4982175)*	-0.2180851 (0.689292)*	-6.720467 (8.420642)	0.0000438 (0.0211538)	-0.0156927 (0.0416121)	0.180584 (0.072819)**	0.88743 (0.23993)***				
Services (Serv)	0.0020174 (0.0073307)	0.4479417 (0.4453102)***	-0.5993832 (0.44026)	1.3145761 (0.5333488)	11.21165 (5.372126)**	0.0034263 (0.0156053)	0.0067759 (0.023871)	0.233617 (0.092861)***	0.755350 (0.043330)***				
Industrial (Ind)	0.006576 (0.0438021)***	0.5341774 (0.2081104)***	-0.0518918 (0.24533)**	0.2451856 (1.917997)*	-2.518027 (0.0035301)	0.0061656 (0.0061352)*	-0.013399 (0.006425)**	0.538462 (0.081677)***	0.776665 (0.046432)***				

Note: Model above is estimated using monthly data over the time period October, 1992 to October, 2015 for all major sectors in Malaysia. Where, S_{R_t} is the sector return for time t and regime i , MR_t is the market return, ΔS_t is the unexpected percent change in the exchange rate, D_t equals 1 if $\Delta S_t < 0$ and zero otherwise, VOL_t is the time-varying exchange rate volatility, and ϵ_t is the error term that is allowed to follow a GARCH (1,1) process. The coefficient estimates are provided along with their associated with White standard error in parentheses. The superscript ***, **, * can be specify significant at 99%, 95%, and 90% significant level

construction and properties sectors. These results are illuminating when viewed in light of the theoretical relations between exchange rate exposure and industrial characteristics delineated by Bodnar and Bodnar (1994). Based on that theory, the exchange rate fluctuations may have different effects on traded and non-traded goods industries. Consequently, the market value of capital of non-traded goods industries tends to increase relative to that of traded goods industries. Hence, it should be expected that appreciation shocks exert positive impacts on non-traded goods industries such as construction and properties. To sum up, while we are quite confident in explaining the exposures of financial, construction and properties sectors. But, we unable do the same for others sectors. However, in general we document evidence supportive of significant exposure for majority of the sectors considered. To be concrete on the determinants of exposure, we believe that a firm-level study is much needed in the future.

REFERENCES

- Adnan Hey, Q. M., Iran, U., & Hye, A. 2009. Exchange-rate and trade: A causality analysis for Pakistan economy. *The IUP Journal of Applied Economics* 8 (September-November): 161–173.
- Adler, M., & B. Dumas. 1980. The exposure of long-term foreign currency bonds. *Journal of Financial and Quantitative Analysis* 15: 973–994.
- Adler, M., & B. Dumas. 1984. Exposure to currency risk: definition and measurement. *Financial Management* 13: 41–50.
- Aydemir, O., & E. Demirhan. 2009. The relationship between stock prices and exchange rates evidence from Turkey. *International Research Journal of Finance and Economics* 23: 207–215.
- Azman-Saini, W. N. W., Habibullah, M. S., Law, S. H., & Dayang-Afizzah, A. M. 2006. Stock price, exchange rates and causality in Malaysia: A note. Munich Personal RePEc Archive: <http://mpra.ub.uni-muenchen.de/656/>
- Baharumshah, A. Z, Mohd, S. H. & Sung, K. A. 2009. On the predictive power of monetary exchange rate model: The case of the Malaysian Ringgit/US dollar rate. *Applied Economics* 41: 1761–1770.
- Bartov, E. & Bodnar, G. M. 1994. Firm valuation, earnings expectations, and the exchange-rate exposure effect. *Journal of Finance* 49: 1755–1785.
- Baillie, R. T. & Bollerslev, T. 1989. Common stochastic trend in a system of exchange rates. *The Journal of Finance* 44(1): 167–181.
- Bollerslev, T., Chou, Ray, Y. & Kroner, Kenneth F. 1992. ARCH Modelling in Finance. *Journal of Econometrics* 52: 5–59.
- Brown, G. W. 2001. Managing foreign exchange risk with derivatives. *Journal of Financial Economics* 60: 401–448.
- Chee, W. H., Hui, B. T. & Annuar, M. N. 2004. Risk sensitivity of bank stocks in Malaysia: Empirical evidence across the Asian financial crisis. *Asian Economic Journal* 18(3): 261–276.
- Chowdhury, A. R. 1993. Does exchange-rate volatility depress trade flows? Evidence from Error-Correction Models. *Review of Economics and Statistics* 75: 700–706.
- Cushman, D. 1983. The effects of real exchange rate risk on international trade. *Journal of International Economics* 15: 44–63.
- Di Iorio, A. & R. Faff. 2000. An analysis of asymmetry in foreign currency exposure of the Australian equities market. *Journal of Multinational Financial Management* 10: 133–159.
- Dominguez, K. M. 1998. The dollar exposure of Japanese companies. *Journal of the Japanese and International Economies* 12: 388–405.
- Dominguez, Kathryn M. E. & Linda L. Tesar. 2001. Trade and exposure. NBER Working paper, No. 466. <http://www.fordschool.umich.edu/rsie/workingpapers/Papers451-475/r466.pdf>
- Dumas, B. 1978. The theory of the trading firm revisited. *The Journal of Finance* 33: 1019–1030.
- Hooy, C. W., Tan, B. T., & Nasir, A. M. 2004. Risk sensitivity of bank stocks in Malaysia: Empirical evidence across the Asian financial crisis. *Asian Economic Journal* 18(3): 261–276.
- Heckerman, D. 1972. The exchange-rate of foreign operations. *Journal of Business* 44(January): 42–48.
- Hodder, J. E. 1982. Exposure to exchange-rate movement. *Journal of International Economics* 13: 375–387.
- Hsieh, D., 1989. Testing for nonlinearity in daily foreign exchange rate change. *Journal of Business* 62: 339–368.
- Ibrahim, M. H. 2008. The exchange-rate exposure of sectoral stock returns: Evidence from Malaysia. *International Journal of Economic Perspectives* 2(2): 64–76.
- Jayasighe, P., & A. K. Tsui. 2008. Exchange rate exposure of sectoral returns and volatilities: Evidence from Japanese industrial sectors. *Japan and the World Economy* 20: 639–660.
- Jorian, P. 1990. The exchange-rate exposure of U.S. Multinational. *The Journal of Business* 63(3): 331–345.
- Joseph, N. L. 2002. Modelling the impacts of interest rate and exchange rate changes on UK stock returns. *Journal on Derivatives Use, Trading and Regulation* 1: 306–323.
- Kamil, H. 2009. How do exchange-rate affect firms' incentives to hedge currency risk in emerging markets? IMF Publisher: http://www.eea-esem.com/files/papers/EEA-ESEM/2009/3215/Herman_Kamil_Barcelona_2009.pdf
- Kaplan, E., & D. Rodrik. 2001. Did the Malaysia capital controls work? NBER Working Paper Series, No.8142. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=261267.
- Koutmos, G. & A. D. Martin. 2003. First and second moment exchange rate exposure: Evidence from U.S. Stock Returns. *The Financial Review* 38: 455–471.
- Kroner, K. F. & W. D. Lastrapes. 1993. The impact of exchange-rate volatility on international trade: reduced form estimates using the GARCH-in mean model. *Journal of International Money and Finance* 12: 298–318.
- Kumar, S. 2009. Investigating causal Relationship between Stock Return with respect to Exchange-rate and FII evidence from India. *Munich Personal RePEc Archive (MPRA)*, Paper No. 15793. http://mpra.ub.uni-muenchen.de/15793/1/MPRA_paper_15793.pdf
- Lobo, B. J. 2000. Asymmetric effects of interest rate changes on stock prices. *The Financial Review* 35: 125–144.

- Lintner, J. 1965. The valuation of risk assets and selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics* 47: 13–37.
- Mahani, Z. A. 2002. *Rewriting the Rule: The Malaysian Crisis Management Model*. Kuala Lumpur: Prentice Hall.
- Martin, A. D., J. Madura, & A. Akhigbe. 1999. Economic exchange-rate exposure of U.S.-based MNCs operating in Europe. *Financial Review* 34: 21–36.
- Meese, R. & Rogoff, K. 1982. The out of sample failure of Empirical Exchange rate Models: sampling Error or Misspecification? Chapter in book, 67–112. <http://www.nber.org/chapters/c11377.pdf>
- Narulita, W. A. & M. Titi. 2006. Measurement on first-moment exchange rate exposure and second-moment sector index exposure: Evidences from Jakarta Stock Exchange. Unpublished article journal. <http://www.fiskal.depkeu.go.id/webbkf/kajian%5CEXCHANGE.pdf>
- Norimah & Podivinsky. 2013. A study of exogeneity tests on export-led growth hypothesis: the empirical evidence on post-crisis exchange rate regime in Malaysia. *International Business Education Journal* 6(1): 7–20.
- Pozo, S. 1992. Conditional exchange-rate volatility and the volume of international trade: Evidence from the early 1900s. *Review of Economics and Statistics* 74: 325–329.
- Schmidt, C. W. & Broll, U. 2008. The effect of exchange-rate on U.S. foreign direct investment: An empirical analysis. Munich Personal RePEc. http://mpira.ub.uni-muenchen.de/10713/1/MPRA_paper_10713.pdf
- Sekmen, F. & Saribus, H. 2007. Cointegration and causality among exchange-rate, export, and import: empirical evidence from Turkey. *Applied Econometrics and International Development* 7(2): 71–78.
- Sercu, P., 1992a. Exchange rate volatility, international trade, and the value of exporting firms. *Journal of Banking and Finance* 16: 155–182.
- Sercu, P., 1992b. Exchange risk, exposure, and the option to trade. *Journal of International Money and Finance* 11: 579–593.
- Shapiro, Alan C., 1975. Exchange rate changes, inflation, and the value of the multinational corporation. *Journal of Finance* 30(May): 485–502.
- Sharpe, W. F. 1964. Capital Asset Prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance* 19(3): 425–442.
- Tiwari, R., 2003. Post-Crisis Exchange Rate Regimes in Southeast ASIA: An Empirical Survey of De-Facto Policies. Working Paper (University of Hamburg).
- Toda, H. & Yamamoto, T., 1995. Statistical inference in vector auto regression with possibly integrated processes. *Journal of Econometrics* 66: 225–250.

Norimah Rambeli@Ramli*
Economics Department
Faculty Management and Economics
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim Perak
MALAYSIA
E-mail: norimah@fpe.upsi.edu.my

Emilda Hashim
Economics Department
Faculty Management and Economics
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim Perak
MALAYSIA
E-mail: emilda@fpe.upsi.edu.my

Asmawi Hashim
Economics Department
Faculty Management and Economics
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim Perak
MALAYSIA
E-mail: asmawi@fpe.upsi.edu.my

Dayang Affizah Awang Marikan
Economics Department
Faculty Economics and Business
Universiti Malaysia Sarawak
94300 Kota Samarahan Sarawak
MALAYSIA
E-mail: amdaffizah@feb.unimas.my

Jan M. Podvinisky
Economics Divison, Social Sciences
University of Southampton
Southampton
SO17 1BJ England
UNITED KINGDOM
E-mail: jmp@soton.ac.uk

*Corresponding author