CURRENCY CARRY TRADE IN EMERGING MARKET COUNTRIES

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ABSTRACT

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This dissertation comprises of two purposes: 1) to examine the causal relationship and the volatility spillover between returns of carry trade strategies and equity markets; and 2) to demonstrate the time-varying risk premium of the carry trade. The Granger causality test under the Vector Autoregressive (VAR) model and the multivariate DCC-GARCH (1,1) are employed for the first purpose. The second one adopts the multi-factor model and the Logistic Smooth Transition Regression (LSTAR) for pricing carry trade returns which depend on the returns of equity and bond factors. The risk exposures to factors are allowed to vary across FX volatility regimes. The daily data of ASEAN-5 emerging markets and developed economies span from August 2006 to March 2015, covering 2,251 observations.

The empirical results show that carry trade portfolio returns of G10 currencies strongly Granger cause returns of equity markets in all developed economies and ASEAN-5 emerging markets. Higher carry trade portfolio returns significantly lead to greater returns in most stock markets regardless of the environments they operate in. The finding of this study is that the US dollar has been more popular in funding for carry trade strategies than the Japanese yen. Conversely the currencies of all ASEAN-5 emerging countries have been used for investment purposes. Moreover, there exists the volatility spillover from the carry trade market to all ASEAN-5 equity markets. The information transmission from the carry trade market to equity markets is rather examined for ASEAN-5 emerging markets than developed economies. The empirical results also indicate that carry trade returns are positively exposed to equity market returns in ASEAN-5 rather than in developed countries. The risk premium of the carry

trade becomes greater during more volatile periods, no matter what the foreign exchange rate policy is adopted.

Overall, the main results show that the carry trade significantly causes high-yielding assets like stocks to move together with carry trade returns. Speculators seek to invest in stocks of emerging markets when they involve in carry trade strategies. As such, the overall evidence suggests that the UIP condition does not seem to hold in emerging markets. In addition, equity markets are regime-dependent. The carry trade yields higher returns in the form of compensation to the higher risk premium when investing in ASEAN-5 equity markets during volatile periods. The risk premium would need to be introduced into the UIP condition.

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CHAPTER 1

INTRODUCTION

1.1 Introduction and Research Motivation

Currency carry trades have been tempting strategies for foreign exchange (FX) traders and speculators over the last decade. For example the well-known international fund Deutsch Bank invested in carry trades, namely PowerShares DB G10 Currency Harvest Fund. Currency carry trade strategies proceed with borrowing low interest rate currencies (funding currencies) then converting these into currencies of countries that offer high-yielding assets to invest (investment currencies). The interest rate differential creates profits for carry trades. Additional carry trade profits are made when investment currencies rise against funding currencies. However, the returns on carry trades raise the puzzle of uncovered interest rate parity (UIP). This states that returns on interest rate differentials between countries should be offset by changes in their pairs of foreign exchange rates. Particularly, the funding currencies should be appreciating against the investment currencies to eliminate the attractive interest rate gap.

There is evidence explaining the UIP puzzle (e.g. Fama (1984), Froot and Thaler (1991), Burnside, Eichenbaum and Rebelo (2007)). These have explored carry trades performance associated with risks (see Plantin and Shin (2007), Ichiue and Koyama, (2008), Brunnermeier et al. (2009)). Much research has revealed the relationship of excess FX returns to risk factors like stock and bond market returns by applying: firstly, an asset pricing approach; and secondly, nonlinear modeling to account for time-varying risk premium (e.g. Lustig, Roussanov, and Verdelhan (2011); Menkhoff, Sarno, Schmeling and Schrimpf (2012); Christiansen, Ranaldo and Söderlind (2011); Bakshi and Panayotov (2013); Atanasov and Nitschka (2014)). Christiansen Ranaldo and Söderlind (2011) found that carry trades were priced by

stock returns and its exposure to stock factor was regime-dependent, which became greater during turbulent periods. Their contributions suggested a partial resolution of the UIP puzzle.

Moreover, capital flows from where returns are low to where they are high, or to countries with high-yielding assets such as stocks (Fung, Tse and Zhao (2013), and it transfers across international financial markets affecting exchange rate and stock price movements. Some scholars studied the connections between the currencies and equity returns in terms of correlations and causality (e.g. Melvin and Taylor (2009), Tse and Zhao (2011)). Tse and Zhao (2011) showed that causality from carry trades to the US stock market does not exist but there is a volatility spillover effect from US stocks to carry trades. Later, in 2013 they found the causality in returns from carry trades to stock markets in Japan, Australia, and India, and bi-directional volatility spillover effects between these markets. Kumar (2013) also reported the bi-directional volatility spillover in other emerging markets using multivariate GARCH. Their contributions show that the UIP condition does not hold in a systematic fashion.

Previous studies reported a close relationship between currencies and stock markets, but not much consistent evidence has emerged to confirm this in different environments. Thus, this motivates the paper to investigate the relationship between carry trade strategies and equity markets in emerging and developed countries, and to indirectly provide an answer to the UIP puzzle. The following details of framework are proposed.

1) Examine the causal relationship and volatility spillover effect between carry trade returns and equity market returns in different economies by using the Granger causality test under Vector Autoregressive (VAR) system, and the multivariate DCC-GARCH model respectively. Particularly, the research tests whether the carry trade and equity markets Granger cause each other, and there exists the volatility spillover effect across these markets. Details are presented in Chapter 3.

2) Investigate time-varying risk premium of carry trades to risk factors (stock and bond market returns) by apply a multi-factor model that allow the factors to vary across regimes of FX volatility. The logistic smooth transition regression (LSTAR) is adopted as an econometric approach to explain the risk premium of carry trades. It

tests whether they are regime-dependent and how exposed they are to other risky asset allocations. Details are contained in Chapter 4.

1.2 Scope of the Study

To extend the literature on the subject, this research focuses on five major emerging markets in Southeast Asia (ASEAN-5), namely Indonesia, Malaysia, the Philippines, Singapore and Thailand, along with countries of G10 currencies. The price index of PowerShares DB G10 Currency Harvest Fund is used to calculate the returns of carry trade strategies. In addition, the excess returns of individual currency pairs are created to proxy for ASEAN-5 currency carry trades due to a small number of ASEAN-5 carry trade portfolios provided and also for robustness to the case of carry trade portfolio returns. Hence, this empirical examination using evidence from those markets and additional proxy of currencies will contribute to updating our knowledge of this subject.

There are three main methodologies estimated in this study. First, the Granger causality test under Vector Autoregressive (VAR) system, tests whether previous currencies returns forecast future values of stock returns (and vice-versa) in different economies. Second, the multivariate DCC-GARCH model is established to examine the volatility spillover across carry trade and equity markets. This research also proposes to represent the excess returns of individual currency as another proxy for ASEAN-5 currency carry trades. It does this in order to more properly analyze the relationships between FX and stocks in ASEAN-5 emerging markets. The details of methodology, data, results, and summary of the Granger causality test and the volatility spillover estimated results are presented in Chapter 3. Third, the logistic smooth transition regression (LSTAR) is adopted to explain the risk premium of carry trades. LSTAR tests whether that risk is regime-dependent and how exposed it is to other risky asset allocations. Additionally, a regime variable, FX volatility of the scope countries, extremely varies especially in financial crises. It motivates the study to control for exchange rate arrangements in the model. Then the analysis will explain the impact of exchange rate arrangement on behaviors of the exposures of carry trades, focusing on a managed exchange rate and a free floating policy. This empirical

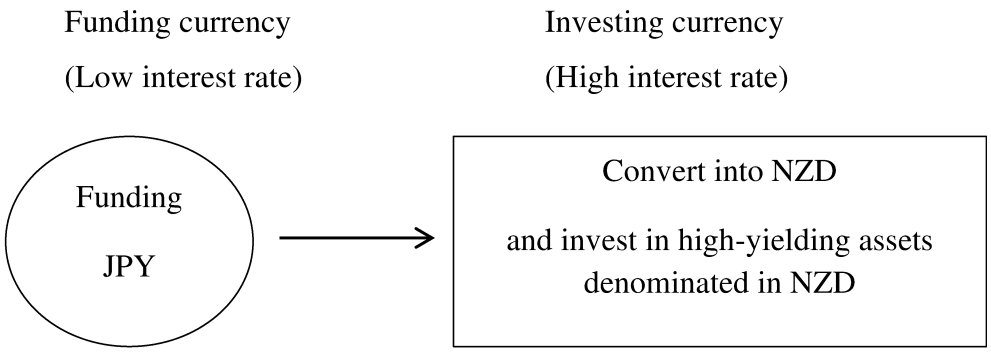
examination uses evidence from those markets in an effort to contribute to currencies investment and stakeholders' speculation decisions. The methodology, data, results, and summary of LSTAR estimated results are contained in Chapter 4. The remainder of this dissertation is organized as follows: Chapter 2 presents the literature review and theoretical background. The last chapter concludes all of this research.

CHAPTER 2

LITURATURE REVIEW AND THEORETICAL BACKGROUND

2.1 Carry Trade Strategy

The carry trade refers to borrowing of currencies in low interest rate countries and then converting them into currencies of countries with high-yielding assets such as stocks and bonds. Figure 2.1 illustrates the example of a favorite yen carry trade.



Borrow and sell the Japanese yen (JPY) against the New Zealand dollar (NZD) and invest in assets such as stocks, bonds, and money market denominated in NZD. Gain is from interest rate differentials plus an appreciation in NZD and asset prices increase.

Figure 2.1 Yen Carry Trade

That is the way a yen carry trade basically proceed. Hedge funds and other big volume traders and speculators borrow the funding currency (JPY) at almost zero interest rates. The Japanese yen is converted into the investment currency (NZD), and invested in government bonds denominated in NZD at higher yields than the interest cost of borrowing JPY. Gain of this strategy is from the differential in interest rates between New Zealand and Japan. Additional profits are made when the New Zealand dollar rises against the Japanese yen. More profits are added up to the carry trade, if bond prices rise and the stock markets in which some of profits are reinvested for

diversification increase. Typically, the Japanese yen and the US dollar known as safe heaven are popular in funding for carry trade strategies. They are converted into favorite investment currencies like the Australian dollar (AUD), the New Zealand dollar (NZD), the British pound (GBP) and more, including the currencies of emerging countries. Further, high-yielding bonds and stocks denominated in these currencies are invested.

A large unwinding of carry trade strategies could happen if the investment assets have defaults on their payments. Since a huge amount of funds around the globe have involved in carry trades, the unwinding can cause a global financial crisis due to the fund transferring out from most developed and emerging markets. And, it causes currencies, bond and stock prices to fall. Another factor that should be aware is the interest rate policy from the countries of funding currencies. If they use a tight monetary policy, carry trades will unwind. The amount of money created by the central banks decrease and interest rates go up. This reduces the attractiveness of carry trades.

2.2 Uncovered Interest Rate Parity (UIP)

The uncovered interest parity (UIP) states that returns on interest rate differentials between countries should be offset by changes in their pairs of foreign exchange rates. Carry trade profits violate uncovered interest rate parity (UIP) theory because the interest rate differential between countries is not equal to the change in corresponding foreign exchange rates. An excess return above what UIP predicts should not exist.

$$r = \Delta i - \Delta s \qquad \text{(eq 2.1)}$$

r represents an excess return from borrowing a low yielding currency and investing in a high yielding currency. Δi is the interest rate differential between countries, while Δs represents the change in spot exchange rate of funding currency against investment currency. Particularly, the funding currencies should be appreciating against the investment currencies to eliminate the attractive interest rate

gap. For example, the return on an investment denominated in currency A (RA) should be the same as the return on an investment denominated in currency B (RB). The expected return (in terms of currency A) on a currency B deposit can be approximated by the sum of the currency B interest rate and the expected depreciation of the currency A against B.

$$R_A = R_B + \frac{E^e_{A/B} - E_{A/B}}{E_{A/B}} \qquad \text{(eq 2.2)}$$

From equation 2.2, if the right hand side is greater than the left hand side investors will commit to arbitrage profits by converting their money from currency A to B and investing in assets denominated in B. The depreciation of exchange rate A against B discredits the UIP condition. Risk may play a role when assets denominated in currency B perceived as being riskier than that of currency A or others because of the default risk for the government debt, the financial instability, the liquidity risk, the country and political risk, etc. As such, assuming agents are risk averse, the UIP condition would take into account for a risk premium as in equation 2.3.

$$R_A = R_B + \frac{E^e_{A/B} - E_{A/B}}{E_{A/B}} + \rho \qquad \text{(eq 2.3)}$$

where ρ represents the risk premium of an investment denominated in currency A. If ρ is greater than 0, it implies that RB is less than RA. The investment denominated in B yields lower than the investment denominated in A. However, the equation 2.3 could be rewritten into an estimate equation as:

$$\frac{E^e_{A/B} - E_{A/B}}{E_{A/B}} = \alpha + \beta\,(R_A - R_B) + \rho \qquad \text{(eq 2.4)}$$

Equation 2.4 follows the interpretation of equation 2.3. The interest rate differential between these 2 countries is related to the expected change in the value of the spot rate. The interest rate differential could be an unbiased estimator of the future

spot exchange rate as long as the expected value of the error is equal to zero, so that the UIP condition is still validated. All available information today is included in the expectation of the future spot rate, which is acceptable. Thus, any additional fluctuation in the future spot rate, in excess of what UIP predicts is simply due to the future unexpected shocks (Krugman, Obstfeld, Melitz, 2012).

From several literatures, it is revealed that returns are systematically greater for investments denominated in currencies that offer higher yields. This is a puzzle of UIP. Froot and Thaler (1990) ran a regression on changes in spot exchange rates with the difference between returns of US and Euro investment. That is written as follows:

$$\Delta s = \alpha + \beta\,(R_{USD}\text{-}R_{EUR}) + \epsilon \qquad \text{(eq 2.5)}$$

where Δ s is the log difference in the spot exchange rate. Under the null hypothesis, α is equal to zero and β is equal to one. From several empirical results, β is mostly less than one, and often less than zero. This validates that investing in high-yielding currency is possible, and clearly violates UIP condition. One reason why UIP does not hold is the risk premium. If the risk premium on exchange rate is positively related to the interest rate, then β should be less than one. According to equation 2.5 that include a risk premium in the UIP condition, where ρ is the risk premium on an investment denominated in currency A. If a higher interest rate causes a greater risk premium, then it fits to β less than one. The higher risk premium due to the higher uncertainty of government debt may actually be followed by increasing interest rates. That means there is a positive correlation between interest rates and risk premiums. This is the main theoretical background behind the attempt of this study to examine the relationship of carry trade and equity returns. The positive carry trade is likely to represent the violation of UIP condition. Its return is excess what UIP predicts. If it positively relates to a high-yielding investment asset, this means that the corresponding exchange rate fails in adjustment of itself to an interest rate differential. The risk premium may need to be introduced to the UIP condition. In addition risk premium of carry trades may behave differently according to different state variables such as the FX volatility, liquidity risk, and the market risk. Details are described in the next section, the time-varying risk premium of carry trade.

Many authors have tested on the risk premium issues. Fama (1984) regressed the ex post forward profit and a one-period ahead depreciation forward premium to analyze some properties of the premium. In order to test whether the current forward spot-differential has power to predict the future change in the spot rate, Fama (1984) considered the following two regressions:

$$\Delta f_t+1 = \alpha_1 + \beta_1 \Delta f_t+\epsilon_{1,t+1} \quad \text{(eq 2.6)}$$

$$\Delta S_t+1 = \alpha_2 + \beta_2 \Delta f_t+\epsilon_{2,t+1} \quad \text{(eq 2.7)}$$

Where, Δ ft = ft – St, and Δ St+1 = St+1 - St . The regression result showed that β1 was not equal to 1, and and β2 was not zero, meaning that forward rate at time t has information about the spot rate at time t+1. Furthermore the premium of current forward-spot has the variation showing up in the future change in spot rate. Fama (1984) also confirmed that this premium varied over time.

2.3 Time-Varying Risk Premium of Carry Trade

After Fama (1984), some researchers applied both single CAPM (Mark, 1988) and conditional model (McCurdy and Morgan, 1991) to pricing currencies forward and detecting the risk premium. Mark (1988) extended the pricing of forward contracts to a broader portfolio of assets that is likely to be held by a representative investor, one of that was equity returns. He priced the forward contracts according to:

$$E_{t-1}(p_t) = \beta^p_{t-1} E_{t-1}(r^p_t - r^f_t) \quad \text{(eq 2.8)}$$

where pt is market portfolio of all traded assets, so the pricing of forward contracts is similar to pricing of any other assets, and a risk premium on a currency is proportional to the expected return on the appropriate portfolio. Beta is the contribution of the forward position to overall portfolio risk. McCurdy and Morgan (1991) also detected the risk premium of currencies by using the equity portfolio like the work done by Mark (1988). He differentiated by using the GARCH formulation to

predict interdependence between a conditional mean of deviation from UIP and the relevant conditional covariance of the benchmark portfolio:

$$E_{t-1}(R^*_{st}) = \frac{cov_{t-1}(R^*_{Bt,}R^*_{st})}{var_{t-1}(R^*_{Bt})} E_{t-1}R^*_{Bt} \qquad \text{(eq 2.9)}$$

R* represents the return in excess of the riskless rate; RBt is the rate of return on a benchmark portfolio; Rst is the rate of return in dollar from investment in foreign asset; and R*st is the excess return that deviates from UIP. The finding favors the conditional beta of time-varying risk premium. The conditional beta consists of the conditional covariance of the deviations from UIRP with the excess return on the benchmark portfolio divided by the conditional variance of the latter. The conditional risk premium is the product of the conditional beta and the conditional expected return on the benchmark portfolio.

The previous literature proposed several explanations for the carry trade performance in which the risk exposures to equity returns were allowed to change according to levels of risk variables. This framework provided the explanation of regime-dependent and non-linear risk-return payoffs. The regime-switching models for exchange rates have been reviewed in detail (see Ichiue and Koyama (2008), and Christiansen, Ranaldo, and Söderlind (2011)). Christiansen et al. proposed to account for FX time-varying risk premium by adopting a similar but different approach. They applied a multi-factor model with explicit factors, where the risk exposures were allowed to change according to one or more state variables. Furthermore they employed a factor model where basic factors were S&P500 future returns (SP) and TN future returns (TN). The logistic smooth transition model (LSTAR) was employed as follows:

$$r_t = [1\text{-}G(s_{t-1})]\beta_t' x_t + G(s_{t-1})\, \beta_2' x_t + \epsilon_t \qquad \text{(eq 2.10)}$$

where, G is a logistic function

$$G(s_{t-1}) = \frac{1}{1+\exp[-\gamma'(s_{t-1}-c)]} \qquad \text{(eq 2.11)}$$

The finding is that the risk exposure of carry trades to the stock and bond markets is regime-dependent. Furthermore, regimes are characterized by the level of foreign exchange volatility.

2.4 Asset Pricing

Following the development of the theory in the early 1960s, empirical analysis of the CAPM was conducted to validate the model. One of the earliest empirical studies of the CAPM is that of Black, Jensen and Scholes (1972). Using monthly return data and portfolios rather than individual stocks, these authors found supporting evidence for the CAPM where the relationship between mean excess returns and beta was linear, and portfolios with high (low) betas had high (low) average returns. However, they also found that the intercept and the slope of the cross-sectional relationship varied with different sub-periods and were not consistent with the traditional form of the capital asset pricing model.

Furthermore, Fama and MacBeth (1973) provided empirical results on the CAPM by using data from the New York Stock Exchange (NYSE) during the period January 1962 to June 1968. They found that the average returns on the NYSE common stocks were positively related to their risk. Fama and MacBeth (1973) conducted a two-pass methodology for testing the CAPM. At the first pass they ran a time series regression of portfolio returns on the market returns, which gave estimates of portfolio betas. To obtain maximum efficiency the portfolios were pre-sorted into various groups based on their beta. At the second pass, they performed cross-sectional regressions on a month-by-month basis and then took the time-series average of the estimated risk premium. This, it turned out, allowed them to test directly from the validity of the zero-beta CAPM. Noticeably, their methodology is one of the most frequently used methodologies in later literature on the relationship between risk and returns.

Ross (1976) provides a multi-factor model, namely the arbitrage pricing theory (APT). He showed that there is not just one, but many, measures of systematic risk that explain returns. Each measure captures the sensitivity of the asset to the corresponding pervasive factor. Following the work of Ross (1976) and Roll (1984),

many empirical studies began to identify variables other than market beta to explain the cross-section of expected returns. The concept of the CAPM has been challenged by Fama and French (1992). They reported on the role of size and book-to-market equity ratio in the cross-section of expected stock returns, and showed that the cross-section of average stock returns is not fully explained by the CAPM beta and in fact, stock risks are multidimensional. Notably, they concluded that the three factors that explain 95% of the variability of stock market returns consists of market risk, firm size and the book-to-market equity ratio. Their empirical evidence also supported the claim that size and book-to-market equity ratios are negatively and positively related to expected returns, respectively.

In subsequent analyses, Fama and French (1993, 1995, 1996, 1998) increased the validity of the original three-factor model. Fama and French (1993) argued that it should be implemented in place of the CAPM. They provided evidence that a three-factor model based on factors formed on the size (SMB) and book-to-market equity ratio (HML), and the market explains average returns, and argued that these characteristics compensate for distress risk. This argument is in line with Chan and Chen (1991) who found that smaller firms are less likely to survive in poor economic conditions since they tend to have high financial leverage and cash-flow problems and generally perform poorly. Subsequently, Fama and French (1998) provided additional out-of-sample evidence from their three factor model. Fama and French (1998) tested their three factor model in 13 different markets over the period 1975 to 1995. They discovered that value stocks outperformed growth stocks in 12 of 13 major markets. They consequently suggested that the value premium exists in emerging markets as well as in the United States.

Other researchers also found results consistent with the Fama and French three factor model in other markets, including those of Southeast Asia. For instance, Chui and Wei (1998) tested the ability of the three factor model in five Pacific Basin emerging markets: Hong Kong, South Korea, Malaysia, Taiwan and Thailand. They found that in all these markets the relationship between average stock returns and the market beta is weak. On the other hand, their results confirm the ability of size and book-to-market equity ratio to explain equity returns in emerging markets. The book-to-market equity could explain the cross-sectional variation of expected stock returns

in Hong Kong, South Korea, and Malaysia, while the size effect was significant in all markets except Taiwan.

Similarly, Lau, Lee and McInish (2002) confirmed the presence of CAPM anomalies in Singapore and Malaysia during the period 1988 to 1996. They illustrated that there is a market risk premium during months with positive market excess returns and found the existence of a negative relationship between stock returns and size for both countries. Van Dijk, Teräsvirta and Franses (2002) examined value and growth portfolios in seven East Asian countries, namely Hong Kong, Indonesia, Japan, Malaysia, Singapore, Taiwan and Thailand, before the 1997 Asian Financial Crisis (July 1976 to June 1997). The value premiums in these countries, except in Indonesia, Taiwan and Thailand, were found to be mainly positive.

CHAPTER 3

THE RELATIONSHIP BETWEEN RETURNS OF CARRY TRADE STRATEGIES AND EQUITY MARKETS

There are two tasks implemented in this chapter. First, the Granger causality under Vector Autoregressive (VAR) system tests whether carry trade returns Granger cause stock returns (and vice-versa) in different economies. Second, the multivariate DCC-GARCH model examines the volatility spillover across carry trade and equity markets. This study also proposes to represent the excess returns of individual currency as another proxy for ASEAN-5 currency carry trades. It does this in order to more properly analyze the relationships between FX and stocks in ASEAN-5 emerging markets. The details of methodology, data, results, and summary of the Granger causality test and the volatility spillover are presented in following sections.

3.1 Methodology

In this section, the Granger causality and the volatility spillover effect are tested. Particularly, the study tests whether the carry trade and equity markets Granger cause each other, and there exists the volatility spillover effect across these two markets. Details are presented in following subsections.

3.1.1 Granger Causality Relationship

The methodology in this subsection is established to determine the Granger causality relationship between the daily returns of currency carry trade strategies and equity markets. The Granger causality is estimated under the two-equation vector autoregressive (VAR) system with lag length p as follows:

$$\mathrm{ET_t} = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \mathrm{CT_{t-i}} + \sum_{i=1}^{p} \gamma_{1i} \mathrm{ET_{t-i}} + \delta_1 \mathrm{DM_t} + \varepsilon_{1t} \qquad \text{(eq. 3.1)}$$

$$\mathrm{CT_t} = \alpha_2 + \sum_{i=1}^{p} \beta_{2i} \mathrm{CT_{t-i}} + \sum_{i=1}^{p} \gamma_{2i} \mathrm{ET_{t-i}} + \delta_2 \mathrm{DM_t} + \varepsilon_{2t} \qquad \text{(eq. 3.2)}$$

where the daily log carry trade returns and the lagged values are denoted as CT_t and CT_{t-i} , while ET_t and ET_{t-i} are the daily log returns of an equity index in period t and its past values, respectively. A dummy variable for financial crisis (DMt) is equal to 1 during a crisis period or 0 if otherwise. The terms ε_{1t} and ε_{2t} are respectively shocks in ET_t and CT_t. All variables in the VAR model are stationary, and testing Granger causality uses the standard F-test under the following restrictions.

1. Ho: $\beta_{1i} = 0$ ($\beta_{11} = \beta_{12} = \ldots = \beta_{1p} = 0$)
2. Ho: $\gamma_{2i} = 0$ ($\gamma_{21} = \gamma_{22} = \ldots = \gamma_{2p} = 0$)

These refer to the coefficients of the cross-market returns between equity and carry trades all equally set to zero. The Granger causality measures past values of one variable that can aid in forecasting future values of another variable in the system. Thus, carry trades Granger cause equity when the first null hypothesis is rejected. It means that the past values of carry trades improve the prediction of future changes in stock prices. On the other hand, rejecting the second restriction implies that changes in currency prices can be predicted from the past values of stock prices.

Moreover, to explain the causality relationship between each other in terms of the economic impacts magnitude (Fung, Tse and Zhao (2013)), the sum of all coefficients of cross-market returns between equity and carry trades ($\sum_{i=1}^{p} \beta_{1i}$ and $\sum_{i=1}^{p} \gamma_{2i}$) are also considered under the restriction tests:

3. Ho: $\sum_{i=1}^{p} \beta_{1i} = 0$
4. Ho: $\sum_{i=1}^{p} \gamma_{2i} = 0$

These rejected restrictions tell us that the total causality relationships across these 2 markets exist. In particular, the sum of all estimated coefficients ($\sum_{i=1}^{p} \hat{\beta}_{1i}$) indicates the magnitude of total causality from carry trade returns to equity market

returns. The sum of all estimated coefficients ($\sum_{i=1}^{p} \hat{\gamma}_{2i}$) describes the magnitude from equity market returns to carry trade returns.

3.1.2 Volatility Spillover Effect

Another task of this study is to investigate the volatility spillover effect between currency carry trade markets and equity markets. The volatility spillover effect measures the information transmission across these two markets. The market participants may consider the relationship between the exchange rate and stock index to predict the future movement of each other effectively. Multinational companies interested in exchange rate forecasting may consider the stock market as an important attribute. There is also an interesting implication for portfolio managers because of the spillover between stock and foreign exchange markets (Kumar, 2013). As such, this rationale may help to create well performing funds across currency carry trade markets and equity markets. The multivariate GARCH model captures that the contemporaneous shocks to variables can be correlated with each other. Additionally, it has been used to investigate volatility and correlation transmission and spillover effects across financial assets or markets. We can expect the volatilities of the two series to be interrelated. The high volatility of one variable is likely to increase the volatility of another variable. As such, this rationale would help to examine the volatility spillover across currency carry trade markets and equity markets. The dynamic conditional correlation (DCC) class of multivariate GARCH model is employed to examine the existence of volatility spillover effects (see Engle (2002); Fung, Tse and Zhao (2013)). Equation 3.1 and 3.2 are mean equations. The residuals from these mean equations are used to estimate the multivariate DCC-GARCH (1,1) with variance system formulated as the following specification.

$$H_{ii,t} = \alpha_{ii} + \sum_{j=1}^{2} \beta_{ij}\, \varepsilon_{i,t-1}^{2} + \gamma_i H_{ii,t-1} + \lambda_i\, \varepsilon_{i,t-1}^{2} I_{\varepsilon_i<0}(\varepsilon_{i,t-1}) \qquad \text{(eq. 3.3)}$$

$$H_{ij,t} = Q_{ij,t} \frac{\sqrt{H_{ii,t} H_{jj,t}}}{\sqrt{Q_{ii,t} Q_{jj,t}}} \qquad \text{(eq. 3.4)}$$

$$Q_t = (1-\delta-\theta)Q_0 + \delta \varepsilon_{i,t-1} \varepsilon'_{i,t-1} + \theta Q_{t-1} \qquad \text{(eq. 3.5)}$$

where $H_{ii,t}$ in equation 3.3 is the model of variance terms

$H_{ij,t}$ in equation 3.4 is the covariance terms between carry trade returns and equity returns

Q_t in equation 3.5 is the conditional correlation matrix and Q_0 is the unconditional correlation matrix

β_{ij} in equation 3.3 captures the volatility spillover effect from asset j to asset i

γ_i in equation 3.3 indicates the GARCH effect

λ_i in equation 3.3 measures the asymmetric volatility

In this study the most commonly used distribution, student's t-distributed, is considered for the process of error terms. The conditional covariance matrix Ht is a product of a time-varying correlation matrix, Rt and diagonal matrices of conditional standard deviation, Dt, giving Ht = DtRtDt.

For interpreting, as in the equation 3.3, β_{ij} indicates the volatility spillover effect from asset j to asset i. In particular, the estimated coefficient β_{12} in this study captures the volatility spillover effect from the equity market to the carry trade market, while β_{21} measures the volatility spillover effect from the carry trade market to the equity market.

3.2 Data Description

In this study, the sample of daily data spans from August 2006 to March 2015, covering 2,251 observations. Two sets of data are classified to examine the causality relationship and spillover effect in different economies. First, the set of developed economies enclose the most liquid and tradable currencies and stock markets (Japan, United States, United Kingdom, Australia, New Zealand, and European Union). Second, ASEAN-5 (namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand) represent the emerging markets environment and the major stock markets in terms of market capitalization in Southeast Asia.

3.2.1 Portfolio Returns of Carry Trade

In the base line analysis, a proxy for the performance of carry trade portfolio is the daily log return created from the DB G10 Currency Future Harvest price Index, collected through Reuters DataStream. It is the index tracked changes by the PowerShares DB G10 Currency Harvest Fund of Deutsche Bank, providing for investors who want to conveniently invest in currency futures. The Index is composed of G10 currencies future contracts and constructed to seek profit in the way that high interest rate currencies tend to appreciate relative to low interest rate currencies.

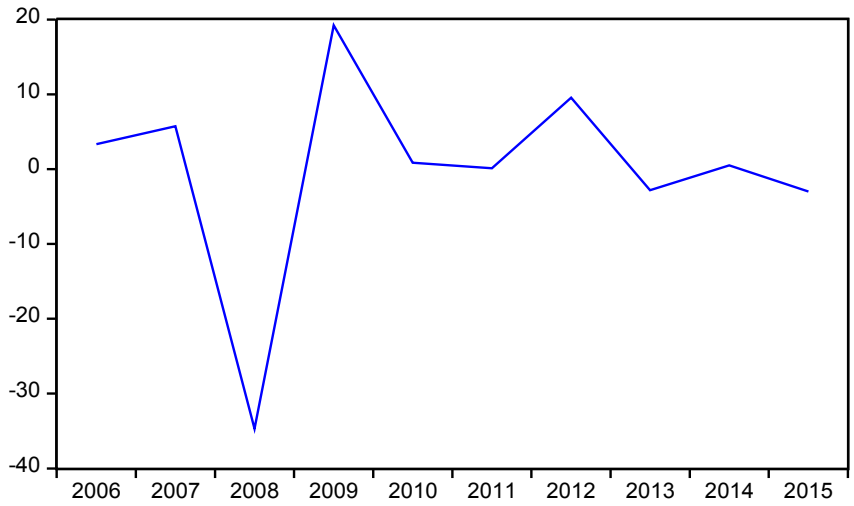


Figure 3.1 Annualized CT performance calculated based on DB G10 Currency Future Harvest Index

G10 currencies are most liquid and traded, including the Australian Dollar (AUD), Canadian Dollar (CAD), Swiss Franc (CHF), Euro (EUR), British Pound (GBP), Japanese Yen (JPY), Norwegian Krone (NOK), New Zealand Dollar (NZD), Swedish Krona (SEK), and US Dollar (USD). The DB G10 Currency Future Harvest Index works on making: firstly, long future contracts of the 3 highest interest rates currencies; and secondly, short future contracts of the 3 lowest interest rate currencies among the G10 countries. Each quarter, there is a performance evaluation and re-weighting 3 long positions of the highest interest rate currencies future and 3 short positions of the lowest interest rate currencies future. The daily portfolio returns of

carry trade are calculated using the continuous compound return method as the following formula:

$$CT_t = 100*\log(P_t / P_{t-1})$$

where CT_t is the daily log carry trade returns

P_t denotes the daily DB G10 Currency Future Harvest price Index

P_{t-1} is the 1-day lag of the daily DB G10 Currency Future Harvest price Index

3.2.2 Excess Returns of Individual Currency

Another proxy of carry trade returns is constructed for robustness. It is also due to the lack of carry trades performance that includes enough Asian currencies into the portfolio. This proxy, the excess returns of each currency pair (funding and investment currencies) is calculated individually based on the interest rate differential in concurrence with UIP theory. Consequently the return calculated from equation 3.3 below is an arbitrage profit or an excess return above what UIP predicts as documented in many studies (eg. Brunnermeier, Nagel, and Pedersen (2009); Christiansen, Ranaldo, and Söderlind (2011)).

$$r_{jt}^{k} = \left(i_{t-1}^{k} - i_{t-1}^{j}\right) - (s_t^k - s_{t-1}^k) \qquad \text{(eq. 3.6)}$$

where r_{jt}^{k} = individual currency pair excess return in period t which is calculated from borrowing currency j and investing in currency k

$i_{t-1}^{k} - i_{t-1}^{j}$ = 1-day lagged interest rate differential of country k and j

s_t^k = log spot exchange rate of currency k per 1 unit of j

s_{t-1}^k = log 1-day lagged spot exchange rate of currency k per 1 unit of j

Mid quotes daily data of spot exchange rates and interest rates are utilized. The most used interest rate is the 1-day interbank overnight money market rate,

except for some countries where only the 1-day interbank T/N (tomorrow-next) money market rate is available.

The Japanese yen (JPY) and US Dollar (USD) are mainly employed as funding currencies in this type of carry trade proxy. The Yen and Dollar are typically known as safe havens and have become the favorite currencies for trading. The US dollar was even more preferred to the Japanese yen since the subprime crisis and the use of quantitative easing policy (Fung et al. (2013). Following Fung, Tse, and Zhao (2013), the investment currency used in this study is the Australian Dollar (AUD), the most selected as long position for carry trade strategies. This is due to its high interest rate. The currencies in emerging markets have been considered as well. The lower yielding currencies like JPY or USD are borrowed and then invested in higher yielding assets. 5 emerging Asian economies' currencies: Thai baht (THB), Indonesian rupiah (IDR), Philippine peso (PHP), Singapore Dollar, (SGD), and Malaysian ringgit (MYR) have been added to our investment scope.

3.2.3 Equity Market Returns

Daily data of stock indices of the above mentioned countries are derived from DataStream. Logarithmic return is applied. The sources for each country's stock indices are: S&P 500 composite (US); FTSE 100 (UK); Nikkei 225 Stock Average (Japan); S&P/ASX 200 (Australia); S&P/NZX 50 (New Zealand); FTSE World Europe (EU); Straits Times Index (Singapore); Bangkok S.E.T. (Thailand); FTSE Bursa Malaysia KLCI (Malaysia); IDX composite (Indonesia); and Psei (Philippines). The daily returns are computed from the following formula:

$$E_{i,t} = 100*\log(P_{i,t} / P_{i,t-1})$$

where $E_{i,t}$ is the daily log stock index returns of each market

$P_{i,t}$ denotes the daily price Index of each stock market

$P_{i,t-1}$ is the 1-day lag of the daily price Index of each stock market

3.3 Empirical Results on Granger Causality Relationship

The base line analysis is the Granger causality relationship between carry trade portfolio returns of G10 currencies and equity market returns. There are 2 directions in which causality can go: 1) carry trade returns cause equity market returns; and 2) equity market returns cause carry trade returns. The test results are summarized in Table 3.1. It reports p-values of test restrictions 1 to 4, and the sum of all estimated coefficients under restrictions 3 and 4 ($\sum_{i=1}^{p} \hat{\beta}_{1i}$, $\sum_{i=1}^{p} \hat{\gamma}_{2i}$). Significant p-values indicate that the Granger causality relationship exists, while the sum of all estimated coefficients describe how these 2 markets Granger cause each other.

From panel A, G10 carry trade portfolio returns strongly Granger cause returns of all equity markets in developed economies. Panel B also highlights the impact of carry trade returns on all ASEAN-5 emerging stock markets. Past currencies values assist in forecasting future values of prices in all stock markets. Positive values of the sum of all coefficients $\sum_{i=1}^{p} \hat{\beta}_{1i}$ explain that higher carry trade portfolio returns of G10 currencies significantly cause higher returns of all stock markets regardless of environments. The exception is the US which shows a negative coefficient.

To illustrate the implication of the estimated results, the violation of UIP theory is reviewed. UIP states that interest rate differentials should be offset by the appreciation of borrowing or funding currencies. Thus, positive returns of carry trades violate UIP. Profits from carry trades persuade more speculators and arbitrageurs to become involved in trading, which leads to more selling (depreciation) of funding currencies and more buying (appreciation) of high yielding or investment currencies. Consequently, funds flow out from (into) countries of funding (investment) currencies. Therefore carry trade returns positively (negatively) relate to stock market returns in countries where currencies are invested (funded) (Fung et al. (2013)). According to this explanation, the results from Table 3.1 mean that currencies of countries that have a positive sum of all estimated coefficients are investment currencies (like the AUD which is normally targeted as an investment currency) since the higher carry trade returns, the higher will be the equity market returns. In other

words, carry trades help funds flow to where equity market returns are high. Thus their currencies are in demand for investment purposes.

This study reexamines the work of Fung, Tse and Zhao (2013) who found a positive value of coefficients for Japan. They argued that the Japanese yen was no longer a funding currency. This paper contributes to the extension of their study by stating that the US dollar plays the leading role in funding currencies instead of the Japanese yen. The evidence discloses the negative value of -0.4699 for the US, and the positive value of 1.2403 for Japan (Table 3.1, column restriction 3). This outcome is well supported by the evidence that higher carry trade profits lead to smaller US stock market returns, indicating that capital flows out from the US equity market to where assets produce higher yields. Conversely, in Japan the higher carry trade profits, the higher will be the equity returns. Thus, from this point the yen becomes an investment currency. The ASEAN-5 stock markets will perform better due to higher carry trade returns. Positive sum of all estimated coefficients implies that ASEAN-5 currencies and equities tend to be invested. Another feature of the Granger causality relationship - equity returns cause carry trade returns - is only found in some equity markets (US, Australia, New Zealand).

For a robustness check, Tables 3.2 and 3.3 contain the Granger causality results for the case of excess returns of individual currency pairs and related equity market returns. This refers, for example, to a relationship between excess returns of borrowing JPY to invest in AUD, and equity markets of Japan and Australia. In this analysis the JPY and USD are used as funding currencies, while the AUD and 5 Asian currencies (THB, IDR, PHP, SGD, and MYR) are selected as investment assets.

Overall, the results from borrowing JPY as shown in Table 3.2 and borrowing USD in Table 3.3 illustrate both directions of the Granger causality relationship. The exception involves Thailand and Malaysia, where carry trade returns do not help to forecast changes in their stock indices. Conversely, carry trade returns are not predictable from the changes in stock index of Singapore. Positive sum of all estimated coefficients in Table 3.2 insists that yen is no longer a funding currency.

3.4 Empirical Results on Volatility Spillover Effect

The volatility spillover effect between carry trade markets and equity markets measures how they move together more or less closely over time. In other words, it investigates the information transmission across these two markets For results interpretation, the coefficient β_{ij} in the equation 3.3 can indicates that effect from asset j to asset i. Specifically the estimated coefficient β_{12} captures the volatility spillover effect from the equity market to the carry trade market, while β_{21} measures the volatility spillover effect from the carry trade market to the equity market. Moreover, the coefficient γ_i indicates the GARCH effect which shows a time-varying variance, while λ_i describes the asymmetric volatility specifying that the variance will be higher during market decline. Bad news induces higher volatility than good news.

From the estimated results shown in Table 4.4, the coefficient β_{21} indicates that there is the significant volatility spillover from the carry trade market to all ASEAN-5 equity markets (Panel B), but not for all equity markets in developed countries (in Panel A only Japan and New Zealand show the significant coefficients). In other words, the information transmission from carry trade markets to equity markets is rather examined for ASEAN emerging markets than developed economies. Table 4.5 illustrates another direction of volatility spillover effect. It reports the significant coefficient β_{12} in all equity markets. This means that there is the significant volatility spillover from all emerging and developed equity markets to carry trade markets regardless of economies.

Table 4.4 and 4.5 also contain the coefficient γ_i and λ_i. All of those coefficients are significant at conventional level. This evidence discloses that GARCH effect and asymmetric volatility effect exist in both directions of information transmission across these two markets, in all economies. As such, today's volatility of carry trade and equity depends on their past volatility, and bad news induces larger volatility than good news. That results support why the multivariate GARCH should be modeled to capture this behavior of the assets.

For a robustness check, Tables 4.6 to 4.9 illustrate the spillover effect, GARCH effect, and asymmetric volatility effect for the case of excess returns of

individual currency pairs and related equity market returns. The tables refer, for example, to those volatility effects between excess returns of borrowing JPY to invest in AUD, and equity markets of Japan and Australia. In particular, Table 4.6 reports the volatility effects from currency excess returns to equity markets when funding by JPY, while Table 4.7 show the revert direction of the volatility effects (from equity markets to currency excess returns). Table 4.8 and 4.9 illustrate the same pattern of results as Table 4.6 and 4.7, but the only slight difference is funding by USD.

From Table 4.6 and 4.7, the results of borrowing JPY to seek the currency excess returns are robust to the case of carry trade portfolio returns. There is the significant volatility spillover from currency excess returns to all ASEAN-5 equity markets and Japan stock market, but not that of Australia. On the other hand, there exists the significant volatility spillover from all equity markets to currency excess returns regardless of economies.

The case of funding by USD, in Table 4.8 and 4.9 also insists the robust results as the case of carry trade portfolio returns and currency excess returns (funding by JPY). The significant volatility spillover from currency excess returns to equity markets is revealed for all ASEAN-5 stock markets. The stock market of Australia also shows a low level of significance. Again, the volatility spillover from equity markets to currency excess returns is significant at conventional level for both emerging and developed equity markets.

Overall, the results of GARCH effect and asymmetric volatility effect shown in Table 4.6 to 4.9 seem to be robust to the case of carry trade portfolio returns. All coefficients γ_i are significant, indicating that there is the GARCH effect in all equity markets. For the asymmetric volatility effect, almost all the coefficients λ_i are significant. The exception is for the case in Table 4.9. Bad news does not affect asset volatility more than good news when borrowing USD to invest in the stock markets of Indonesia, Malaysia, and Thailand. However, it does affect for all other cases discussed earlier.

Table 3.1 Granger Causality Relationship between Carry Trade Portfolio Returns and Equity Market Returns

		Carry Trade cause Equity			**Carry Trade cause Equity**		
		Restriction 1	**Restriction 3**		**Restriction 2**	**Restriction 4**	
Equity Markets	**lag**	**P-values**	**P-values**	**Sum Coeff**	**P-values**	**P-values**	**Sum Coeff**
Panel A: Developed Economies							
Japan	8	0.0000	0.0000	1.2403 ***	0.0004	0.7540	-0.0144
US	12	0.0001	0.0115	-0.4699 **	0.0055	0.0621	0.1533 *
Europe	6	0.0000	0.0000	1.7265 ***	0.0545	0.2601	0.0464
UK	6	0.0000	0.0328	0.2314 **	0.1032	0.3409	0.0511
Australia	6	0.0000	0.0000	0.7687 ***	0.0335	0.0157	0.1269 **
New Zealand	11	0.0000	0.0000	0.3415 ***	0.0005	0.0446	0.1864 **
Panel B: ASEAN Emerging Markets							
Indonesia	8	0.0000	0.0000	1.0861 ***	0.0006	0.2786	-0.0481
Malaysia	6	0.0000	0.0000	0.3668 ***	0.0860	0.9432	-0.0042
Philippines	6	0.0000	0.0000	0.9041 ***	0.2353	0.0928	-0.0649
Singapore	7	0.0000	0.0000	0.5651 ***	0.0159	0.1265	0.0818
Thailand	6	0.0000	0.0000	0.6908 ***	0.1454	0.0743	-0.0683

Note: * Significant at 90% confidence interval

** Significant at 95% confidence interval

*** Significant at 99% confidence interval

Table 3.2 Granger Causality between Individual Currency Excess Returns (funding JPY) and Equity Market Returns

		Carry Trade cause Equity			**Carry Trade cause Equity**		
		Restriction 1	**Restriction 3**		**Restriction 2**	**Restriction 4**	
Equity Markets	**lag**	**P-values**	**P-values**	**Sum Coeff**	**P-values**	**P-values**	**Sum Coeff**
Pair 1 : JPY / AUD							
Japan	2	0.0000	0.0111	0.1447 **	0.0002	0.0000	0.1221 ***
Australia	5	0.0814	0.8210	0.0137	0.0089	0.0078	0.1589 ***
Pair 2 : JPY / IDR							
Japan	7	0.0000	0.0000	0.7450 ***	0.0000	0.1475	0.0674
Indonesia	8	0.0000	0.0000	0.7042 ***	0.0094	0.9051	-0.0056
Pair 3 : JPY / MYR							
Japan	3	0.0002	0.0028	0.3014 ***	0.0000	0.0068	0.0662 ***
Malaysia	2	0.1556	0.6703	-0.0140	0.0006	0.0019	0.0987 ***
Pair 4 : JPY / SGD							
Japan	5	0.0000	0.0000	1.8510 ***	0.0359	0.0276	-0.0691 **
Singapore	2	0.0000	0.0000	0.5531 ***	0.7787	0.4999	0.0135
Pair 5 : JPY / THB							
Japan	2	0.0000	0.0143	0.2193 **	0.0013	0.0003	0.0568 ***
Thailand	6	0.0379	0.1213	0.1836	0.0000	0.0138	0.0661 **
Pair 6 : JPY / PHP							
Japan	5	0.0002	0.5728	0.1724	0.0000	0.0000	0.2227 ***
Philippines	5	0.2714	0.5310	0.0567	0.0000	0.0000	0.1414 ***

Note: *Significant at 90% confidence interval

**Significant at 95% confidence interval

***Significant at 99% confidence interval

Table 3.3 Granger Causality between Individual Currency Excess Returns (funding USD) and Equity Market Returns

		Carry Trade cause Equity			**Carry Trade cause Equity**		
		Restriction 1	**Restriction 3**		**Restriction 2**	**Restriction 4**	
Equity Markets	**lag**	**P-values**	**P-values**	**Sum Coeff**	**P-values**	**P-values**	**Sum Coeff**
Pair 1 : USD / AUD							
US	10	0.0328	0.7092	-0.0493	0.0094	0.1774	-0.1017
Australia	7	0.0000	0.0000	0.5199 ***	0.2463	0.7954	-0.0151
Pair 2 : USD / IDR							
US	2	0.8185	0.6806	0.0281	0.0000	0.0007	0.0564 ***
Indonesia	2	0.0000	0.0000	0.8133 ***	0.0000	0.0000	0.0693 ***
Pair 3 : USD / MYR							
US	2	0.5442	0.4076	0.0839	0.0000	0.0000	0.1198 ***
Malaysia	1	0.7407	0.7407	0.0140	0.0025	0.0025	0.0364 ***
Pair 4 : USD / SGD							
US	12	0.0001	0.0227	0.6927 **	0.0038	0.0051	-0.0755 ***
Singapore	2	0.0000	0.0000	0.9567 ***	0.5665	0.3945	-0.0079
Pair 5 : USD / THB							
US	5	0.0108	0.5578	0.1215	0.0000	0.0005	0.0419 ***
Thailand	6	0.5429	0.2642	0.2704	0.0000	0.0000	0.0543 ***
Pair 6 : USD / PHP							
US	2	0.9595	0.9900	-0.0014	0.0000	0.0000	0.1350 ***
Philippines	5	0.0152	0.0343	0.3765 **	0.0000	0.0000	0.0879 ***

Note: * Significant at 90% confidence interval

** Significant at 95% confidence interval

*** Significant at 99% confidence interval

Table 3.4 Volatility Spillover from Carry Trade to Equity Markets

	Carry Trade to Equity					
	spillover		**garch**		**asymetric**	
Equity Markets	**(β21)**		**(γi)**		**(λi)**	
Panel A : Developed Economies						
Japan	0.0445		0.8897		0.0816	
	0.0015	***	0.0000	***	0.0000	***
US	0.0275		0.8842		0.1646	
	0.1179		0.0000	***	0.0000	***
Europe	0.0110		0.9343		0.0904	
	0.2820		0.0000	***	0.0000	***
UK	0.0156		0.9055		0.1369	
	0.2372		0.0000	***	0.0000	***
Australia	0.0187		0.9180		0.0998	
	0.1199		0.0000	***	0.0000	***
New Zealand	0.0348		0.9310		0.0395	
	0.0042	***	0.0000	***	0.0082	***
Panel B : ASEAN Emerging Markets						
Indonesia	0.0834		0.8523		0.0841	
	0.0002	***	0.0000	***	0.0031	***
Malaysia	0.1016		0.8699		0.0414	
	0.0000	***	0.0000	***	0.1065	
Philippines	0.0955		0.8053		0.0959	
	0.0001	***	0.0000	***	0.0019	***
Singapore	0.0349		0.9324		0.0618	
	0.0043	***	0.0000	***	0.0002	***
Thailand	0.0745		0.8576		0.1039	
	0.0001	***	0.0000	***	0.0000	***

Note: * Significant at 90% confidence interval

** Significant at 95% confidence interval

*** Significant at 99% confidence interval

Table 3.5 Volatility Spillover from Equity to Carry Trade Market

	Equity to Carry Trade		
	spillover	**garch**	**asymetric**
Equity Markets	**(β12)**	**(γi)**	**(λi)**
Panel A : Developed Economies			
Japan	0.0924	0.8770	0.0545
	0.0000***	0.0000***	0.0386**
US	0.0962	0.8771	0.0467
	0.0000***	0.0000***	0.0715*
Europe	0.0878	0.8850	0.0500
	0.0000***	0.0000***	0.0503*
UK	0.0890	0.8855	0.0473
	0.0000***	0.0000***	0.0606*
Australia	0.0923	0.8836	0.04351
	0.0000***	0.0000***	0.0854*
New Zealand	0.0812	0.8948	0.0425
	0.0000***	0.0000***	0.0722*
Panel B : ASEAN Emerging Markets			
Indonesia	0.0903	0.8847	0.0485
	0.0000***	0.0000***	0.0527*
Malaysia	0.0862	0.8848	0.0542
	0.0000***	0.0000***	0.0336**
Philippines	0.0888	0.8835	0.0518
	0.0000***	0.0000***	0.0407**
Singapore	0.0869	0.8846	0.0528
	0.0000***	0.0000***	0.0397**
Thailand	0.0890	0.8831	0.0536
	0.0000***	0.0000***	0.0364**

Note: * Significant at 90% confidence interval

** Significant at 95% confidence interval

*** Significant at 99% confidence interval

Table 3.6 Volatility Spillover from Individual Currency Excess Returns (funding JPY) to Equity Markets

	Currency to Equity		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{21})**	**(γ_i)**	**(λ_i)**
Pair 1 : JPY/AUD			
Japan	0.0326	0.8860	0.1120
	0.0195**	0.0000***	0.0000***
Australia	0.0170	0.9124	0.1161
	0.1687	0.0000***	0.0000***
Pair 2 : JPY/IDR			
Japan	0.0259	0.8906	0.1108
	0.0781*	0.0000***	0.0000***
Indonesia	0.1070	0.8078	0.0957
	0.0001***	0.0000***	0.0054***
Pair 3 : JPY/MYR			
Japan	0.0324	0.8847	0.1157
	0.0232**	0.0000***	0.0000***
Malaysia	0.0915	0.8694	0.0654
	0.0000***	0.0000***	0.0122**
Pair 4 : JPY/SGD			
Japan	0.0546	0.8913	0.0632
	0.0006***	0.0000***	0.0015***
Singapore	0.0340	0.9320	0.0683
	0.0037***	0.0000***	0.0000***
Pair 5 : JPY/THB			
Japan	0.0290	0.8861	0.1211
	0.0378**	0.0000***	0.0000***
Thailand	0.0688	0.8590	0.1104
	0.0002***	0.0000***	0.0000***

Table 3.6 (Continued)

	Currency to Equity		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{21})**	**(γ_i)**	**(λ_i)**
Pair 6 : JPY/PHP			
Japan	0.0337	0.8855	0.1112
	0.0190**	0.0000***	0.0000***
Philippines	0.0967	0.8168	0.1000
	0.0001***	0.0000***	0.0013***

Note: * Significant at 90% confidence interval

** Significant at 95% confidence interval

*** Significant at 99% confidence interval

Table 3.7 Volatility Spillover from Equity Markets to Individual Currency Excess Returns (funding JPY)

	Equity to Currency		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{12})**	**(γ_i)**	**(λ_i)**
Pair 1 : JPY to AUD			
Japan	0.0816	0.8739	0.0851
	0.0001***	0.0000***	0.0010***
Australia	0.0829	0.8710	0.0862
	0.0001***	0.0000***	0.0007***
Pair 2 : JPY to IDR			
Japan	0.0681	0.8904	0.0625
	0.0001***	0.0000***	0.0057***
Indonesia	0.0704	0.8868	0.0648
	0.0001***	0.0000***	0.0054***

Table 3.7 (Continued)

	Equity to Currency		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{12})**	**(γ_i)**	**(λ_i)**
Pair 3 : JPY to MYR			
Japan	0.0554	0.8947	0.0734
	0.0004***	0.0000***	0.0010***
Malaysia	0.0567	0.8870	0.0813
	0.0003***	0.0000***	0.0004***
Pair 4 : JPY to SGD			
Japan	0.0518	0.9107	0.0701
	0.0005***	0.0000***	0.0006***
Singapore	0.0476	0.9124	0.0756
	0.0010***	0.0000***	0.0003***
Pair 5 : JPY to THB			
Japan	0.0588	0.8966	0.0502
	0.0001***	0.0000***	0.0208**
Thailand	0.0642	0.8816	0.0607
	0.0001***	0.0000***	0.0110**
Pair 6 : JPY to PHP			
Japan	0.0528	0.9106	0.0415
	0.0002***	0.0000***	0.0444**
Philippines	0.0407	0.9114	0.0586
	0.0020***	0.0000***	0.0039***

Note: *Significant at 90% confidence interval

**Significant at 95% confidence interval

***Significant at 99% confidence interval

Table 3.8 Volatility Spillover from Individual Currency Excess Returns (funding USD) to Equity Markets

	Currency to Equity		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{21})**	**(γ_i)**	**(λ_i)**
Pair 1 : USD/AUD			
US	0.0092	0.8953	0.1743
	0.5366	0.0000***	0.0000***
Australia	0.0224	0.9121	0.1022
	0.0657*	0.0000***	0.0000***
Pair 2 : USD/IDR			
US	0.0019	0.8905	0.2038
	0.8973	0.0000***	0.0000***
Indonesia	0.0749	0.8086	0.1597
	0.0022***	0.0000***	0.0000***
Pair 3 : USD/MYR			
US	0.0011	0.8916	0.2027
	0.9408	0.0000***	0.0000***
Malaysia	0.0914	0.8716	0.0612
	0.0000***	0.0000***	0.0176**
Pair 4 : USD/SGD			
US	0.0057	0.8978	0.1724
	0.6973	0.0000***	0.0000***
Singapore	0.0310	0.9305	0.0734
	0.0086***	0.0000***	0.0000***
Pair 5 : USD/THB			
US	0.0042	0.8937	0.1890
	0.7753	0.0000***	0.0000***
Thailand	0.0698	0.8544	0.1176
	0.0002***	0.0000***	0.0000***

Table 3.8 (Continued)

	Currency to Equity		
Equity Markets	**spillover (β_{21})**	**garch (γ_i)**	**asymetric (λ_i)**
Pair 6 : USD/PHP			
US	0.0014	0.8906	0.2043
	0.9243	0.0000***	0.0000***
Philippines	0.0954	0.8224	0.0976
	0.0001***	0.0000***	0.0012***

Note: *Significant at 90% confidence interval
**Significant at 95% confidence interval
***Significant at 99% confidence interval

Table 3.9 Volatility Spillover from Equity Markets to Individual Currency Excess Returns (funding USD)

	Equity to Currency		
Equity Markets	**spillover (β_{12})**	**garch (γ_i)**	**asymetric (λ_i)**
Pair 1 : USD/AUD			
US	0.0409	0.9263	0.0502
	0.0055***	0.0000***	0.0025***
Australia	0.0376	0.9278	0.0545
	0.0097***	0.0000***	0.0010***
Pair 2 : USD/IDR			
US	0.3920	0.7555	0.1084
	0.0000***	0.0000***	0.1597
Indonesia	0.3449	0.7854	0.1149
	0.0000***	0.0000***	0.1006

Table 3.9 (Continued)

	Equity to Currency		
	spillover	**garch**	**asymetric**
Equity Markets	**(β_{12})**	**(γ_i)**	**(λ_i)**
Pair 3 : USD/MYR			
US	0.0950	0.8958	0.0253
	0.0000***	0.0000***	0.2552
Malaysia	0.1019	0.8887	0.0261
	0.0000***	0.0000***	0.2601
Pair 4 : USD/SGD			
US	0.0237	0.9486	0.0500
	0.0248**	0.0000***	0.0005***
Singapore	0.0258	0.9488	0.0479
	0.0148**	0.0000***	0.0006***
Pair 5 : USD/THB			
US	0.3091	0.7484	0.0067
	0.0000***	0.0000***	0.8990
Thailand	0.3068	0.7378	0.0365
	0.0000***	0.0000***	0.5054
Pair 6 : USD/PHP			
US	0.0664	0.9112	0.0264
	0.0000***	0.0000***	0.1228
Philippines	0.0645	0.9007	0.0352
	0.0000***	0.0000***	0.0557*

Note: *Significant at 90% confidence interval

**Significant at 95% confidence interval

***Significant at 99% confidence interval

3.5 Chapter Summary

This chapter attempts to build on existing studies concerning the Granger causality relationship in returns, and the volatility spillover between carry trade strategies and equity markets by controlling for economies factor. Carry trade returns are represented by portfolio returns as the analysis base line, and individual currency pair excess returns for a robustness check. Stock markets in developed economies and ASEAN-5 emerging markets are selected. Daily data used for carry trade proxies and equity market returns are from August 2006 to March 2015, covering 2,251 observations.

The empirical results show that carry trade portfolio returns of G10 currencies strongly Granger cause returns of all equity markets in both developed economies and emerging markets. Higher carry trade portfolio returns lead to significantly higher stock market returns in most developed markets and all the emerging markets. The implication made here is that the US dollar has been used as the funding currency instead of the Japanese yen. For the case of excess returns of individual currency pairs, results show the directions which the Granger causality relationship can go, exist in most equity markets. In particular, carry trade returns causing equity market returns are found in most stock markets except for Thailand and Malaysia. In contrast, equity market returns do not cause carry trade returns in Singapore. The causality from equity market returns to carry trade returns is explicitly revealed when a carry trade proxy consists of individual currency pairs' excess returns rather than using carry trade portfolio returns. In addition, the results show that there exists the volatility spillover from the carry trade market to all ASEAN-5 equity markets. The information transmission from the carry trade market to equity markets is rather examined for ASEAN emerging markets than developed economies. The higher volatility in one market affects the greater volatility in another market in emerging countries. Conversely, there is the significant volatility spillover from all emerging and developed equity markets to the carry trade market regardless of economies. The results are robust when the currency excess return proxy is tested. The GARCH effect and asymmetric volatility effect exist in most cases. The volatility of carry trade and

equity markets depends on their past volatility, and bad news induces larger volatility than good news.

Overall, carry trade returns Granger cause equity returns in most emerging and developed markets. The results are robust to the individual currency excess return case. This means that carry trade strategies mostly have the significant positive causal relationship to stock markets, and the volatility spillover effect has shown in most emerging stock markets (ASEAN-5). This supports that the procedure of carry trade strategies significantly cause high-yielding assets to move together with carry trade returns, which actually should not happen according to the uncovered interest rate parity (UIP) condition. Speculators seek to invest in high-yielding assets, but they should suffer from the exchange rate movements. As such, the overall evidence suggests that the UIP condition is violated.

CHAPTER 4

TIME-VARYING RISK PREMIUM OF CARRY TRADE

To investigate time-varying risk premium of carry trades that is exposed to risk factors, an asset pricing model that allow the risk exposures to vary across regimes of FX volatility is applied. Specifically, the logistic smooth transition regression (LSTAR) is adopted as an econometric approach to explain the risk premium of carry trades. It tests whether they are regime-dependent and how exposed they are to other risky asset allocations. Details of methodology, data, results, and summary of the test are contained in sections below.

4.1 Methodology

The methodology explained in this section is to: (1) study the risk premium of carry trade strategies that is exposed to explicit factors like equity and bond markets; (2) assess how the magnitude of the exposures behaves at different exchange rate risk levels, or in other words, if it is regime-dependent; and (3) test whether the risk premium of carry trades persists in different exchange rate arrangements where there is a focus on managed exchange rate policies and free floating. The latter, moreover, implies the exchange rate arrangement has an impact on the exposures of carry trades or the risk premiums that should be rewarded in such different FX policies. The procedures to achieve the research purposes are discussed below in more detail.

4.1.1 Risk Premium of Carry Trade Strategies

Several traditional models have been developed for investigating the risk premiums of currencies' returns. Mark (1988) suggested that by using a single-beta CAPM model risk premiums can be a consistent result of time variation in the expected excess return on the reference assets, and equity returns as a portfolio of

assets are involved in pricing forward contracts. In another analysis, McCurdy and Morgan (1991) stated that expected return on any asset is a function of its conditional beta with benchmark portfolio. They tested the excess return on the uncovered foreign currency position or deviation from UIP by using the Morgan Stanley Capital International (MSCI) world equity index as the benchmark portfolio. Bansal and Dahlquist (2000) also captured a CAPM specification by adding the equity factor to the model. Moreover, there have been reviews of using bonds as a factor model of exchange rates (see Bacchetta and Wincoop (2006), Christiansen, Ranaldo, and Soderlind (2011)).

Based on this literature evidence, this paper follows the asset pricing analysis by constructing carry trade returns with a factor model as follows:

$$CT_t = \beta_0 + \beta_1 Et + \beta_2 Dt + \varepsilon t \qquad \text{(eq 4.1)}$$

where the carry trade return in period t is denoted as CT_t in the analysis in this dissertation. Stock and bond returns are basic factors denoted as E_t and D_t, respectively. To account for the autocorrelation, the lags of all variables are included and then the following is obtained:

$$CT_t = \beta_0 + \beta_1 E_t + \beta_2 E_{t-1} + \beta_3 D_t + \beta_4 D_{t-1} + \beta_5 CT_{t-1} + \varepsilon_t \qquad \text{(eq 4.2)}$$

where lags of stock returns, bond returns, and carry trade returns are denoted as E_{t-1} , D_{t-1}, and CT_{t-1}, respectively.

4.1.2 Regime-Dependent Pricing Model

An unwinding carry trade that leads to a decline in speculation can cause patterns of non-linear exchange rate returns to emerge (Plantin and Shin, 2007). Some economists for example, Ang, Hodrick, Xing, and Zhang (2006) and Acharya and Pedersen (2005) also provided evidence for market volatility and risk premiums. These issues suggest that a factor model of exchange rates should depend on different states of risk or particularly exchange rate volatility regimes. They do this by differentiating between low and high foreign exchange rate volatility (FXV).

Specifically, FXV is used as a proxy to set up volatility regimes. Thus, the logistic smooth transition regression (LSTAR) is adopted as an econometric approach to explain the risk premium of carry trade strategies in this research (see Christiansen, Ranaldo, and Soderlind (2011), and aims to: firstly, show the regime-dependent pricing model; and secondly, observe how the exposures of carry trade relate to other risky asset allocations. The econometric approach is as follows.

The logistic smooth transition regression (LSTAR) allows all parameters to change smoothly which depends on a logistic function in equation (4.3):

$$\theta = [\, 1+ \exp(-\gamma\,(st\text{-}1 - c))]^{-1} \qquad \text{(eq 4.3)}$$

where c is interpreted as a threshold between two regimes, and γ is the smoothness parameter that determines the change from one regime to another. St-1 is a transition variable or a state variable which is assumed here to be a lagged FXV (the transition variable can be assumed to be a lag of endogenous variable or exogenous variable (Dijk, Terasvirta, and Franses (2002)). Then the LSTAR model for CTt can be formulated below as:

$$CT_t = \beta 0 + \beta_1 E_t + \beta_2 E_{t-1} + \beta_3 D_t + \beta_4 D_{t-1} + \beta_5 CT_{t-1} + \theta\,[\,\alpha_0 + \alpha_1 E_t + \alpha_2 E_{t-1} + \alpha_3 D_t + \alpha_4 D_{t-1} + \alpha_5 CT_{t-1}] + \varepsilon_t \qquad \text{(eq 4.4)}$$

The coefficients α and β in (4) change smoothly depending on the transformation of the transition variable s_{t-1} from low to high value and the smoothness parameter γ. As γ approaches 0 or ∞, then the value of θ is constant and this allows the LSTAR model to become equation (2) so that the behavior of CT_t is given by $\beta_0 + \beta_1 E_t + \ldots + \beta_5 CT_{t-1} + \varepsilon$. For the intermediate values of γ, the coefficients α and β values depend on the transition variable s_{t-1}. As s_{t-1} approaches $-\infty$, θ approaches zero so CT_t is also given as in equation (2). As st-1 approaches $+\infty$, θ approaches 1, so CT_t is represented as $(\beta_0 + \alpha_0) + (\beta_1 + \alpha_1)\, E_t + (\beta_2 + \alpha_2)\, E_{t-1} + \ldots + (\beta_5 + \alpha_5)\, CT_{t-1} + \varepsilon_t$. This means both coefficients and the intercept can change depending on the transition variable s_{t-1} (see Enders, 2004: 400-417).

4.1.3 Exchange Rate Arrangement

In order to evaluate the impact of exchange rate arrangement on the exposures or the risk premiums of carry trades, the exchange rate arrangement is classified into 2 main coarse arrangements; managed exchange rate and freely floating. According to the International Monetary Fund (IMF) coarse classification of exchange rate arrangements (see Table 4.1), there are 6 classes indicating the degree of exchange rate arrangements ranging from strictly fixed to free floating, respectively. The free floating countries are clearly grouped as code 4 only, but the managed arrangements are divided into sub-groups (codes 1 - 3) which indicate the levels of managing FX policy from no separate legal tender, currency board arrangement, de facto peg, horizontal band, crawling peg, and so on, to managed floating. Thus, we can classify each country into 2 main specified groups in our analysis.

From Table 4.1, many of the G10 countries have operated free floating or less managed exchange rates policy in the last few decades, while among the 5 Asian countries, Thailand and Indonesia have adopted a managed float over the same period of time. The Philippines has been in managed floating period for 5 years, but utilized the crawling peg before that. Malaysia seems to have the strictest policy because it has adopted a highly managed exchange rate (codes 1 and 3 in Table 4.1; note that code 3 in bold represents a crawling band groups not a managed floating. Singapore has varied from implementing the crawling peg, crawling band, and other managed arrangements. For more details, see IMF annual reports on exchange arrangements and exchange restrictions.

The countries of origin or the countries base of stock and bond factors are set up for modeling the carry trade returns (CT_t). Thus, there are: (1) a managed floating countries base: Thailand, Indonesia, The Philippines, Malaysia, and Singapore (the last 2 countries are more strictly managed currencies); and (2) a free floating countries base consisting of the G10 countries.

Table 4.1 Exchange Rate Arrangements, 1993-2013

Year	G10 Countries									5 Asian Countries				
	UNITED STATES	JAPAN	AUSTRALIA	NEW ZEALAND	CANADA	UNITED KINGDOM	NORWAY	SWEDEN	SWITZERLAND	THAILAND	INDONESIA	PHILIPPINES	SINGAPORE	MALAYSIA
2000	4	4	4	3	2	3	3	3	3	3	3	2	3	1
2001	4	4	4	3	2	3	3	3	3	3	3	2	3	1
2002	4	4	4	3	3	3	3	3	3	3	3	2	3	1
2003	4	4	4	3	3	3	3	3	3	3	3	2	3	1
2004	4	4	4	3	3	3	3	3	3	3	3	2	3	1
2005	4	4	4	3	3	3	3	3	3	3	3	2	3	1
2006	4	4	4	3	3	3	3	3	3	3	3	2	3	1
2007	4	4	4	3	3	3	3	3	3	3	3	2	3	3
2008	4	4	4	3	3	3	3	3	3	3	3	3	3	3
2009	4	4	4	3	3	3	3	3	3	3	3	3	3	3
2010	4	4	4	3	3	3	3	3	3	3	3	3	3	3
2011	4	4	4	4	4	4	4	4	3	3	3	3	3	3
2012	4	4	4	3	4	4	4	4	3	3	2	3	2	3
2013	4	4	4	3	4	4	4	4	2	3	3	3	2	3

Note: The course classification codes above are:

1 - No separate legal tender

1 - Pre-announced peg or currency board arrangement

1 - Pre-announced horizontal band that is narrower than or equal to +/-2%

1 - De facto peg

2 - Pre-announced crawling peg

2 - Pre-announced crawling band that is narrower than or equal to +/-2%

2 - De facto crawling peg

2 - De facto crawling band that is narrower than or equal to +/-2%

3 - Pre-announced crawling band that is wider than or equal to +/-2%

3 - De facto crawling band that is narrower than or equal to +/-5%

3 - Moving band that is narrower than or equal to +/-2% (i.e. allows for both appreciation and depreciation over time)

3 - Managed floating

4 - Freely floating

5 - Freely falling

6 - Dual market in which parallel market data is missing.

4.1.4 Robustness Check with Individual Currency Excess Returns

For a robustness check, this study also tests for individual currency excess returns as another proxy for carry trade returns. Moreover, the author also compares the efficiency of the LSTAR model (eq.4) to OLS approach (eq.2), and uses the dummy variable for the foreign exchange volatility (FXV) to differentiate high risk from low risk regimes. The transition efficiency of the LSTAR model is also used for comparative purposes. However, the results are quite robust to LSTAR but it seems not to illustrate clearly as LSTAR (see the estimated results in appendix).

4.2 Data Description

In this analysis, the same sample of daily data as in Chapter 3 is used. The data spans from August 2006 to March 2015, covering 2,251 observations. Two sets of stock, and bond returns are classified as developed and emerging markets. First, the developed economies include Japan, United States, United Kingdom, Australia, New Zealand, and European Union. Second, ASEAN-5 (namely, Indonesia, Malaysia, the Philippines, Singapore, and Thailand), represent the emerging markets in Southeast Asia. In addition, proxies of carry trade returns consist of carry trade portfolio returns and excess returns of individual currency. The foreign exchange volatility (FXV) is collected to examine the time-varying risk premium of carry trades. All data details are described as following subsections.

4.2.1 Carry Trade Portfolio Returns

To investigate the performance of carry trade strategies, the daily DB G10 Currency Future Harvest Index - total return is collected through DataStream that is published by Reuters. This index tracks the changes in price by The PowerShares DB G10 Currency Harvest Fund of Deutsche Bank (see Table 4.2). It is made available to investors who want to conveniently invest in currency futures. The Index is composed of G10 currencies future contracts and is constructed to create profits where high interest rates currencies tend to appreciate relative to low interest rates currencies. The Group of Ten or G10 Currencies include the Australian Dollar (AUD), Canadian Dollar (CAD), Swiss Franc (CHF), Euro Dollar (EUR), British Pound (GBP),

Japanese Yen (JPY), Norwegian Krone (NOK), New Zealand Dollar (NZD), Swedish Krona (SEK), and US Dollar (USD).

The DB G10 Currency Future Harvest Index works in the context of the G10 countries, i.e. making long future contracts of the 3 highest interest rates currencies and short future contracts of 3 lowest interest rates currencies. Every quarter, there is a performance evaluation and re-weighting of the 3 long highest interest rates currencies future position and the 3 short lowest interest rates currencies future position (see Table 4.3).

Table 4.2 The PowerShares DB G10 Currency Harvest Fund Annual Index History

	DB G10 Currency Future Harvest Index ER	**DB G10 Currency Future Harvest Index TR**
2007	4.70	9.96
2008	-28.50	-27.81
2009	21.86	22.09
2010	1.40	1.81
2011	1.48	1.23
2012	10.39	20.48
2013	-1.96	-1.93
2014	0.93	0.95
2015 YTD	-2.13	-2.19

Table 4.3 PowerShares DB G10 Currency Harvest Fund index weights

Commodity	Contract Expiry Date	Index Weight	Base Weight
AUD	09/14/2015	32.40%	33.33%
CHF	09/14/2015	-33.05%	-33.33%
EUR	09/14/2015	-33.00%	-33.33%
NOK	09/14/2015	32.28%	33.33%
NZD	09/14/2015	32.15%	33.33%
SEK	09/14/2015	32.64%	-33.33%

4.2.2 Excess Returns of Individual Currency

For robustness the G10 currencies returns are individually calculated based on the interest rate differentials in accordance with UIP theory. The return calculated from (4.5) is an arbitrage profit or an excess return above what UIP predicts as documented in many studies (eg. Brunnermeier, Nagel, and Pedersen (2009), Christiansen, Ranaldo, and Söderlind (2011)).

$$r_{jt}^{k} = \left(i_{t-1}^{k} - i_{t-1}^{j}\right) - \left(s_{t}^{k} - s_{t-1}^{k}\right) \qquad \text{(eq. 4.5)}$$

where r_{jt}^{k} = individual currency pair excess return in period t which is calculated from borrowing currency j and investing in currency k

$i_{t-1}^{k} - i_{t-1}^{j}$ = 1-day lagged interest rate differential of country k and j

s_{t}^{k} = log spot exchange rate of currency k per 1 unit of j

s_{t-1}^{k} = log 1-day lagged spot exchange rate of currency k per 1 unit of j

Daily spot exchange rates and interest rates data are collected through DataStream and Eikon which are published by Reuters. The interest rate mostly used is the 1-day interbank overnight money market rate, except for some countries employing the 1-day interbank T/N (tomorrow-next) money market rate. The sample spans from August 2006 to March 2015 (2,251 observations). The limitation of FX

volatility data controls the starting point of all data including the above carry trade returns and the explanatory variables which are explained more fully below.

4.2.3 Explanatory variables

To study the risk premium of carry trade, stock and bond market returns are used as the main explanatory variables according to the traditional factor models for exchange rates (McCurdy and Morgan, 1991), and the option-implied FX volatility (FXV) serves to classify the high and low state of risk. In this way we test whether the carry trade is regime-dependent (Christiansen, Ranaldo and Soderlind, 2011). Daily log returns of equity index of each country base *j*, (E_t^j) represent the stock market factor and daily log returns of the bond index of each country base *j*, (D_t^j) represent the bond market factor. The country bases represent the home countries of investors who invest in both carry trade portfolio returns and the case of individual currency excess returns. The analysis mainly focuses on the 5-Asian countries base (Indonesia, Malaysia, The Philippines, Singapore, and Thailand) and some G10 countries. Those countries are classified by the coarse class of exchange rate arrangement as described in the previous section. The five Asian currencies are the Thai baht (THB), Indonesian rupiah (IDR), Philippine peso (PHP), Singapore dollar, (SGD), and Malaysian ringgit (MYR).

Daily bond indices of 5 Asian countries are derived from ADB Asian bond online provided by the Asian Development Bank (http://asianbondsonline.adb.org). Other countries' daily bond indices originate from Eikon by Reuters. Daily FX spot rate, equity indices and option-implied FX volatility (FXV) of 5 Asian and some G10 countries also are found on DataStream and Eikon based on mid-quote. All data time spans are from August 2006 to March 2015 because they are subjected to FXV condition. The tenor for daily FXV used is spot week volatility and 1-month volatility, subject to availability.

4.3 Empirical Results

The estimated results of the logistic smooth transition regression (LSTAR) model are mainly organized as: (1) the results of carry trade portfolio returns that are exposed to ASEAN-5 equity and bond markets; (2) the results of carry trade portfolio returns that are exposed to equity and bond markets of G10 countries; (3) the results of individual currency excess returns that are exposed to ASEAN-5 equity and bond markets; and (4) the results of individual currency excess returns that are exposed to equity and bond markets of G10 countries. Details are reported in subsections below.

4.3.1 Carry Trade Returns and ASEAN-5 Markets

The results estimated from the logistic smooth transition regression (LSTAR) model for carry trade returns (CT) in ASEAN-5 countries are summarized in Table 4.4. The first 2 lines are parameters estimated from LSTAR. The middle part shows the coefficients of factors in a low regime of FX volatility (FXV), while the bottom part is that of a high regime of FXV. The results clearly indicate that carry trade returns are positively exposed to equity market returns and are significant during calm periods in all ASEAN-5 countries. During volatile periods, all 5 Asian countries except for Thailand, experience risk exposures to equity market returns that are significantly greater. For the bond markets, the results are different to that of the stock markets. The risk exposures to the bond market returns are mostly negative and insignificant in the low regime, and become insignificantly more negative in volatile periods.

Moreover, as shown in Table 4.5 the more managed exchange rate countries like Malaysia and Singapore, their differences in values of risk exposures to stock market returns from low to high volatile periods are much larger and significant compared to Indonesia and The Philippines 5 (Malay 0.38, Sing 0.16, Philip 0.07, Indo 0.05). This pattern is not evident for Thailand which has implemented a managed floating policy. It appears to have the least managed rate policy of all five Asian nations.

The regression results for the ASEAN-5 countries imply that, for more managed rate countries, the risk exposure to equity market depends on FX volatility

or it is regime dependent. The higher the degree of managed exchange rate policy, the greater the risk of exposure to equity market returns. At this point, it is not solid enough to conclude that. Let find out further for the case of G10 countries.

Table 4.4 Logistic Smooth Transition Regression (LSTAR) for Carry Trade Returns and ASEAN-5 Markets

	Thai		**Indo**		**Philip**		**Sing**		**Malay**	
Coefficients										
γ	0.87		42.96		28.94		7.44		1.53	
c	20.17		5.11	***	11.18		8.69	***	7.89	***
Low regime										
C	0.00		0.00		0.00		0.00		0.00	
E	0.20	***	0.12	**	0.09	***	0.19	***	0.11	**
Et-1	-0.02		-0.05		-0.02		0.02		-0.02	
D	-0.34	***	0.05		-0.06		-0.32	***	0.23	
Dt-1	0.37	***	-0.07		-0.06		0.07		0.03	
CTt-1	-0.12	***	-0.05		-0.09	***	-0.14	***	-0.05	
High regime										
C	0.02		0.00		0.00		0.00		0.00	
E	-1.05		0.17	***	0.16	***	0.35	***	0.49	***
Et-1	1.34		0.03	*	-0.14	***	0.07	**	-0.05	
D	-1.59		0.10	**	-0.27	**	-1.52	***	-0.72	***
Dt-1	35.37		-0.16	***	0.87	***	-0.36		-0.16	
CTt-1	-2.75		-0.15	***	-0.16	***	-0.23	***	-0.16	***

Table 4.5 The difference in value of coefficients (High regime – Low regime) from table 4.4

Coefficients	Thai	Indo	Philip	Sing	Malay
C	0.02	0.00	0.00	0.00	0.00
E	-1.26	0.05 **	0.07 ***	0.16 ***	0.38 **
Et-1	1.35	0.08	-0.12	0.05	-0.03
D	-1.25	0.04	-0.20	-1.19 ***	-0.96
Dt-1	35.00	-0.09	0.92	-0.43	-0.19
CTt-1	-2.63	-0.10	-0.07 ***	-0.09 ***	-0.11

4.3.2 Carry Trade Returns and Markets of G10 Countries

LSTAR results for carry trade returns (CT) in G10 countries (Table 4.6) are revealed in the same magnitude of risk exposure to the stock and bond in emerging markets. That is, carry trade returns are positively exposed to equity market returns and become greater during more volatile periods. CT returns are negatively exposed to the bond market and more negatively exposed during more volatile periods. However, only Great Britain (GB), Sweden (SWD), and Switzerland (SWL) show this to be statistically significant, especially for GB where both coefficients of equity and lagged of equity are significant. This does not support a previous finding that the CT exposures to ASEAN-5 stock markets appear, irrespective of the country of origin of the companies' returns (Christiansen, Ranaldo, and Soderlind, 2011).

Table 4.6 Logistic Smooth Transition Regression (LSTAR) for Carry Trade Returns and Markets of G10 Countries [+]

	AUS	CAN	SWL	GB	NZL	SWD	JP	NW
Coefficients								
γ	0.07 *	0.25 *	0.68 *	0.44 **	0.13	0.23 *	0.06	0.05
c	54.46 *	9.32 **	10.51 ***	10.43 ***	41.72 ***	17.21 ***	159.21	177.62
Low regime								
C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	0.08	0.13	0.21 ***	0.15 **	0.13 ***	0.12 *	0.05	0.01
Et-1	0.05	0.06	0.02	0.07 **	-0.02	0.03	0.01	0.04
D	-0.16 **	-0.09	-0.13	-0.06	-0.22	-0.13	-0.33	-0.37
Dt-1	0.38	0.16	-0.10	-0.11	0.07	0.06	0.89	0.02
CTt-1	-0.12 **	0.20	-0.03	-0.02	-0.11 ***	-0.01	-0.03	0.08
High regime								
C	0.00	0.00	0.00	0.00	0.00	0.00	-4.18	-1.66
E	1.01	0.44 ***	0.44 ***	0.48 ***	0.09	0.45 ***	922	439.77
Et-1	-0.56	0.01	0.00	0.04 *	0.25	0.02	-121	-43.30
D	-1.28	-0.84 ***	-0.38 ***	-0.45 ***	-2.94 **	-0.54 ***	3208	238.99
Dt-1	-5.69	-0.39 ***	-0.07	-0.02	1.11	-0.53 ***	-10961	-9.66
CTt-1	-0.91	-0.26 ***	-0.24 ***	-0.30 ***	-0.27 *	-0.36 ***	-1340	-388.71

Note: [+] The table excludes Europe and the U.S. due to the lack of equity returns and volatility data.

Since the G10 are free floating exchange rate countries, the degree of managed rate influence is revealed according to the results. Table 4.7 highlights the differences in values of risk exposures to stock market returns. The differences in coefficient values are close to each other for the 3 significant countries base. Nevertheless, these differences in values are less than that of Malaysia (see Table 4.5) which is the most strictly managed rate country in our sample. The finding from the regression of 2 classes of exchange rate arrangement is that the risk exposures to equity market returns seem to be significantly regime-dependent in countries with the managed rate arrangement and in some free floating countries, but not for all countries. The risk premium of CT is time-varying since it is higher in more volatile periods (and even more in countries with high managed rate policy). In other words, the carry trade strategy yields higher returns in the form of compensation to higher risk premium in

some countries where the managed rate arrangement is adopted during turbulent times. Again, it is not solid enough to conclude that. Let find out further for the case of individual currency excess returns.

Table 4.7 The difference in value of coefficients of selected 3 countries from table 4.6

Coeff (H-L)	SWL	GB	SWD
C	0.00	0.00	0.00
E	0.24 ***	0.32 **	0.32 *
Et-1	-0.02	-0.03 **	-0.00
D	-0.24	-0.39	-0.41
Dt-1	0.03	0.03	0.59
CTt-1	-0.21	-0.28 *	-0.34

4.3.3 Individual Currency Excess Returns (borrowing ASEAN-5 currencies to invest in G10 currencies) and ASEAN-5 Markets

In order to discover that the risk exposures to equity and bond market returns of the individual currency returns are time-varying as in the CT returns case, the LSTAR estimated results should follow the sign pattern that Christiansen, Ranaldo and Soderlind (2011) suggested. Typically, high yielding currencies such as the NZD and AUD as investment assets are positively exposed to equity returns. Furthermore they become greater in a high regime, while low yielding currencies like JPY, CHF, and SEK have negative exposures to equity returns and become more negative in a high regime. Exposures to bond market returns behave differently. In the analysis of the 5 Asian countries base, Indonesia and the Philippines on average tend to have higher interest rates than the others (see Figure 4.1), so the sign pattern may be opposite to a normal analysis. For example, the NZD typically has a positive exposure to the others but could be negative when the Indonesian rupiah is a countries base's currency.

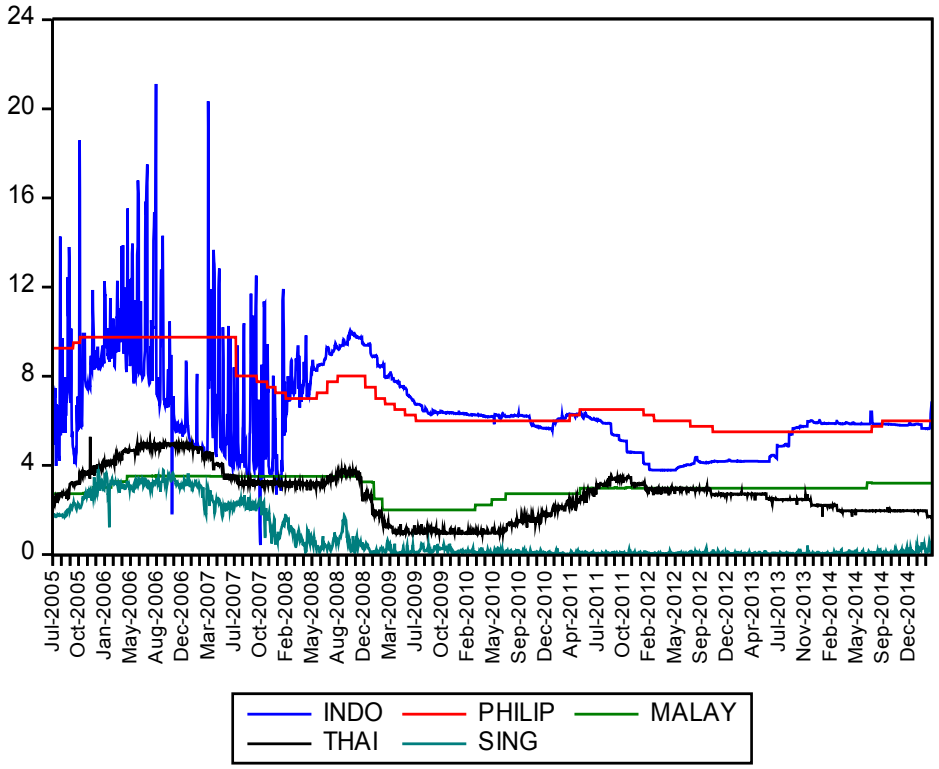


Figure 4.1 ASEAN-5 countries' interest rates

The results of individual currency excess returns (borrowing 5 Asian currencies to invest in G10 currencies) and 5 Asian equity and bond markets are summarized in Table 4.8 below. Not many significant coefficients are reported in the table for both stock and bond market returns. However, Malaysia and Singapore show 3 significant coefficients out of 10, while 3 managed floating policy countries (Thailand, Indonesia, The Philippines) indicated fewer than that. High differences in coefficient values are also not solid to pronounce in more managed rate policy countries as in the CT returns case (See Malaysia).

Table 4.8 LSTAR for Individual Currency Excess Returns (borrowing ASEAN-5 currencies to invest in G10 currencies) and ASEAN-5 Markets

Equity and Bond Markets	Investment Currencies																			
	AUD		CAD		CHF		EUR		GBP		JPY		NOK		NZD		SEK		USD	
Thai base																				
γ	0.12		1.37		217.66		303.75		28.66		235.67		0.59		9.53		333.74		1.62	
c	82.00		10.28	***	2.99		2.20		9.24		2.28		34.33		22.65		2.20		22.98	
Low regime																				
C	0.00		0.00		0.00		-0.01	**	0.00		0.00		0.00		0.00		-0.01	***	0.00	
E	0.13		0.09	***	0.08		0.12		0.03	***	-0.31		0.10	***	0.16		0.56	**	-0.05	***
E t-1	0.07		0.05	***	0.00		-0.15		0.00		0.01		0.02	**	0.05		-0.18		-0.02	***
D	-0.27		-0.30	***	0.35		-1.73		-0.20	***	-1.19		-0.13		-0.24		-1.89		-0.14	***
D t-1	-0.15		0.03		0.02		-2.33		-0.10		-0.43		0.11		0.19		-4.91	**	0.01	
r t-1	0.06		0.01		-0.11		-0.43		0.08	***	0.12		0.01		0.02		-0.48		0.06	***
High regime																				
C	1.67		0.00	**	0.00		0.00		0.00		0.00		11.06		0.68		0.00		-2.00	
E	447.91		0.03		-0.03	***	0.04	***	0.12	***	-0.13	***	-5936.21		-5.83		0.11	***	778.97	
E t-1	19.84		0.01		-0.04	***	-0.02	*	-0.10	*	-0.07	***	378.84		1.36		0.02		-23.06	
D	492.92		-0.43		0.02		-0.09		-0.07		0.30	***	26016.84		-0.46		-0.16	*	2601.68	
D t-1	2309.48		0.53		0.17	*	0.09		-0.42		0.00		13431.54		0.98		0.14		-1398.39	
r t-1	-611.11		-0.27		0.02		0.04	**	0.21		-0.06	***	-2584.91		-5.70		-0.04	**	-186.03	
Indo base	**AUD**		**CAD**		**CHF**		**EUR**		**GBP**		**JPY**		**NOK**		**NZD**		**SEK**		**USD**	
γ	0.95		14.89		13.15		1.98		16.10		86.68		1.79		16.01		27.02		16.30	
c	0.00	***	25.34		25.47		7.19	***	25.20		5.97	***	6.69		25.28		15.59	**	25.13	
Low regime																				
C	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
E	0.12	***	0.01		-0.06		0.01		-0.03		-0.13	***	0.04		0.05		-0.01		-0.06	
E t-1	0.05	***	0.01		-0.01		0.03		0.01		0.00		0.00		0.03		-0.01		0.00	
D	-0.21	***	-0.15		-0.10		-0.33	***	-0.13		-0.40	***	-0.29		-0.15		-0.13	***	-0.24	
D t-1	-0.07		0.01		0.00		0.06		-0.05		0.36	***	-0.10		-0.05		-0.12	**	0.12	
r t-1	-0.16	***	-0.07		-0.04		-0.21	***	-0.07		-0.24	***	-0.04		-0.06		-0.08	***	-0.20	
High regime																				
C	0.00		-1.25		-1.95		0.00		-0.26		0.00		0.00		-0.64		0.00		-0.06	
E	-0.14	***	89.68		140.33		-0.08	***	21.80		-0.11	***	0.02		23.13		0.00		1.63	
E t-1	-0.02		56.50		20.54		0.01		12.28		-0.02		-0.01		1.99		0.01		0.09	
D	0.06		-213.51		-26.13		-0.07		-53.37		-0.10		-0.14		-0.96		-0.17	**	-12.62	
D t-1	0.14	**	190.92		68.07		0.01		40.40		0.03		0.12		99.34		0.34	***	6.80	
r t-1	0.06		-190.58		-514.01		-0.09	***	-26.94		-0.14	***	-0.16		-47.04		-0.20	***	-8.39	
Philip base	**AUD**		**CAD**		**CHF**		**EUR**		**GBP**		**JPY**		**NOK**		**NZD**		**SEK**		**USD**	
γ	3.11	**	0.40		0.15		0.12		-2.38		0.03		1.00		26.65		42.30		54.00	
c	10.49	***	6.94	*	61.02		-10.57		-48.51		-98.60		44.00		11.20		11.19		3.96	***
Low regime																				
C	0.00		0.00		0.00		-0.01		0.00		-0.14		0.00		0.00		0.00		0.00	
E	0.13	***	-0.03		-0.13		-1.17		0.07		3.56		-0.02		-0.02		-0.05	***	0.09	
E t-1	-0.02		-0.05		-0.07		0.44		-0.09		1.67		-0.01		0.00		0.00		-0.02	
D	0.07		-0.09		0.17		-1.17		0.01		40.73		-0.20		-0.16	***	-0.01		-0.04	
D t-1	-0.21	***	-0.24		-0.21		0.21		-0.06		-29.48		0.05		0.05		-0.01		0.11	
r t-1	-0.11	***	-0.17	*	0.00		-1.52		-0.06		-17.31		-0.13		-0.14	***	-0.15	***	-0.81	***
High regime																				
C	0.00		0.00		1.15		0.00		64.49		0.01		1.00		0.00		0.00	*	0.00	
E	0.28	***	0.27	**	323.73		0.22		57.30		-0.35		1.00		0.14	**	-0.03		-0.01	**
E t-1	0.36	***	-0.08	***	-108.81		-0.16		16.36		-0.19		1.00		-0.06		-0.12	**	-0.10	***
D	0.03		0.12		-337.32		0.13		-10.36		-2.19		1.00		-0.34	***	-0.41	**	-0.06	***
D t-1	0.07		-0.04		393.47		-0.10		-1.41		1.47		1.00		0.85	***	0.46	**	-0.05	***
r t-1	-0.35	***	-0.11	**	-209.37		0.05		20.83		0.85		1.00		-0.14	***	-0.09		0.08	***

Table 4.8 (Continued)

Equity and Bond Markets	Investment Currencies																	
	AUD		CAD		CHF		EUR		GBP		JPY		NOK		NZD		SEK		USD	
Sing base																				
γ	32.96		2.99		2.72		25.84		2.91		0.34		28.62		8.13		3.02		2.24	
c	7.75	***	8.44	***	7.51	***	11.59	***	16.61		-19.05		13.45	**	31.40		4.87	***	16.14	***
Low regime																				
C	0.00		0.00		0.00		0.00		0.00		-1.51		0.00		0.00		0.00		0.00	
E	0.12	***	0.04	***	-0.04	**	-0.01		0.02	**	281.17		0.14	***	0.15	***	0.02		-0.06	***
E t-1	0.04	**	0.02		0.04	**	0.04	***	0.04	***	156.56		0.02	*	0.03	**	0.01		0.00	
D	-0.17	*	-0.32	***	0.06		-0.15	***	-0.20	***	-526.86		-0.01		-0.28	***	0.22		-0.01	
D t-1	0.01		0.10		0.10		0.03		-0.02		-18.27		-0.06		-0.06		0.12		0.01	
r t-1	-0.13	***	-0.07	**	-0.12	***	-0.03		0.01		244.52		-0.06	***	-0.09	***	0.04		-0.06	***
High regime																				
C	0.00	*	0.00		0.00		0.00		0.70		0.00		0.00		0.57		0.00		0.01	
E	0.25	***	0.07	***	-0.08	***	-0.01		-125.65		-0.25	***	0.03		1.02		0.19	***	-7.54	
E t-1	0.06	***	0.11	***	0.01		-0.10	***	4.46		-0.05		0.06		1.01		-0.01		1.29	
D	-0.85	***	-0.64	***	-0.02		-0.41		74.25		0.56	***	0.02		1.00		-0.27	***	32.27	
D t-1	-0.26		-0.23		-0.14		-0.10		-536.64		0.06		-0.69		1.00		-0.15		-31.61	
r t-1	-0.17	***	-0.09	**	0.00		0.02		36.32		-0.22	***	-0.57	***	1.01		-0.07	***	-15.73	
Malay base	**AUD**		**CAD**		**CHF**		**EUR**		**GBP**		**JPY**		**NOK**		**NZD**		**SEK**		**USD**	
γ	2.59		2.98		140.34		3.05	*	3.37		11.73		66.88		6.08		0.74		1.20	**
c	9.75	***	9.71	***	4.21		11.75	***	3.49	***	6.88	***	3.89		24.32		23.99		6.47	***
Low regime																				
C	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
E	0.05	*	-0.04	*	-0.14	**	-0.03	*	0.03		-0.25	***	-0.01		0.14	***	0.00		-0.05	
E t-1	0.08	***	0.00		0.00		-0.03		0.01		-0.01		0.13	*	0.04	*	0.03		-0.01	
D	-0.55	***	-0.42	**	-0.39		-0.24	*	-1.15		-0.04		-0.91		-0.43	**	-0.26		-0.35	*
D t-1	0.15		-0.05		-0.35		-0.11		0.31		-0.03		0.31		0.19		0.09		-0.13	
r t-1	-0.16	***	-0.15	***	-0.42	***	0.06	***	0.03		0.03		0.06		-0.13	***	-0.14	***	0.11	
High regime																				
C	0.00		0.00		0.00		0.00	***	0.00		0.00	*	0.00		5.10		-0.97		0.00	*
E	0.47	***	0.17	***	-0.17	***	0.08		-0.04	**	-0.55	***	0.00		0.47		140.66		-0.27	***
E t-1	0.09	*	0.14	***	-0.02		-0.22	**	0.00		-0.05	*	0.03		0.16		-916.52		-0.02	
D	-0.31		0.04		0.16		4.33	**	-0.09		0.46	**	-0.11		0.98		3245.27		-0.45	***
D t-1	-0.48		-0.19		0.04		5.06	**	-0.34	**	0.02		-0.09		0.97		-1543.07		0.02	
r t-1	-0.24	***	-0.18	***	-0.01		-0.02		0.07	***	-0.10	***	-0.14	***	0.89		-1026.89		-0.10	***

4.3.4 Individual Currency Excess Returns (borrowing G10 currencies to invest in ASEAN-5 currencies) and Markets of G10 countries

Table 4.9 shows the results of individual currency excess returns (borrowing G10 currencies to invest in 5 Asian currencies) and equity and bond markets of G10 countries. We select 3 countries that typically have low interest rate (JPY, CHF, and SEK) from G10 as the countries base wanting to invest in 5 Asian currencies. We do this in order that we can analyze the sign pattern. Only the JPY base shows the pattern of positive exposures to equity returns. In particular, selling the Japanese yen (JPY) and investing in the Malaysian ringgit (MYR) and Philippine peso (PHP) provides the positive risk exposure sign pattern. By comparing the results of JPY base investing in

MYR and PHP, we see that the exposures increase in high regime of PHP (0.07), more than that of MYR (0.01). It possibly but weakly implies that the investment currencies of countries with low level of controlling FX policy are related to higher risk premiums, which oppose to previous cases' results.

Table 4.9 LSTAR for Individual Currency Excess Returns (borrowing G10 currencies to invest in ASEAN-5 currencies) and Markets of G10 countries

Equity and Bond Markets	Investment Currencies			
	Indo	**Malay**	**Philip**	**Thai**
JPY base				
γ	0.22 ***	0.49	0.26 **	0.11
c	71.91	9.04 **	18.14 ***	110.29
Low regime				
C	0.00	0.00	0.00 **	0.00
E	0.09 ***	0.24 ***	0.12 ***	0.20 ***
E t-1	0.02	0.07 *	0.21 ***	0.05 ***
D	0.04	0.21	-0.42 ***	-0.43 ***
D t-1	0.06	0.13	0.42 *	0.18
r t-1	-0.14 ***	-0.03	-0.09 ***	-0.11 ***
High regime				
C	-21.37	0.00	0.00 **	-9.07
E	174.99	0.25 ***	0.19 ***	218.29
E t-1	554.97	0.07 ***	0.15 ***	-111.48
D	-7508.56	-0.70 ***	-0.75 ***	2729.74
D t-1	-16948.57	0.03	-1.47 ***	-5401.77
r t-1	-316.67	-0.18 ***	-0.25 ***	28.39
CHF base	**Indo**	**Malay**	**Philip**	**Thai**
γ	4.45	0.28 **	11.99	12.92
c	40.03	60.24	28.76	28.81
Low regime				
C	0.00	0.00	0.00	0.00
E	0.25	0.06 ***	0.06	0.05
E t-1	0.06	0.13 ***	0.10	0.08
D	0.03	-0.09	-0.05	-0.06
D t-1	0.05	0.03	0.00	0.07
r t-1	-0.24	-0.11 ***	-0.09	0.02
High regime				
C	21.32	1.34	-0.18	-0.21
E	6.54	1902.25	1.17	9.87
E t-1	1.46	583.43	-1.94	-3.61
D	1.25	-1236.49	-6.95	9.81
D t-1	0.97	-1638.64	13.18	33.18
r t-1	10.58	60.36	18.59	3.36
SEK base	**Indo**	**Malay**	**Philip**	**Thai**
γ	0.21	3.79	0.05	0.42 *
c	2.42	25.36 ***	-102.92	14.57 ***
Low regime				
C	0.00	0.00	-0.22	0.00
E	0.63	-0.06 ***	219.20	0.04
E t-1	-0.55	-0.04 ***	-30.74	0.00
D	0.46	0.24 ***	55.26	0.09
D t-1	-0.35	0.08	76.95	0.31 ***
r t-1	0.94	-0.19 ***	24.60	-0.06
High regime				
C	0.00	0.00 **	0.00	0.00 *
E	-0.13 ***	-0.07 **	-0.54	-0.10 ***
E t-1	0.06 **	-0.23 ***	0.09	-0.21 ***
D	0.27 ***	-0.76 **	0.09	0.24 ***
D t-1	0.15	0.42	-0.09	0.22 ***
r t-1	-0.21 ***	-0.20 ***	-0.21	-0.11 ***

Table 4.10 LSTAR for Individual Currency Excess Returns (borrowing and invest among ASEAN-5 currencies) and ASEAN-5 Markets

Equity and Bond Markets	Investment Currencies		
	Indo	**Malay**	**Philip**
Sing base			
γ	13.66	20.15	1.06
c	25.68	16.11	5.69 ***
Low regime			
C	0.00	0.00	0.00 **
E	0.03	0.01	-0.04 **
E t-1	0.15	0.02	0.10 ***
D	-0.72	-0.05	-0.34 **
D t-1	1.13	0.06	0.13
r t-1	-0.50	-0.01	-0.06
High regime			
C	-11.08	-20.60	0.00
E	2.82	-49.57	-0.04 ***
E t-1	0.94	-16.47	0.00
D	1.51	1.87	0.07
D t-1	-0.09	-2.66	0.07
r t-1	2.83	10.40	-0.31 ***
Thai base	**Indo**	**Malay**	**Philip**
γ	14.93	105.91	388.91
c	16.55	4.43 ***	2.70
Low regime			
C	0.00	0.00	0.00
E	0.00	0.06 ***	-0.06
E t-1	0.05	0.00	0.12 *
D	-0.62	-0.20 *	-2.55 ***
D t-1	0.26	0.10	1.39 **
r t-1	0.00	0.01	-0.43 ***
High regime			
C	0.00	0.00	0.00
E	0.11	0.01 *	-0.01
E t-1	-0.03	0.02 **	0.01
D	-3.22	-0.10 *	-0.05
D t-1	-0.04	0.12 **	-0.03
r t-1	-0.25	-0.15 ***	-0.17 ***
Malay base	**Indo**	**Philip**	
γ	189.90	70.68	
c	3.42 **	7.23 ***	
Low regime			
C	0.00	0.00 *	
E	0.07	0.02 *	
E t-1	0.02	0.02	
D	0.59	0.02	
D t-1	0.20	0.05	
r t-1	-0.08	-0.01	
High regime			
C	0.00	0.00	
E	0.03 *	-0.05 ***	
E t-1	0.00	-0.01	
D	-0.14	-0.34 ***	
D t-1	0.02	0.20 **	
r t-1	-0.15 ***	0.00	

4.3.5 Individual Currency Excess Returns (borrowing and invest among each other in ASEAN-5 currencies) and ASEAN-5 Markets

The author chooses 2 countries that typically have the lowest interest rates (THB and SGD) from the 5 Asian countries as the countries base wanting to invest in 3 higher interest rate currencies (IDR, PHP, MYR), and a scenario that MYR invests in IDR and PHP. In these scenarios, there is no sign pattern indicating the relationship between individual currencies excess returns and equity and bond market returns (see Table 4.10). That time-varying risk premium does not persist when both borrowing currencies and investing currencies are of emerging markets.

4.4 Chapter Summary

This chapter studies the time-varying risk premium of carry trade strategies by applying a multi-factor model, which the carry trade exposures to factors are allowed to change depending on the level of FX volatility. Several traditional models were constructed for investigating the risk premium of carry trade returns to stock and bond markets. Unwinding carry trade strategies that lead to a fall in speculation can cause non-linear patterns to emerge in exchange rate returns (Plantin and Shin, 2008). Additionally, some economists such as Ang, Hodrick, Xing, and Zhang (2006) and Acharya and Pedersen (2005) provided evidence concerning the market volatility and the risk premium. These issues suggest that a factor model of exchange rates should depend on different states of risk or particularly exchange rate volatility regimes. They can do this by differentiating between low and high foreign exchange rate volatility (FXV). Thus, the logistic smooth transition regression (LSTAR) model is adopted as the preferred econometric approach to explain the risk premium of carry trade strategies in this research. The objective of this methodology is to demonstrate the regime-dependent pricing model and assess how the exposures of carry trade returns relate to other risky assets like stock and bond. To observe the impact of exchange rate arrangements on the exposures of carry trade returns, the exchange rate arrangements are classified into 2 main coarse arrangements: firstly, a managed exchange rate; and secondly, a free floating. These are both applied to the ASEAN-5

and G10 countries. All daily data used are from August 2006 to March 2015, covering 2,251 observations.

Overall, the empirical results show that carry trade returns are positively exposed to all equity returns in emerging markets, this means that ASEAN-5 currencies are for investment. The exposures become greater during more volatile periods (regime- dependent) regardless of the FX policy. The higher the market risk premium in ASEAN-5 stock markets, the greater the risk premium of carry trade strategies. The results are not very strongly robust when the case of individual currency returns is tested. For most bond markets, the risk exposures of carry trade strategies to bond markets are not significant in both emerging and developed countries. Since carry trade returns are significantly and positively exposed to stocks of ASEAN-5 markets. It seems that speculators tend to invest in high-yielding assets of emerging markets to proceed carry trade strategies. Thus, this suggests that the UIP condition does not seem to hold in emerging markets. Carry trade strategies yield higher returns in the form of compensation to the higher risk premium when investing in ASEAN-5 markets where the risk is rather be rewarded. Hence, the risk may play a role when assets are denominated in currencies that are perceived as being riskier than others. The risk premium would need to be introduced into the UIP condition.

CHAPTER 5

CONCLUSION

Currency carry trade (CT) has been reviewed in detail, particularly its strong correlation to the world's stock markets when capital flows from/to financial markets. This dissertation attempts to examine the relationship between carry trade strategies and equity markets in emerging and developed countries focusing on two purposes: 1) to examine the causal relationship and the volatility spillover between returns of carry trade strategies and equity markets, and 2) to study the time-varying risk premium of carry trade strategies. The Granger causality test under the Vector Autoregressive (VAR) model and the multivariate DCC-GARCH (1,1) are employed for the first purpose, while another one uses the logistic smooth transition regression (LSTAR) as an econometric approach to model carry trade returns which depend on the returns of equity and bond factors. The risk exposures of CT to the factors are allowed to vary across high and low regimes of FX volatility (FXV). The daily return data of carry trade returns, equity and bond returns, and FXV in developed economies and ASEAN-5 emerging markets span from August 2006 to March 2015, covering 2,251 observations.

The empirical results show that carry trade portfolio returns of G10 currencies strongly Granger cause returns of equity markets in all developed economies and ASEAN-5 emerging markets. Higher carry trade portfolio returns significantly lead to greater returns in most stock markets regardless of the environments they operate in. The finding of this study is that the US dollar has been more popular in funding for carry trade strategies than the Japanese yen. Conversely the currencies of all ASEAN-5 emerging countries have been used for investment purposes. For the case that excess returns of individual currency pairs are proxies for CT as a robustness check, the results indicate that the yen is no longer a funding currency for carry trade strategies. Moreover, there exists the volatility spillover from the carry trade market to all ASEAN-5 equity markets. This volatility transmission from the carry trade market to equity markets is rather examined for ASEAN-5 emerging markets than developed

economies. In other words, the higher volatility in CT affects the greater volatility in equity markets for emerging countries. GARCH effect and asymmetric GARCH indicate respectively that the volatility of the carry trade market and equity markets depends on their past volatility, and bad news induces larger volatility than good news.

The empirical results from investigating the behavior of time-varying risk premium of carry trade strategies show that carry trade returns are positively exposed to equity market returns in ASEAN-5 rather than in developed countries. The higher the market risk premiums in ASEAN-5 countries, the greater the risk premium of CT. In addition, the risk premium of CT becomes greater during more volatile periods, and regardless of the foreign exchange rate policy.

Overall, the results support that the procedure of carry trade strategies significantly cause high-yielding assets like stock to move together with carry trade returns, which actually should not happen according to the uncovered interest rate parity (UIP) condition. Speculators seek to invest in stock of emerging markets when they involve in carry trade strategies, but they should suffer from the exchange rate movements. As such, the overall evidence suggests that the UIP condition does not seem to hold in emerging markets. In addition, equity markets are regime-dependent. They are subject to the time-varying matter of the FX volatility. Carry trade strategies yield higher returns in the form of compensation to the higher risk premium when investing in ASEAN-5 equity markets during volatile periods. Hence, the risk may play a role when investment assets are denominated in currencies that are perceived as being riskier than others. The risk premium would need to be introduced into the UIP condition.

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APPENDIX

DATA STATISTICS

Figure A1 Interest rates-Indonesia Comparing to G10 Countries

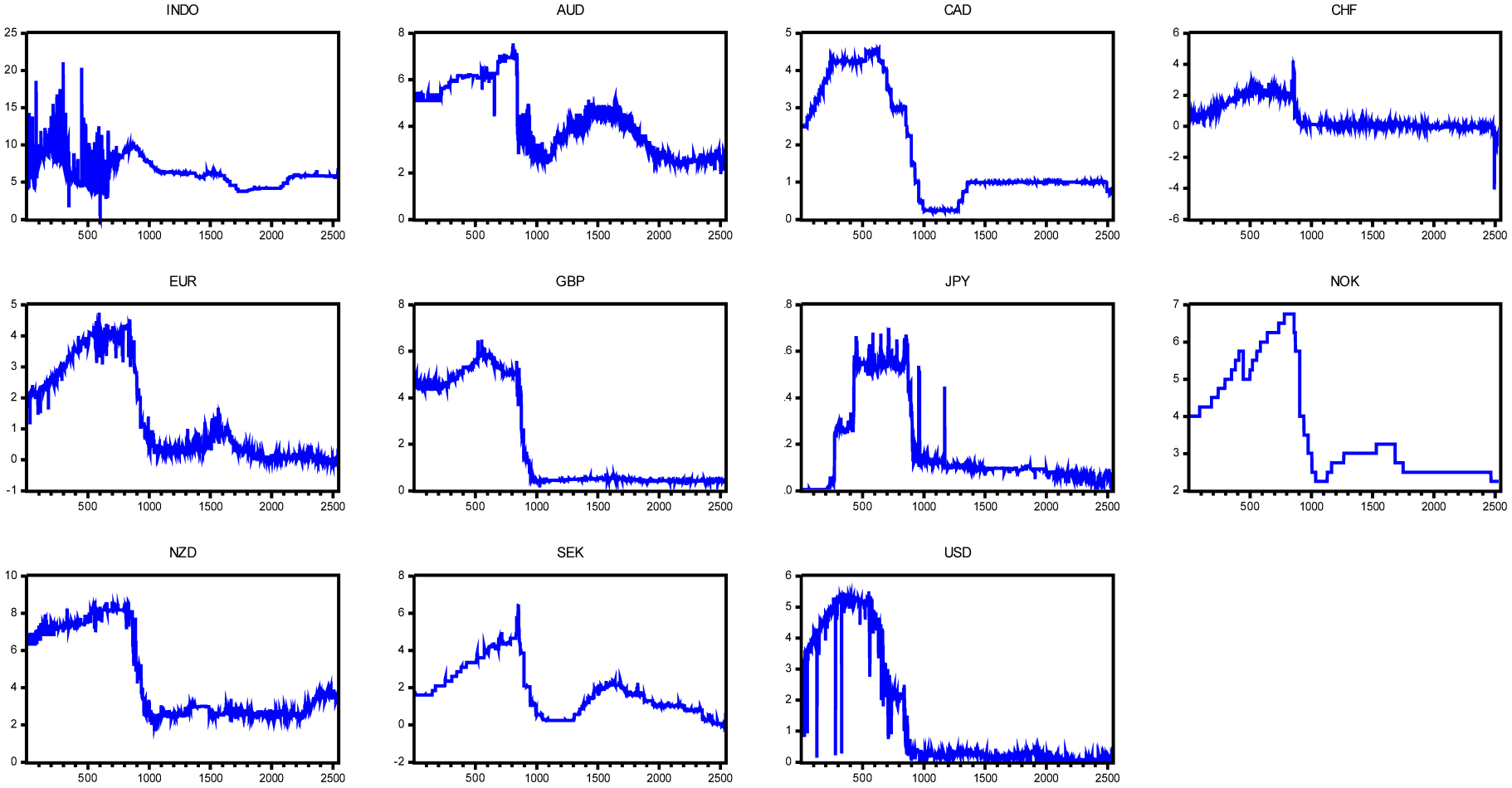


Figure A2 Interest rates-The Philippines Comparing to G10 Countries

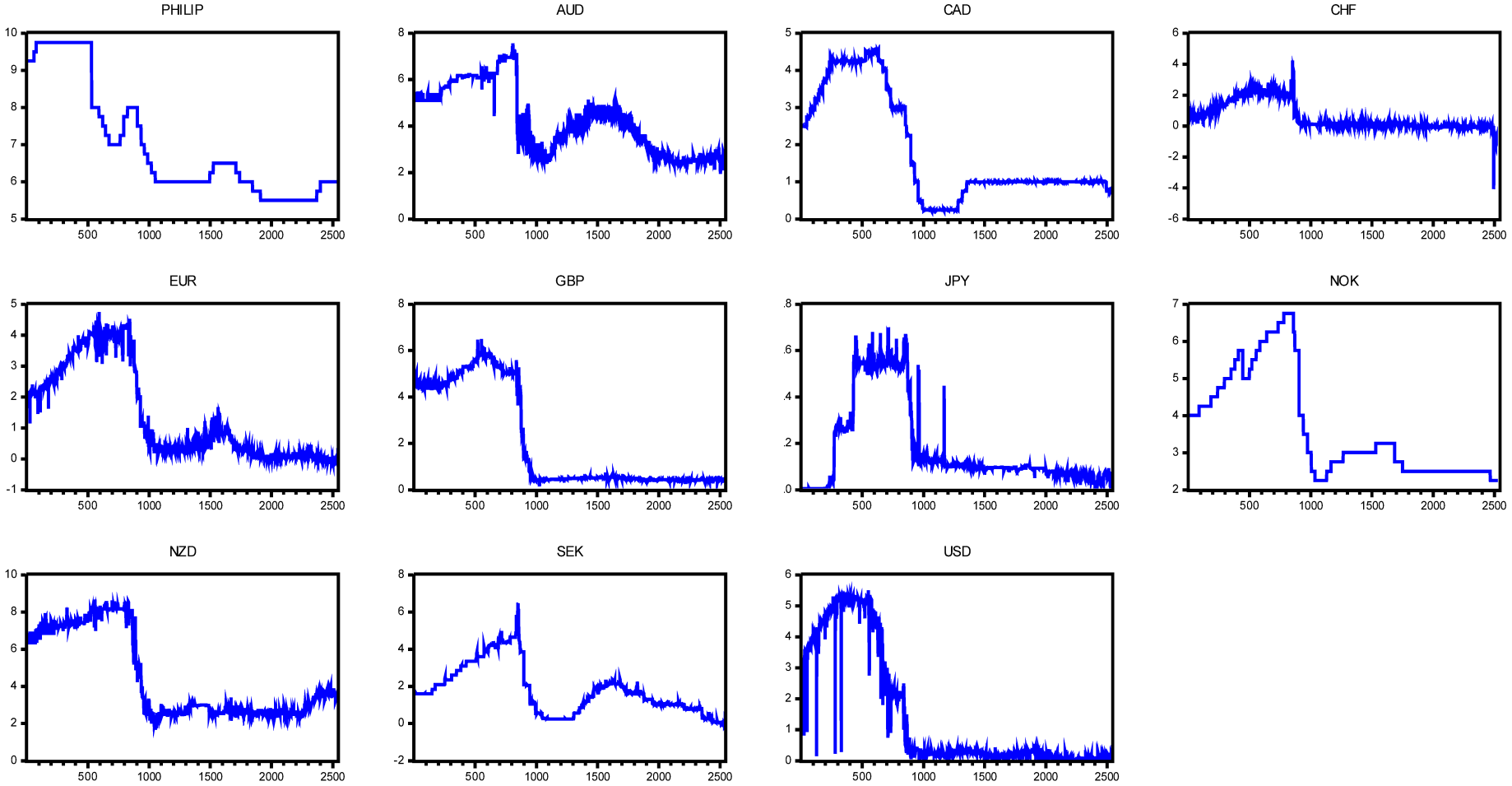


Figure A3 Interest rates-Malaysia Comparing to G10 Countries

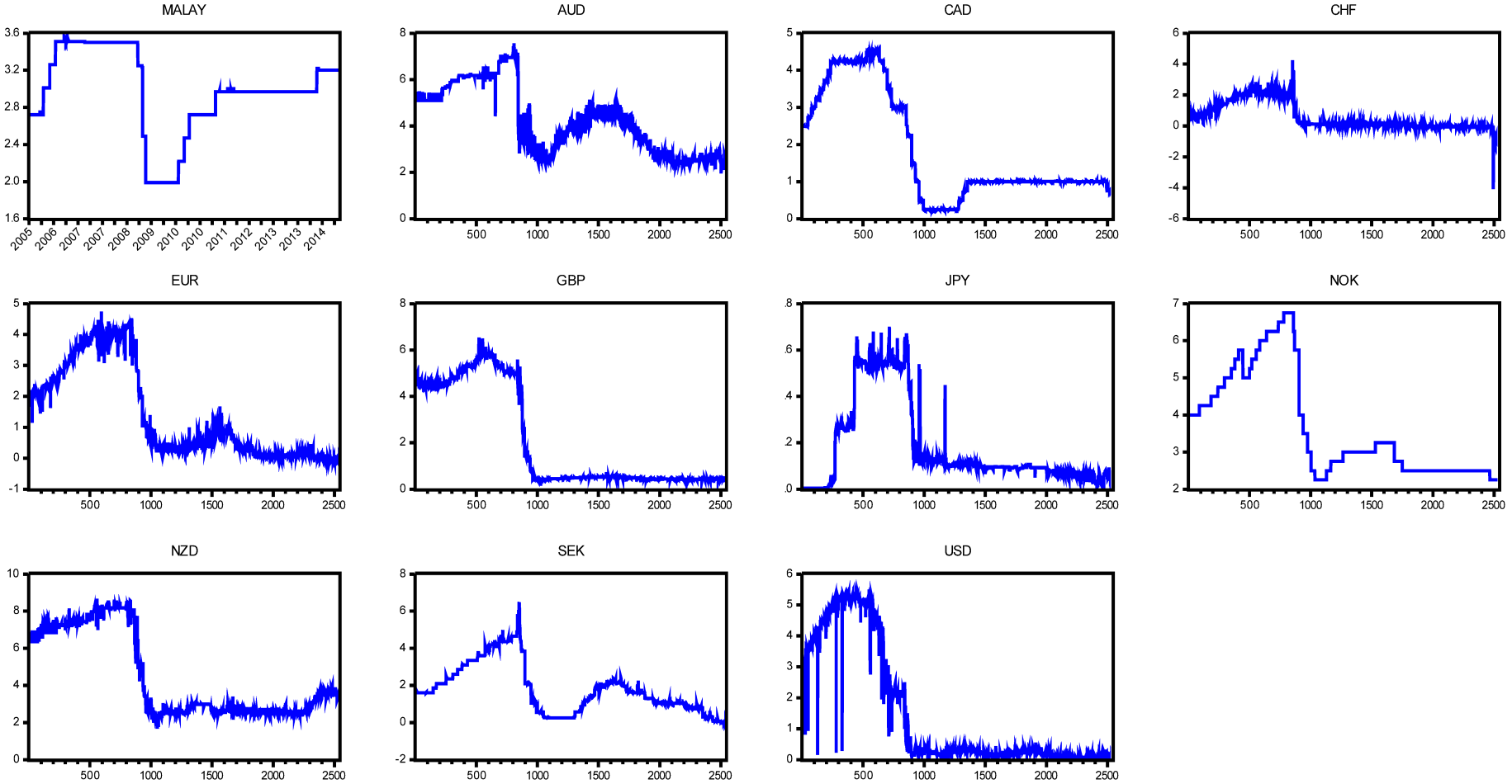


Figure A4 Interest rates-Singapore Comparing to G10 Countries

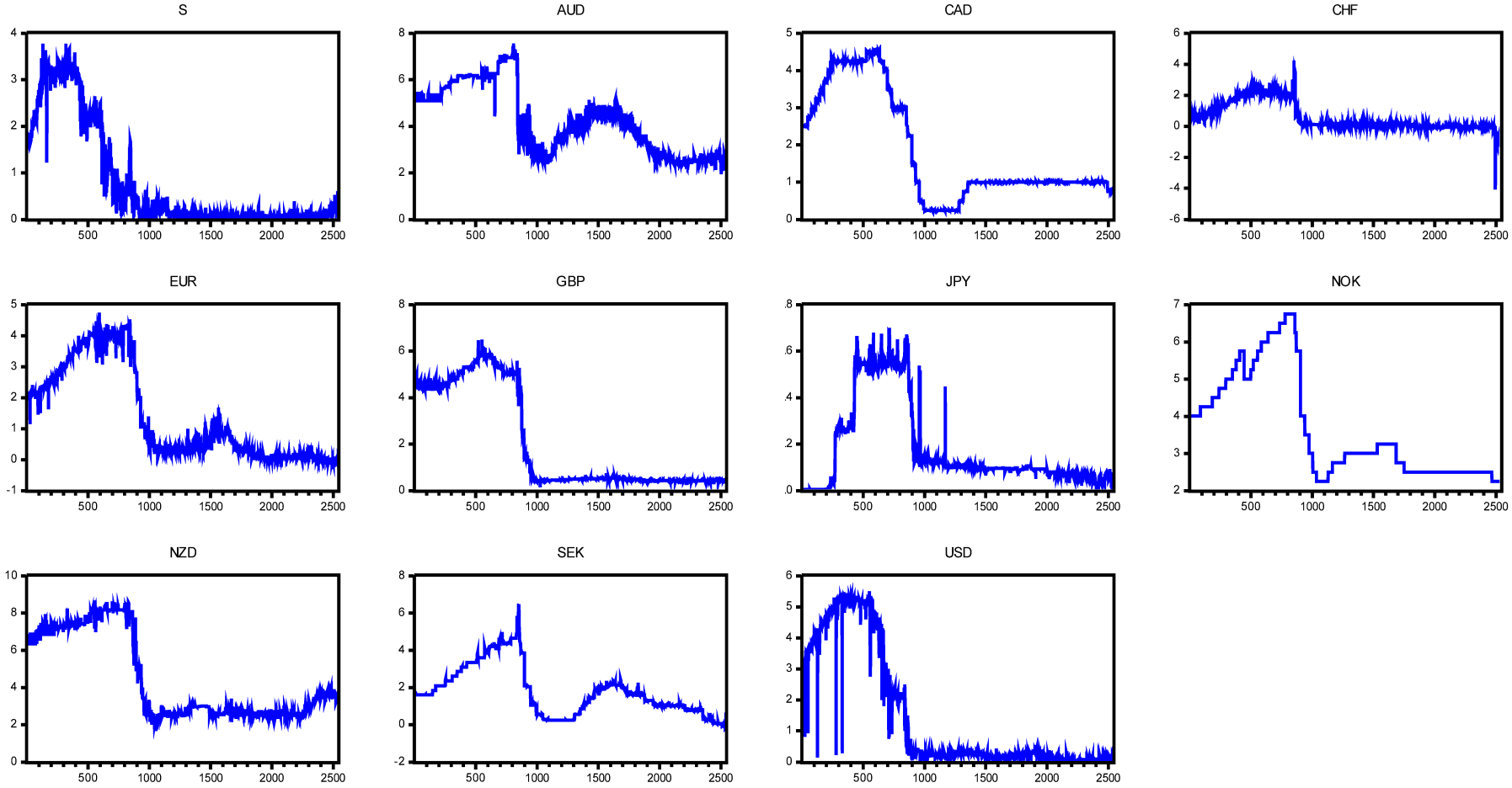


Figure A5 Interest rates-Thailand Comparing to G10 Countries

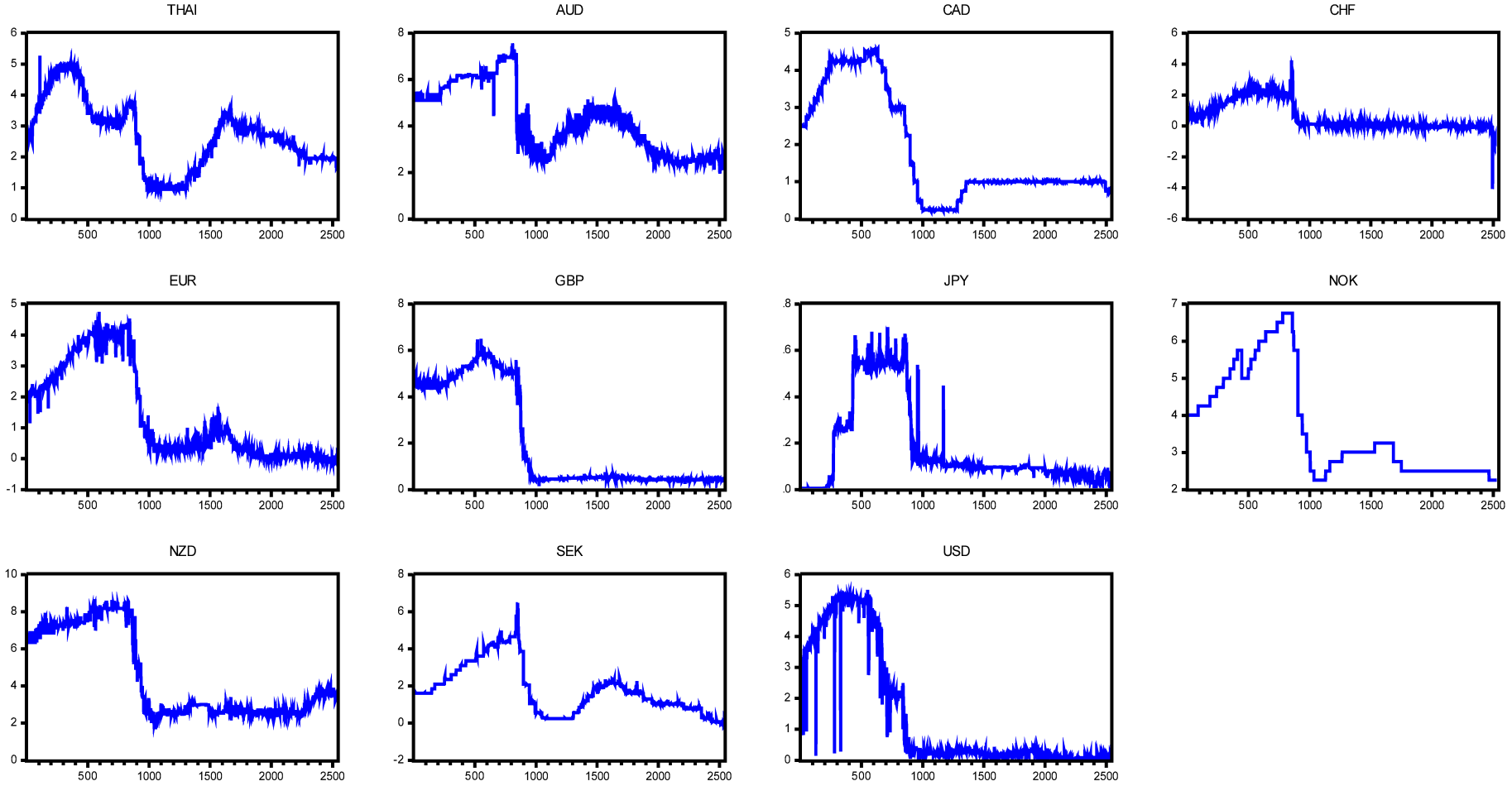
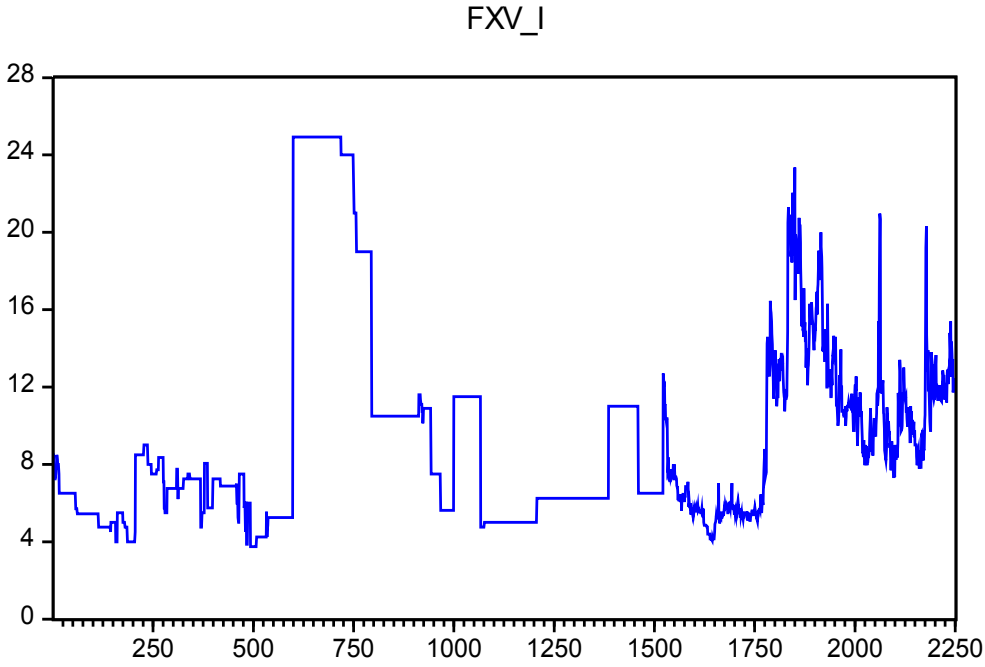
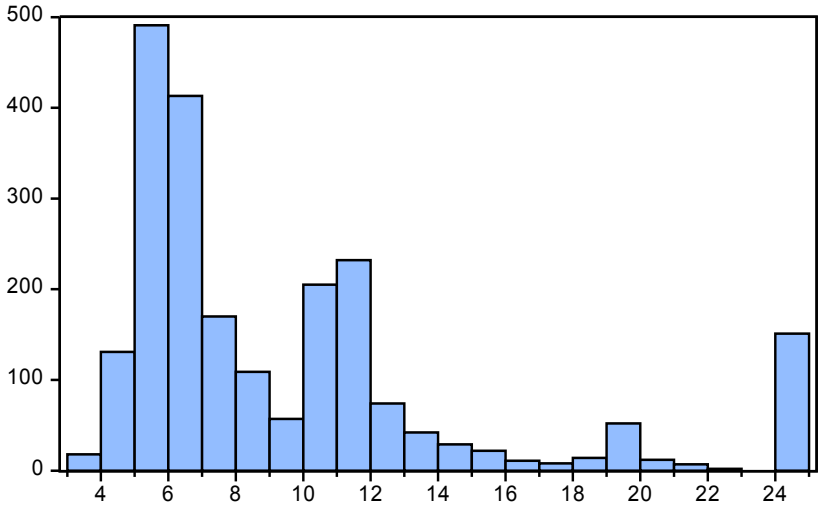


Figure A6 FXV Descriptive Statistic-Indonesia





Series: FXV_I	
Sample 1 2251	
Observations 2251	
Mean	9.521415
Median	7.300000
Maximum	24.92500
Minimum	3.750000
Std. Dev.	5.421060
Skewness	1.598344
Kurtosis	4.875872
Jarque-Bera	1288.483
Probability	0.000000

Figure A7 FXV Descriptive Statistic-Malaysia

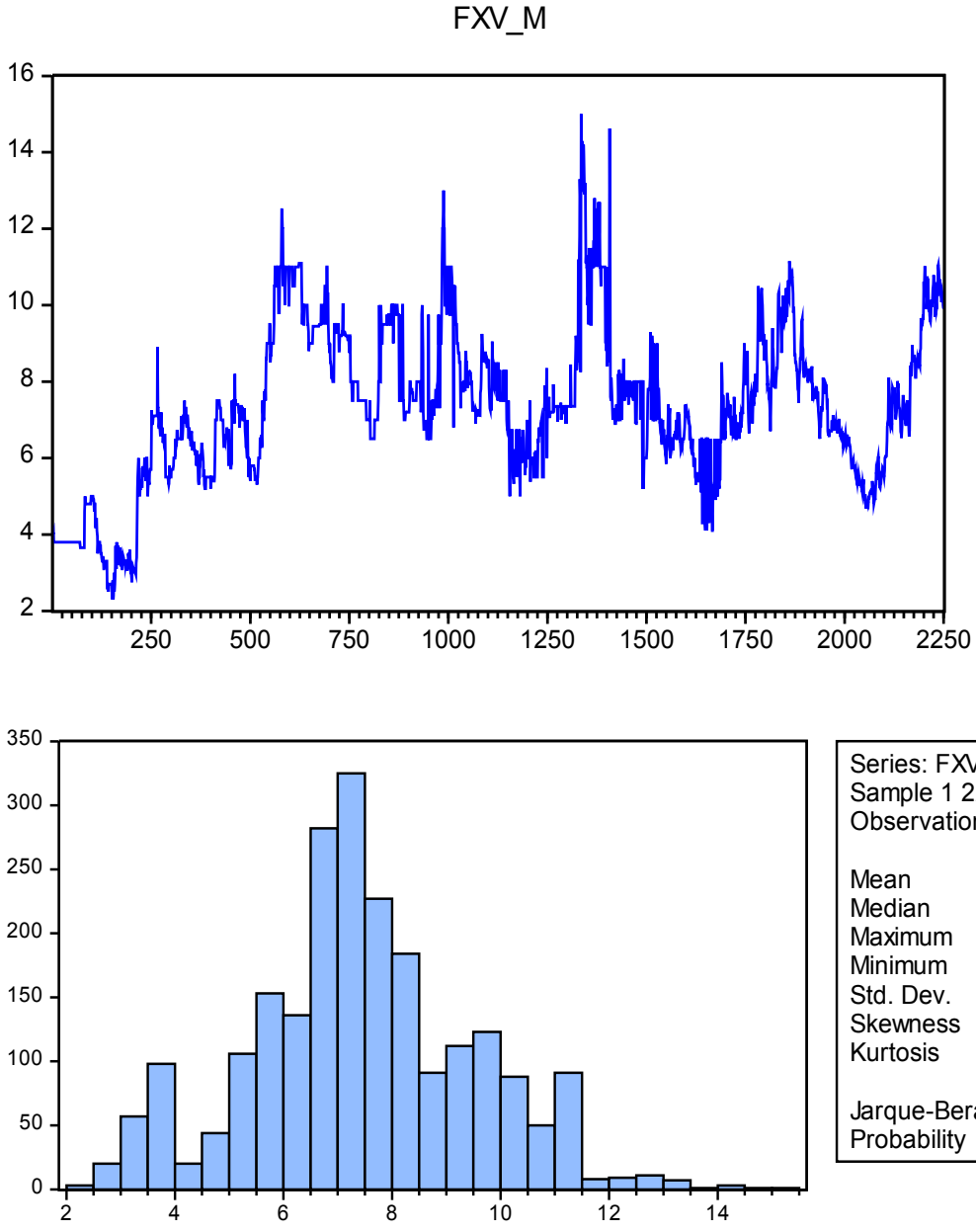
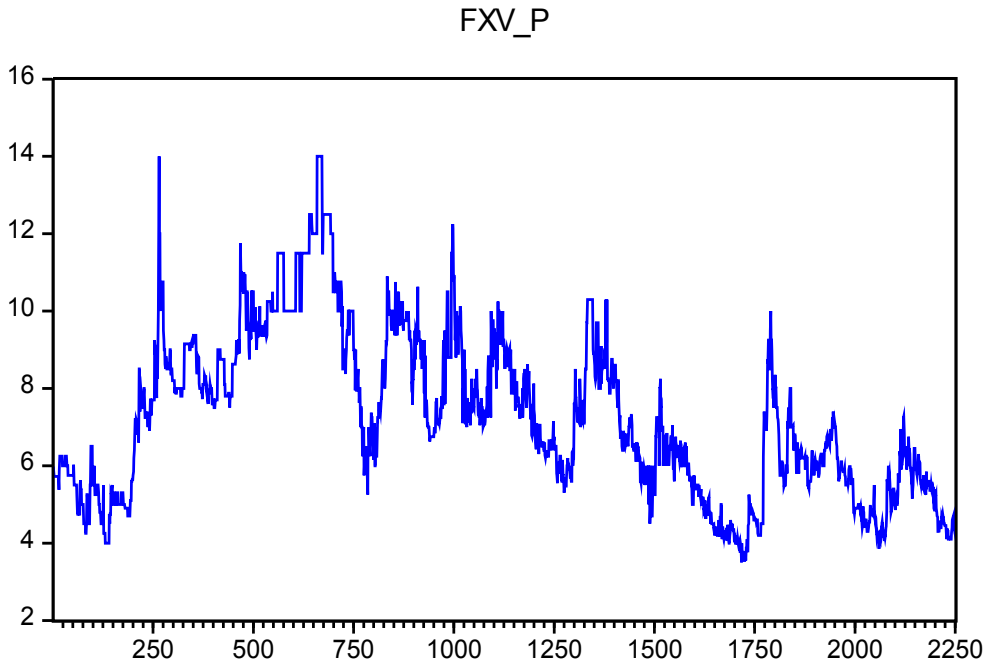
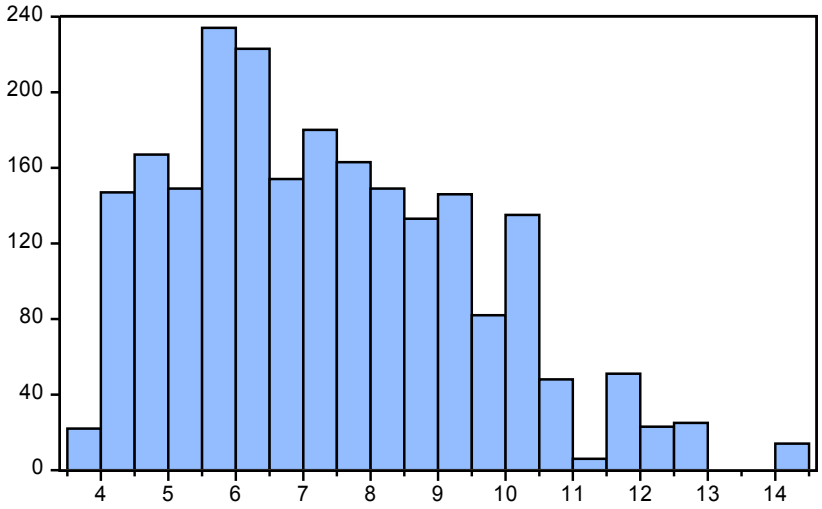


Figure A8 FXV Descriptive Statistic-The Philippines





Series: FXV_P	
Sample 1 2251	
Observations 2251	
Mean	7.264875
Median	7.000000
Maximum	14.00000
Minimum	3.500000
Std. Dev.	2.126025
Skewness	0.532788
Kurtosis	2.729095
Jarque-Bera	113.3794
Probability	0.000000

Figure A9 FXV Descriptive Statistic-Singapore

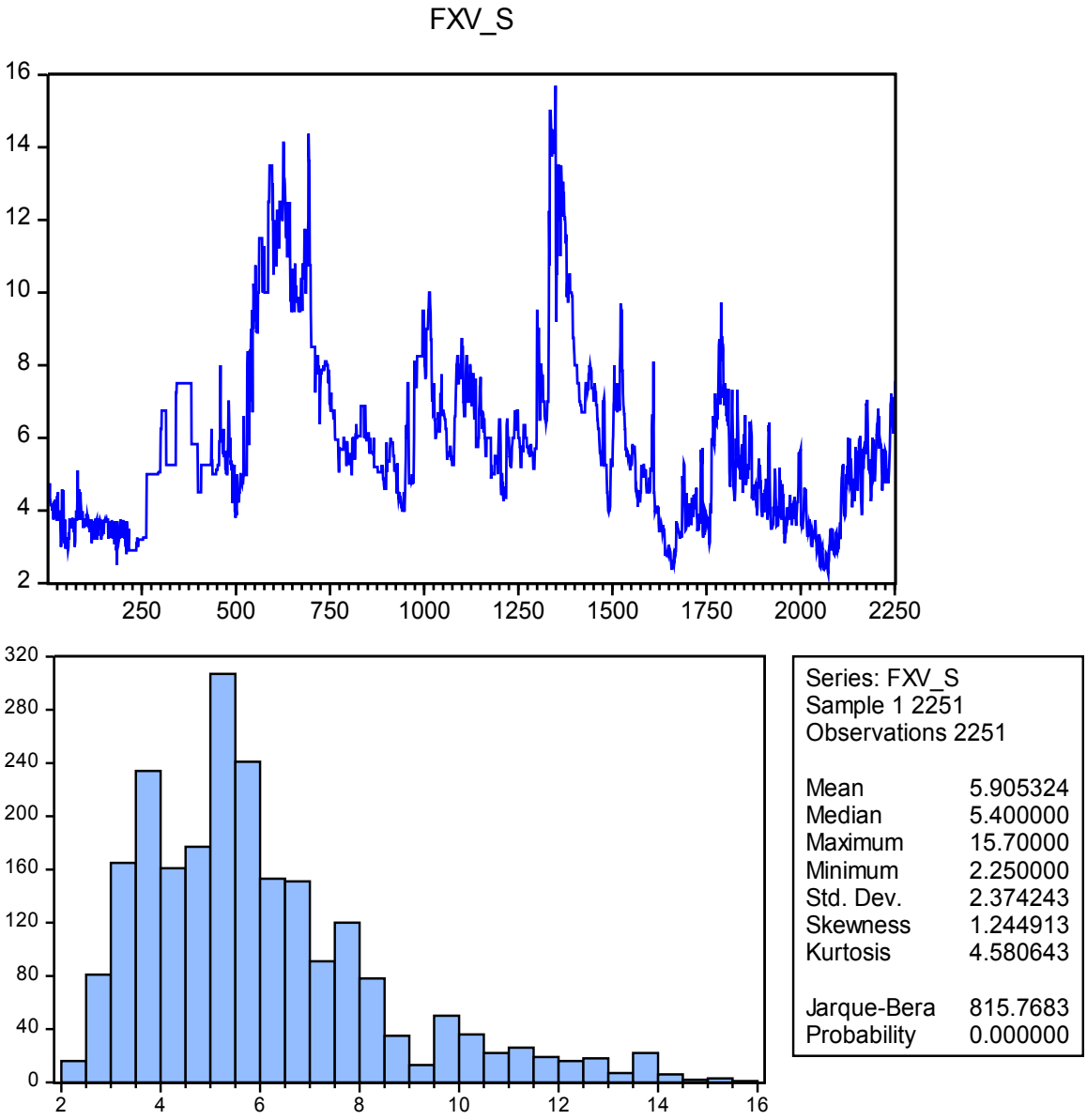
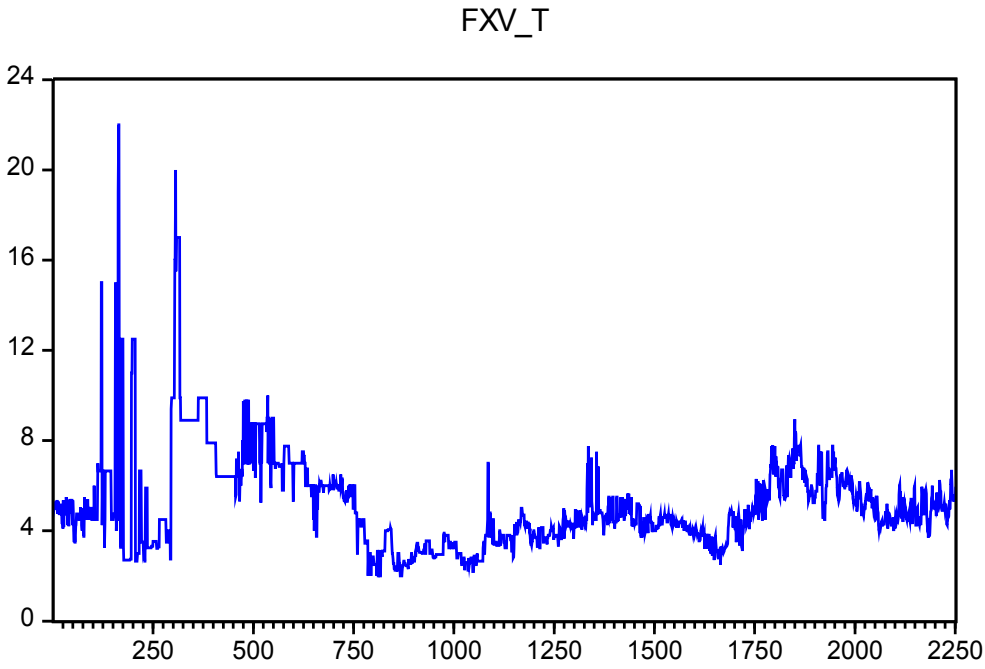
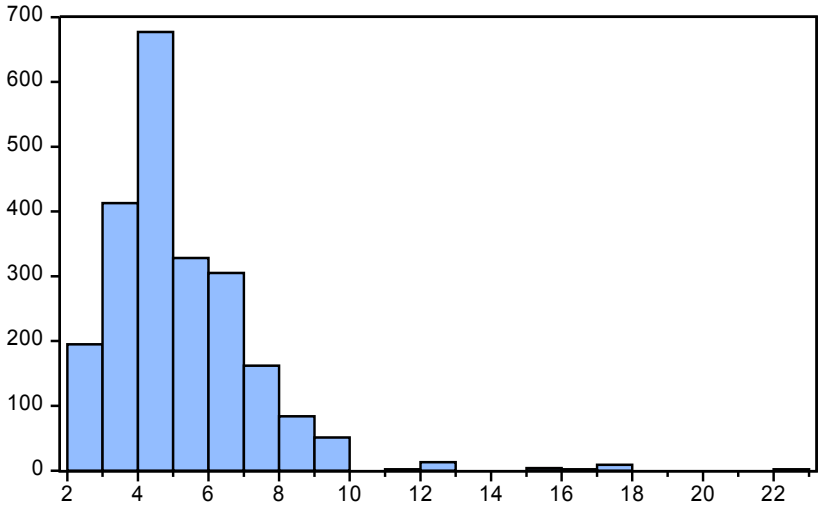


Figure A10 FXV Descriptive Statistic-Thailand





Series: FXV_T	
Sample 1 2251	
Observations 2251	
Mean	5.163534
Median	4.700000
Maximum	22.00000
Minimum	2.000000
Std. Dev.	2.117104
Skewness	2.281278
Kurtosis	13.09857
Jarque-Bera	11517.43
Probability	0.000000

Table A1 OLS estimation (ASEAN- 5 investing in G10)

Indo		c_aud_i		prob	c_cad_i		prob	c_chf_i		prob	c_eur_i		prob	c_gbp_i		prob	c_jpy_i		prob	c_nok_i		prob	c_nzd_i		prob	c_sek_i		prob	c_usd_i		prob
C	c1	0.00		0.45	0.00		0.87	0.00		0.29	0.00		0.87	0.00		0.97	0.00		0.69	0.00		0.75	0.00		0.26	0.00		0.83	0.00		0.30
E	c2	0.07	***	0.00	0.03	**	0.03	-0.05	***	0.00	-0.04	***	0.01	-0.01		0.61	-0.11	***	0.00	0.03	**	0.05	0.05	***	0.00	-0.01		0.42	-0.06	***	0.00
E t-1	c3	0.04	***	0.01	0.01		0.35	-0.02		0.21	0.01		0.26	0.02		0.16	-0.02		0.26	-0.01		0.42	0.03	**	0.05	-0.01		0.70	-0.01		0.62
B	c4	-0.19	***	0.00	-0.23	***	0.00	-0.13	***	0.01	-0.20	***	0.00	-0.25	***	0.00	-0.21	***	0.00	-0.22	***	0.00	-0.16	***	0.00	-0.16	***	0.00	-0.33	***	0.00
B t-1	c5	0.00		0.96	0.08	**	0.02	0.01		0.81	0.04		0.26	0.04		0.30	0.16	***	0.00	0.01		0.73	0.01		0.80	0.00		0.98	0.16	***	0.00
r t-1	c6	-0.13	***	0.00	-0.18	***	0.00	-0.22	***	0.00	-0.15	***	0.00	-0.19	***	0.00	-0.18	***	0.00	-0.11	***	0.00	-0.09	***	0.00	-0.12	***	0.00	-0.30	***	0.00
Malay		c_aud_m		prob	c_cad_m		prob	c_chf_m		prob	c_eur_m		prob	c_gbp_m		prob	c_jpy_m		prob	c_nok_m		prob	c_nzd_m		prob	c_sek_m		prob	c_usd_m		prob
C	c1	0.00		0.78	0.00		0.72	0.00		0.64	0.00		0.61	0.00		0.70	0.00		0.95	0.00		0.65	0.00		0.55	0.00		0.54	0.00		0.30
E	c2	0.14	***	0.00	0.01		0.55	-0.16	***	0.00	-0.02		0.11	-0.03	**	0.03	-0.42	***	0.00	0.00		0.90	0.14	***	0.00	0.00		0.95	-0.19	***	0.00
E t-1	c3	0.08	***	0.00	0.03	*	0.09	-0.02		0.29	-0.03	**	0.02	0.00		0.94	-0.04		0.10	0.04	*	0.07	0.04	*	0.08	0.01		0.68	-0.01		0.19
B	c4	-0.48	***	0.01	-0.33	**	0.02	0.14		0.42	-0.17		0.17	-0.15		0.24	0.27	*	0.09	-0.19		0.29	-0.43	**	0.02	-0.19		0.30	-0.44	***	0.00
B t-1	c5	0.01		0.97	-0.07		0.64	0.00		0.99	-0.04		0.74	-0.30	**	0.02	0.03		0.85	-0.07		0.71	0.19		0.31	0.05		0.77	-0.02		0.82
r t-1	c6	-0.18	***	0.00	-0.15	***	0.00	-0.07	***	0.00	0.05	**	0.02	0.07	***	0.00	-0.07	***	0.00	-0.14	***	0.00	-0.13	***	0.00	-0.16	***	0.00	-0.05	**	0.03
Philip		c_aud_p		prob	c_cad_p		prob	c_chf_p		prob	c_eur_p		prob	c_gbp_p		prob	c_jpy_p		prob	c_nok_p		prob	c_nzd_p		prob	c_sek_p		prob	c_usd_p		prob
C	c1	0.00		0.15	0.00	**	0.02	0.00		0.72	0.00	**	0.05	0.00	**	0.03	0.00		0.73	0.00		0.24	0.00		0.70	0.00		0.13	0.00		0.15
E	c2	0.17	***	0.00	0.16	***	0.00	0.00		0.78	0.08	***	0.00	0.07	***	0.00	-0.16	***	0.00	-0.02		0.21	0.00		0.88	-0.05	***	0.00	-0.01	**	0.03
E t-1	c3	0.06	***	0.00	-0.06	***	0.00	-0.11	***	0.00	-0.10	***	0.00	-0.09	***	0.00	-0.11	***	0.00	-0.01		0.64	0.00		0.89	-0.01		0.52	-0.10	***	0.00
B	c4	0.06		0.23	0.05		0.19	0.05		0.31	0.00		0.96	0.01		0.87	-0.09	**	0.04	-0.20	***	0.00	-0.19	***	0.00	-0.09	*	0.07	-0.06	***	0.00
B t-1	c5	-0.11	**	0.04	-0.12	***	0.00	-0.06		0.21	-0.07	*	0.07	-0.06		0.11	-0.07	*	0.09	0.05		0.37	0.23	***	0.00	0.08		0.12	-0.05	**	0.02
r t-1	c6	-0.18	***	0.00	-0.14	***	0.00	-0.07	***	0.00	-0.11	***	0.00	-0.06	***	0.01	-0.04	**	0.03	-0.13	***	0.00	-0.13	***	0.00	-0.14	***	0.00	0.07	***	0.00
Sing		c_aud_s		prob	c_cad_s		prob	c_chf_s		prob	c_eur_s		prob	c_gbp_s		prob	c_jpy_s		prob	c_nok_s		prob	c_nzd_s		prob	c_sek_s		prob	c_usd_s		prob
C	c1	0.00		0.69	0.00		0.58	0.00		0.75	0.00		0.30	0.00		0.29	0.00		0.35	0.00		0.41	0.00		0.35	0.00		0.44	0.00		0.61
E	c2	0.19	***	0.00	0.06	***	0.00	-0.06	***	0.00	-0.01		0.27	0.02	*	0.08	-0.20	***	0.00	0.13	***	0.00	0.15	***	0.00	0.16	***	0.00	-0.06	***	0.00
E t-1	c3	0.05	***	0.00	0.06	***	0.00	0.02	*	0.07	0.02	***	0.01	0.04	***	0.00	-0.02	*	0.09	0.02	*	0.07	0.03	**	0.02	-0.01		0.59	0.00		0.96
B	c4	-0.33	***	0.00	-0.39	***	0.00	0.03		0.74	-0.16	***	0.01	-0.21	***	0.00	0.45	***	0.00	-0.02		0.81	-0.28	***	0.00	-0.15	**	0.05	-0.01		0.81
B t-1	c5	-0.06		0.47	0.04		0.54	0.02		0.78	0.03		0.65	-0.02		0.68	0.05		0.52	-0.06		0.43	-0.06		0.49	-0.06		0.40	0.00		0.96
r t-1	c6	-0.14	***	0.00	-0.06	***	0.00	-0.09	***	0.00	-0.03		0.20	0.02		0.47	-0.17	***	0.00	-0.07	***	0.00	-0.09	***	0.00	-0.04	**	0.04	-0.07	***	0.00
Thai		c_aud_t		prob	c_cad_t		prob	c_chf_t		prob	c_eur_t		prob	c_gbp_t		prob	c_jpy_t		prob	c_nok_t		prob	c_nzd_t		prob	c_sek_t		prob	c_usd_t		prob
C	c1	0.00		0.57	0.00		0.28	0.00		0.87	0.00		0.15	0.00		0.30	0.00		0.27	0.00		0.24	0.00		0.98	0.00		0.20	0.00		0.42
E	c2	0.18	***	0.00	0.09	***	0.00	-0.03	***	0.01	0.04	***	0.00	0.03	***	0.00	-0.13	***	0.00	0.09	***	0.00	0.16	***	0.00	0.11	***	0.00	-0.05	***	0.00
E t-1	c3	0.07	***	0.00	0.05	***	0.00	-0.04	***	0.00	-0.02	*	0.06	0.00		0.95	-0.07	***	0.00	0.02	**	0.04	0.05	***	0.00	0.02		0.14	-0.02	***	0.00
B	c4	-0.21	**	0.02	-0.31	***	0.00	0.02		0.86	-0.09		0.19	-0.19	***	0.01	0.30	***	0.00	-0.12		0.18	-0.24	***	0.01	-0.16	*	0.09	-0.15	***	0.00
B t-1	c5	0.13		0.16	0.06		0.39	0.16	*	0.08	0.09		0.22	-0.11		0.12	-0.01		0.93	0.12		0.21	0.19	**	0.05	0.14		0.15	0.00		0.94
r t-1	c6	-0.01		0.60	0.00		0.95	0.01		0.50	0.04	**	0.03	0.08	***	0.00	-0.06	***	0.01	0.01		0.66	0.02		0.44	-0.04	**	0.05	-0.04	*	0.08

Table A2 OLS estimation (G10 investing in ASEAN- 5)

CHF		c_i_chf		prob	c_m_chf		prob	c_p_chf		prob	c_s_chf		prob	c_t_chf		prob
C	c1	0.00		0.43	0.00		0.70	0.00		0.43	0.00		0.64	0.00		0.95
E	c2	0.25	***	0.00	0.11	***	0.00	0.06	***	0.00	0.20	***	0.00	0.09	***	0.00
E t-1	c3	0.05	***	0.01	0.18	***	0.00	0.08	***	0.00	-0.01		0.48	0.13	***	0.00
B	c4	0.04		0.60	-0.11	*	0.06	-0.07		0.20	0.04		0.47	-0.05		0.32
B t-1	c5	0.05		0.54	0.03		0.62	-0.05		0.39	0.01		0.91	0.09		0.10
r t-1	c6	-0.24	***	0.00	-0.11	***	0.00	-0.08	***	0.00	-0.14	***	0.00	-0.01		0.62
JPY		c_i_jpy		prob	c_m_jpy		prob	c_p_jpy		prob	c_s_jpy		prob	c_t_jpy		prob
C	c1	0.00		0.98	0.00		0.43	0.00	**	0.03	0.00		0.65	0.00		0.15
E	c2	0.12	***	0.00	0.25	***	0.00	0.15	***	0.00	0.16	***	0.00	0.21	***	0.00
E t-1	c3	0.04	***	0.00	0.07	***	0.00	0.19	***	0.00	-0.01		0.39	0.05	***	0.00
B	c4	0.02		0.88	-0.44	***	0.00	-0.46	***	0.00	0.07		0.35	-0.33	***	0.00
B t-1	c5	-0.04		0.73	0.06		0.45	-0.01		0.92	-0.07		0.38	0.02		0.68
r t-1	c6	-0.19	***	0.00	-0.15	***	0.00	-0.13	***	0.00	-0.21	***	0.00	-0.11	***	0.00
SEK		c_i_sek		prob	c_m_sek		prob	c_p_sek		prob	c_s_sek		prob	c_t_sek		prob
C	c1	0.00		0.99	0.00		0.46	0.00	*	0.08	0.00		0.51	0.00		0.29
E	c2	-0.07	***	0.00	-0.06	***	0.00	-0.14	***	0.00	-0.04	***	0.00	-0.05	***	0.00
E t-1	c3	0.02		0.14	-0.06	***	0.00	0.04	***	0.00	-0.07	***	0.00	-0.12	***	0.00
B	c4	0.30	***	0.00	0.23	***	0.00	0.17	***	0.00	0.21	***	0.00	0.15	***	0.00
B t-1	c5	0.12	**	0.05	0.06		0.26	0.10	*	0.07	0.22	***	0.00	0.27	***	0.00
r t-1	c6	-0.13	***	0.00	-0.19	***	0.00	-0.16	***	0.00	-0.09	***	0.00	-0.07	***	0.00
USD		c_i_usd		prob	c_m_usd		prob	c_p_usd		prob	c_s_usd		prob	c_t_usd		prob
C	c1	0.00		0.44	0.00		0.87	0.00	***	0.01	0.00		0.88	0.00		0.18
E	c2	0.16	***	0.00	0.02	***	0.00	0.01		0.14	0.13	***	0.00	0.01	*	0.06
E t-1	c3	0.08	***	0.00	0.12	***	0.00	0.01	***	0.01	0.02	***	0.00	0.05	***	0.00
B	c4	0.10	***	0.00	-0.02		0.28	0.01		0.49	0.04	***	0.01	0.00		0.75
B t-1	c5	0.08	***	0.00	0.04	**	0.04	-0.03	*	0.09	0.02		0.25	0.05	***	0.00
r t-1	c6	-0.23	***	0.00	-0.02		0.26	0.12	***	0.00	-0.05	**	0.02	-0.01		0.62
NZD		c_i_nzd		prob	c_m_nzd		prob	c_p_nzd		prob	c_s_nzd		prob	c_t_nzd		prob
C	c1	0.00		0.25	0.00		0.38	0.00		0.53	0.00		0.35	0.00		0.55
E	c2	0.04		0.14	-0.07	***	0.00	-0.10	***	0.00	0.03		0.15	-0.20	***	0.00
E t-1	c3	-0.02		0.54	-0.04	*	0.09	-0.01		0.62	-0.02		0.36	0.00		0.91
B	c4	0.28	***	0.00	0.31	***	0.00	-0.33	***	0.00	0.38	***	0.00	0.42	***	0.00
B t-1	c5	-0.04		0.44	0.13	***	0.01	0.06		0.32	-0.04		0.44	0.15	***	0.00
r t-1	c6	-0.10	***	0.00	-0.14	***	0.00	-0.14	***	0.00	-0.04	*	0.06	0.04	*	0.08

Table A3 OLS estimation (investing among each other in ASEAN- 5)

Sing		c_i_s		prob	c_m_s		prob	c_p_s		prob
C	c1	0.00		0.94	0.00		0.93	0.00	**	0.02
E	c2	0.03		0.88	0.01		0.18	-0.04	***	0.00
E t-1	c3	0.15		0.47	0.02	***	0.00	0.03	***	0.00
B	c4	-0.72		0.61	-0.05		0.13	-0.11	**	0.04
B t-1	c5	1.13		0.42	0.06	**	0.04	0.09	*	0.08
r t-1	c6	-0.50	***	0.00	-0.01		0.79	-0.22	***	0.00
Thai		**c_i_t**		**prob**	**c_m_t**		**prob**	**c_p_t**		**prob**
C	c1	0.00		0.35	0.00		0.41	0.00		0.22
E	c2	0.00		0.99	0.02	***	0.00	-0.01		0.24
E t-1	c3	0.05		0.32	0.01	**	0.03	0.01		0.19
B	c4	-0.62		0.14	-0.13	**	0.01	-0.11		0.16
B t-1	c5	0.27		0.53	0.12	**	0.02	0.00		0.98
r t-1	c6	0.00		0.95	-0.10	***	0.00	-0.20	***	0.00
Malay		**c_i_m**		**prob**	**c_p_m**		**prob**			
C	c1	0.00		0.56	0.00	**	0.01			
E	c2	0.04	**	0.03	-0.01		0.12			
E t-1	c3	0.00		0.87	0.00		0.91			
B	c4	-0.12		0.38	-0.22	***	0.00			
B t-1	c5	0.03		0.84	0.13	*	0.08			
r t-1	c6	-0.15	***	0.00	0.00		0.86			

Table A4 Estimation using Dummy Variable of FX volatility (Indonesia investing in G10)

Indo	c_aud_i	c_cad_i	c_chf_i	c_eur_i	c_gbp_i	c_jpy_i	c_nok_i	c_nzd_i	c_sek_i	c_usd_i
Low regime										
C	0.000126	0.000188	0.000247	0.000248	0.0000911	0.000273	0.000224	0.000254	0.000203	0.000335 *
E	0.122079 ***	0.0375 **	-0.038909 *	-0.004237	-0.003375	-0.109547 ***	0.039788 **	0.092317 ***	0.001947	-0.047816 ***
E t-1	0.04524 ***	0.007101	-0.010291	0.021386	0.009255	-0.01271	-0.007645	0.030106 *	-0.003475	0.000735
B	-0.207673 ***	-0.171707 ***	-0.186415 ***	-0.290366 ***	-0.166708 ***	-0.291695 ***	-0.260441 ***	-0.168446 ***	-0.16305 ***	-0.327038 ***
B t-1	-0.068297	-0.006971	0.015124	0.047939	-0.075356	0.259026 ***	-0.064457	-0.064929	-0.119399 **	0.178676 ***
r t-1	-0.162943 ***	-0.122653 ***	-0.0732 **	-0.18056 ***	-0.135613 ***	-0.212551 ***	-0.080259 ***	-0.115041 ***	-0.096075 ***	-0.268388 ***
High regime										
C	0.000237	-0.000252	0.000166	-0.000258	-0.00018	-0.000137	-0.00026	0.0002	-0.000274	-0.000129
E	-0.014198	0.006015	-0.066462 **	-0.091189 ***	-0.006438	-0.132944 ***	0.015179	-0.017116	-0.030954	-0.077459 ***
E t-1	0.022623	0.016802	-0.034143	0.0114	0.036249	-0.024251	-0.012197	0.031421	-0.002112	-0.018917
B	-0.153038 **	-0.292698 ***	-0.031513	-0.06886	-0.339163 ***	-0.119589 *	-0.144726 **	-0.127004 *	-0.124436 *	-0.322873 ***
B t-1	0.072261	0.188451 ***	0.027066	0.029413	0.182972 ***	0.046745	0.123914 *	0.091677	0.154581 **	0.138924 ***
r t-1	-0.097598 ***	-0.242345 ***	-0.296378 ***	-0.107215 ***	-0.223364 ***	-0.134251 ***	-0.143725 ***	-0.073873 **	-0.14529 ***	-0.32917 ***

Table A5 Estimation using Dummy Variable of FX volatility (Malaysia investing in G10)

Malay	c_aud_m	c_cad_m	c_chf_m	c_eur_m	c_gbp_m	c_jpy_m	c_nok_m	c_nzd_m	c_sek_m	c_usd_m
Low regime										
C	0.000109	-0.000034	0.0000509	0.0000526	-0.000197	-0.000281	0.000121	0.0000775	-0.0000744	-0.0000558
E	0.044761	-0.035581	-0.181197 ***	-0.066977 ***	-0.074687 ***	-0.31142 ***	-0.039974	0.100067 ***	-0.053156 *	-0.133305 ***
E t-1	0.060807 **	-0.014238	-0.03938	0.001627	0.018265	-0.040119	0.047762	0.021489	0.014094	-0.011623
B	-0.366762	-0.31993	0.297695	-0.275836	-0.012221	0.021864	-0.183281	-0.177403	-0.18142	-0.351882 ***
B t-1	-0.048353	-0.293507	-0.144697	-0.026347	-0.133593	0.016185	-0.205258	0.094932	-0.224993	-0.061351
r t-1	-0.169212 ***	-0.150748 ***	-0.126877 ***	0.064352 *	-0.010816	-0.063989 *	-0.162365 ***	-0.139977 ***	-0.159817 ***	-0.016537
High regime										
C	-0.0000834	-0.0000713	0.0000852	-0.000197	0.0000576	0.000401 *	-0.000313	0.0000997	-0.00014	0.000293 **
E	0.262149 ***	0.069145 ***	-0.140763 ***	0.031516	0.017017	-0.558008 ***	0.058992 *	0.194665 ***	0.065561 *	-0.260349 ***
E t-1	0.092462 ***	0.078398 ***	-0.012959	-0.076066 ***	-0.030789	-0.032219	0.028771	0.061826 *	0.0000804	-0.020175
B	-0.585748 **	-0.364816 **	0.015553	-0.111331	-0.244404	0.483566 **	-0.223963	-0.632274 ***	-0.23673	-0.495828 ***
B t-1	0.053969	0.075283	0.127492	-0.036493	-0.371041 **	0.003939	0.039296	0.275883	0.256522	0.007224
r t-1	-0.194808 ***	-0.154875 ***	-0.031089	0.042906 *	0.096101 ***	-0.07308 ***	-0.13242 ***	-0.135778 ***	-0.166868 ***	-0.07179 ***

Table A6 Estimation using Dummy Variable of FX volatility (The Philippines investing in G10)

Philip	c_aud_p	c_cad_p	c_chf_p	c_eur_p	c_gbp_p	c_jpy_p	c_nok_p	c_nzd_p	c_sek_p	c_usd_p
Low regime										
C	-0.000295	-0.000468 **	-0.00014	-0.000422 **	-0.000212	-0.000469 **	-0.000388	0.000179	-0.000413	-0.000163 *
E	0.098713 ***	0.100257 ***	-0.043239 *	0.046695 **	0.052113 ***	-0.120602 ***	0.002589	-0.004615	-0.042936 *	-0.010275
E t-1	-0.01614	-0.046163 **	-0.075594 ***	-0.067366 ***	-0.073638 ***	-0.087323 ***	0.010869	-0.03139	0.006673	-0.074891 ***
B	0.059643	0.021514	0.090384	-0.030225	-0.023468	0.026276	-0.060425	-0.184299 **	-0.011606	-0.037147
B t-1	-0.191931 **	-0.157688 ***	-0.08288	-0.052732	-0.092874	-0.1595 **	0.002423	0.058726	0.035112	-0.055638 *
r t-1	-0.156591 ***	-0.142493 ***	-0.060109 *	-0.144032 ***	-0.127481 ***	-0.093109 ***	-0.14051 ***	-0.107683 ***	-0.146153 ***	0.114551 ***
High regime										
C	0.0000376	-0.0000475	0.0000367	-0.000111	-0.000373	0.000304	-0.0000861	-0.000271	-0.000152	-0.0000366
E	0.201167 ***	0.193963 ***	0.019736	0.096552 ***	0.073567 ***	-0.182604 ***	-0.023589	0.003487	-0.047871 ***	-0.00987
E t-1	0.095798 ***	-0.071023 ***	-0.125589 ***	-0.111112 ***	-0.093245 ***	-0.108915 ***	-0.011962	0.004305	-0.015958	-0.107642 ***
B	0.036257	0.056525	0.00928	0.018821	0.024279	-0.158318 ***	-0.305909 ***	-0.20178 ***	-0.1553 **	-0.077105 ***
B t-1	-0.06687	-0.085228 *	-0.037129	-0.084005	-0.040205	0.00935	0.093335	0.343667 ***	0.125292 *	-0.031095
r t-1	-0.191148 ***	-0.130953 ***	-0.079614 ***	-0.093066 ***	-0.023382	-0.018733	-0.121129 ***	-0.141071 ***	-0.133871 ***	0.046745 **

Table A7 Estimation using Dummy Variable of FX volatility (Singapore investing in G10)

Sing	c_aud_s	c_cad_s	c_chf_s	c_eur_s	c_gbp_s	c_jpy_s	c_nok_s	c_nzd_s	c_sek_s	c_usd_s
Low regime										
C	-0.00000588	-0.0000208	0.0000646	-0.000136	-0.0000941	-0.000277	-0.000108	0.000193	-0.0000974	0.0000459
E	0.11507 ***	0.043205 ***	-0.039286 *	0.006024	0.028935 *	-0.151988 ***	0.110062 ***	0.090049 ***	0.104694 ***	-0.042038 ***
E t-1	0.038706 *	0.02366	0.033175	0.033379 **	0.022003	0.006835	0.02663	0.015203	0.002442	0.002608
B	-0.07628	-0.293744 ***	0.077635	-0.115246	-0.112378	0.338503 ***	0.101933	-0.081364	-0.01969	-0.129355 **
B t-1	-0.029246	0.080028	0.147352	0.057637	-0.00439	0.031279	0.037533	0.003292	0.02468	0.012382
r t-1	-0.110934 ***	-0.058867 *	-0.105921 ***	-0.049766	-0.038665	-0.152071 ***	-0.050565	-0.058243 *	-0.023122	-0.02681
High regime										
C	0.000226	-0.0000818	0.0000036	-0.0000757	-0.000137	0.0000351	-0.0000959	0.000125	-0.0000778	-0.000193
E	0.216874 ***	0.061003 ***	-0.0749 ***	-0.01821 *	0.006885	-0.223546 ***	0.144316 ***	0.173498 ***	0.184769 ***	-0.075296 ***
E t-1	0.053734 ***	0.075726 ***	0.019031	0.018502 *	0.04698 ***	-0.034337 **	0.016361	0.037864 **	-0.012566	-0.000517
B	-0.579728 ***	-0.468192 ***	-0.014042	-0.198075 **	-0.285146 ***	0.543542 ***	-0.137385	-0.48242 ***	-0.274402 ***	0.114115 *
B t-1	-0.097122	-0.00445	-0.08948	-0.002308	-0.039449	0.0718	-0.155139	-0.127121	-0.153177	-0.000646
r t-1	-0.160574 ***	-0.072729 ***	-0.06769 **	-0.010019	0.048027 *	-0.179108 ***	-0.078128 ***	-0.108748 ***	-0.058833 **	-0.087327 ***

Table A8 Estimation using Dummy Variable of FX volatility (Thailand investing in G10)

Thai	c_aud_t	c_cad_t	c_chf_t	c_eur_t	c_gbp_t	c_jpy_t	c_nok_t	c_nzd_t	c_sek_t	c_usd_t
Low regime										
C	-0.0000618	-0.0000839	-0.0000999	-0.000187	-0.000224	-0.000171	-0.000187	0.0000103	-0.000192	-0.0000167
E	0.129407 ***	0.074463 ***	-0.030595 *	0.036187 ***	0.013075	-0.126819 ***	0.096748 ***	0.136973 ***	0.117458 ***	-0.063916 ***
E t-1	0.056712 ***	0.042366 ***	-0.033662 **	-0.015957	-0.008686	-0.060471 ***	0.023675	0.04385 **	0.033798 *	-0.022918 ***
B	-0.314004 *	-0.388654 ***	0.278451 *	-0.063007	-0.043389	0.380802 ***	-0.183382	-0.292615 *	-0.101805	-0.20071 ***
B t-1	-0.013366	-0.175506	-0.015501	-0.086998	-0.084828	-0.026972	-0.051161	-0.079134	-0.077799	0.003294
r t-1	-0.004788	0.014591	0.015987	0.062625 **	0.040322	-0.046398	0.007299	0.03013	-0.044881	0.069116 **
High regime										
C	0.000000268	-0.000116	0.0000686	-0.0000976	0.0000168	-0.000138	-0.000129	0.0000836	-0.000227	-0.000035
E	0.220442 ***	0.093108 ***	-0.0259 *	0.048501 ***	0.04337 ***	-0.140413 ***	0.092063 ***	0.180619 ***	0.096937 ***	-0.047478 ***
E t-1	0.071357 ***	0.047154 ***	-0.04074 ***	-0.01683	0.005498	-0.07171 ***	0.025058	0.058605 ***	0.005698	-0.019076 ***
B	-0.164049	-0.287306 ***	-0.101983	-0.11158	-0.248378 ***	0.263338 ***	-0.105154	-0.226384 **	-0.193133 *	-0.134296 ***
B t-1	0.169585	0.154842 *	0.249813 **	0.157588 *	-0.111227	0.007224	0.182696 *	0.291824 ***	0.230169 **	-0.005971
r t-1	-0.019779	-0.01284	0.012804	0.025511	0.11954 ***	-0.0656 **	0.009653	-0.000378	-0.040955	-0.151369 ***

Table A9 Estimation using Dummy Variable of FX volatility (G10 investing in ASEAN- 5)

JPY	c_i_jpy	c_m_jpy	c_p_jpy	c_s_jpy	c_t_jpy
Low regime					
C	0.0000375	0.000199	0.000469 **	0.000052	0.00025
E	0.089231 ***	0.244506 ***	0.096431 ***	0.151964 ***	0.175969 ***
E t-1	-0.004556	0.066838 ***	0.190949 ***	0.006992	0.054838 ***
B	-0.048636	-0.303266 ***	-0.436416 ***	0.115429	-0.317256 ***
B t-1	-0.101106	0.055246	0.207957 *	-0.169705	0.033563
r t-1	-0.115728 **	-0.09393 **	-0.090297 ***	-0.174785 ***	-0.048907
High regime					
C	0.0000597	-0.0000713	0.0000321	0.0000482	0.0000286
E	0.135994 ***	0.256893 ***	0.164943 ***	0.160869 ***	0.221351 ***
E t-1	0.058447 ***	0.073791 ***	0.184999 ***	-0.012723	0.052275 ***
B	0.054267	-0.545177 ***	-0.513786 ***	0.045001	-0.367145 ***
B t-1	-0.018874	0.04587	-0.177217 *	0.013301	0.017165
r t-1	-0.213363 ***	-0.170569 ***	-0.155222 ***	-0.227649 ***	-0.13274 ***

CHF	c_i_chf	c_m_chf	c_p_chf	c_s_chf	c_t_chf
Low regime					
C	-0.000298	0.0000305	0.00025	-0.000237	0.0000503
E	0.327241 ***	0.097676 ***	0.037604	0.297795 ***	0.059067 **
E t-1	0.013056	0.152642 ***	0.150401 ***	-0.006488	0.08155 ***
B	0.000419	-0.067126	-0.055961	0.067953	-0.013333
B t-1	0.072192	0.07516	0.03855	-0.051202	0.032153
r t-1	-0.020674	-0.176607 ***	-0.095442 **	-0.087356 *	0.038412
High regime					
C	0.0000407	-0.000116	-0.000101	0.0000949	-0.0000364
E	0.216875 ***	0.115673 ***	0.07077 ***	0.158046 ***	0.099567 ***
E t-1	0.06486 ***	0.189546 ***	0.057442 ***	-0.009992	0.143042 ***
B	0.049002	-0.133213 **	-0.076183	0.003125	-0.070951
B t-1	0.021663	0.009006	-0.109793	0.024568	0.124463 *
r t-1	-0.282927 ***	-0.07874 ***	-0.079008 ***	-0.146896 ***	-0.024173

SEK	c_i_sek	c_m_sek	c_p_sek	c_s_sek	c_t_sek
Low regime					
C	-0.0000829	0.0000238	0.000263	-0.0000238	0.00000523
E	-0.005107	-0.000717	0.004358	0.002419	0.003607
E t-1	-0.025427	0.007497	0.035923 *	-0.026541	-0.027522
B	0.270551 ***	0.232162 ***	0.220725 ***	0.170784 ***	0.097224
B t-1	0.07188	0.183206 **	0.1033	0.142957 **	0.256912 ***
r t-1	-0.025552	-0.132932 ***	-0.128224 ***	0.010423	-0.050538
High regime					
C	0.00016	0.00029	0.000356	0.000229	0.000348
E	-0.098929 ***	-0.09249 ***	-0.218782 ***	-0.061146 ***	-0.066317 ***
E t-1	0.040009 **	-0.108037 ***	0.03801 **	-0.097175 ***	-0.171569 ***
B	0.312899 ***	0.232663 ***	0.131865 *	0.229931 ***	0.189439 ***
B t-1	0.136737	-0.081621	0.076115	0.277233 ***	0.272494 ***
r t-1	-0.169691 ***	-0.232476 ***	-0.180105 ***	-0.141628 ***	-0.099919 ***

NZD	c_i_nzd	c_m_nzd	c_p_nzd	c_s_nzd	c_t_nzd
Low regime					
C	-0.000222	-0.00013	0.0000829	-0.000106	-0.0000988
E	0.08874 **	0.137331 ***	-0.116908 ***	0.056524	0.008391
E t-1	0.019781	0.02901	-0.030908	0.006086	0.02217
B	0.172949 **	0.312988 ***	-0.267391 ***	0.308521 ***	0.273816 ***
B t-1	-0.057994	-0.034422	0.100256	-0.072348	0.086321
r t-1	-0.002015	-0.105284 ***	-0.082292 **	-0.013668	0.063041 *
High regime					
C	-0.000279	-0.000463	0.000219	-0.000263	-0.000288
E	0.008412	-0.199439 ***	-0.079686 **	0.017762	-0.323283 ***
E t-1	-0.050232	-0.083402 **	-0.002819	-0.038438	-0.023266
B	0.401414 ***	0.293909 ***	-0.413361 ***	0.459944 ***	0.541262 ***
B t-1	-0.057296	0.26503 ***	0.033254	-0.010214	0.218652 ***
r t-1	-0.161841 ***	-0.178317 ***	-0.179042 ***	-0.063088 **	-0.004857

Table A10 Estimation using Dummy Variable of FX volatility (investing among each other in ASEAN- 5)

Sing	c_i_s	c_m_s	c_p_s
Low regime			
C	-0.000166	0.000000138	0.000287 **
E	0.031507	0.043113 ***	-0.041681 ***
E t-1	0.206335	0.022046 ***	0.068861 ***
B	-1.685337	-0.035809	-0.231746 ***
B t-1	2.227071	0.075373 *	0.123328 *
r t-1	-0.500607 ***	0.011222	-0.131727 ***
High regime			
C	-0.00021	-0.00004	0.0000251
E	0.062305	-0.013218 **	-0.035762 ***
E t-1	0.095472	0.024638 ***	0.008808
B	0.263266	-0.052377	0.022856
B t-1	0.016286	0.04826	0.066363
r t-1	-0.224048	-0.025352	-0.280795 ***

Thai	c_i_t	c_m_t	c_p_t
Low regime			
C	0.000158	-0.0000217	0.000251
E	-0.016357	0.029184 ***	-0.013806
E t-1	-0.001033	0.021692 **	-0.009678
B	-0.160434	-0.196321 **	-0.274352 *
B t-1	-0.091301	0.061918	0.129594
r t-1	-0.216191	-0.143649 ***	-0.190527 ***
High regime			
C	0.001531	-0.000134	0.0000572
E	0.005157	0.021886 **	-0.011912
E t-1	0.098842	0.006538	0.030583 **
B	-0.813395	-0.100638	-0.029221
B t-1	0.405769	0.145404 **	-0.064012
r t-1	0.000977	-0.025765	-0.21267 ***

Malay	c_i_m	c_p_m
Low regime		
C	0.0000508	0.000218 **
E	-0.01523	0.008773
E t-1	0.012599	0.012036
B	-0.187638	-0.027705
B t-1	0.121268	0.058048
r t-1	-0.056112	-0.001801
High regime		
C	-0.000253	0.000146
E	0.105224 ***	-0.042267 ***
E t-1	-0.007405	-0.011665
B	-0.10106	-0.357221 ***
B t-1	-0.017422	0.204285 **
r t-1	-0.169694 ***	0.003143

Table A11 Carry trade Returns comparing to Individual Returns (ASEAN- 5 to G10)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
DVB TR	3.57	8.59	-33.32	19.24	0.84	0.09	9.58	-2.84	0.47	-2.90
c_aud_s	1.70	6.68	-18.76	24.72	6.78	4.30	-1.86	-10.17	-3.81	-1.56
c_cad_s	-6.29	11.53	-19.72	13.47	-3.53	-0.64	-2.95	-2.70	-3.17	-5.31
c_chf_s	-1.37	0.65	6.07	1.35	1.12	0.62	-3.37	5.74	-4.99	4.46
c_eur_s	0.90	4.60	-2.78	1.02	-15.61	-1.82	-3.89	7.42	-7.06	-9.44
c_gbp_s	1.32	-2.84	-28.36	8.52	-12.30	0.76	-1.05	5.47	-2.16	-0.34
c_jpy_s	-5.66	-1.45	20.09	-4.41	4.64	6.43	-18.01	-16.05	-8.25	3.33
c_nok_s	-1.99	10.40	-21.70	18.35	-7.91	1.22	3.11	-3.97	-13.65	-4.32
c_nzd_s	9.66	5.90	-23.53	22.31	0.51	2.76	2.13	4.25	-0.44	2.09
c_sek_s	1.83	1.43	-15.78	4.94	-2.06	0.19	1.00	4.50	-13.78	-5.99
c_usd_s	-2.30	-4.63	0.15	-1.73	-8.93	1.14	-5.83	3.38	3.72	4.59
c_aud_t	-0.26	5.17	-18.28	21.81	5.48	5.97	-0.80	-8.49	-8.05	-7.33
c_cad_t	-6.61	10.41	-18.10	10.22	-6.40	1.61	-2.25	-0.96	-9.26	-10.08
c_chf_t	-3.24	-0.84	10.24	-3.57	-1.71	3.31	-2.46	7.08	-11.19	0.49
c_eur_t	-1.06	3.91	-0.07	-2.78	-19.00	1.26	-3.09	8.67	-13.08	-13.24
c_gbp_t	0.09	-3.63	-27.49	4.71	-13.82	2.67	-0.76	7.33	-6.40	-6.29
c_jpy_t	-7.67	-4.37	24.18	-6.76	0.93	7.80	-16.18	-14.24	-14.78	-1.42
c_nok_t	-4.31	8.58	-19.93	16.14	-10.76	3.55	3.76	-2.59	-18.85	-8.55
c_nzd_t	7.95	5.12	-21.70	16.43	-0.94	5.50	2.36	6.34	-3.40	-4.70
c_sek_t	-0.18	0.17	-14.38	2.88	-4.66	2.79	1.63	5.30	-18.96	-10.84
c_usd_t	-3.84	-5.81	2.39	-5.30	-10.90	3.09	-5.31	5.15	-0.91	-1.56
c_aud_p	-2.69	-8.35	-12.97	21.93	6.62	-2.03	-5.45	-9.94	-10.85	-6.22
c_cad_p	-9.02	-3.57	-10.99	8.67	-5.29	-6.12	-7.11	-2.47	-11.70	-9.37
c_chf_p	-4.86	-14.99	14.32	-1.96	-0.80	-4.05	-7.51	5.36	-13.36	1.27
c_eur_p	-2.88	-10.10	6.30	-3.55	-17.94	-6.09	-8.28	6.98	-15.33	-12.46
c_gbp_p	-1.91	-17.83	-18.56	1.45	-12.67	-4.42	-6.26	5.77	-8.72	-5.57
c_jpy_p	-9.21	-18.64	30.97	-7.69	1.77	0.27	-20.57	-16.09	-17.52	-0.44
c_nok_p	-4.58	-6.00	-11.47	13.60	-8.94	-4.68	-1.62	-3.06	-22.29	-8.43
c_nzd_p	6.22	-9.62	-12.99	17.06	-1.41	-2.42	-2.66	4.81	-6.08	-4.97
c_sek_p	-0.71	-15.39	-7.18	2.71	-3.99	-5.29	-3.83	5.43	-21.96	-11.51
c_usd_p	-5.58	-19.95	9.62	-6.86	-9.63	-4.38	-10.52	3.64	-3.59	-0.64
c_aud_m	-0.65	6.11	-17.58	25.45	3.68	3.85	-1.44	-8.66	-2.68	-1.52
c_cad_m	-7.35	11.06	-17.54	12.38	-6.58	-0.77	-2.42	-1.19	-4.04	-3.46
c_chf_m	-3.30	0.86	9.37	-0.32	-2.80	1.11	-2.95	7.68	-6.68	7.45
c_eur_m	-1.15	5.07	0.22	-0.19	-20.20	-0.74	-3.73	9.24	-8.45	-6.29
c_gbp_m	-0.32	-3.29	-27.07	8.42	-15.42	0.66	-0.88	7.16	-1.33	0.50
c_jpy_m	-7.44	-2.65	23.91	-4.75	0.41	5.87	-16.21	-14.96	-8.89	4.92
c_nok_m	-4.14	9.99	-19.48	18.44	-10.61	0.28	3.40	-2.13	-14.83	-1.96
c_nzd_m	7.18	5.84	-21.53	22.03	-3.04	2.48	2.40	5.77	1.37	1.51
c_sek_m	0.40	0.86	-14.16	5.89	-5.44	-0.58	1.29	6.55	-14.56	-4.97
c_usd_m	-3.78	-5.54	3.46	-2.50	-12.08	1.02	-5.77	4.99	4.14	5.60
c_aud_i	2.75	14.46	-10.35	7.87	6.43	1.21	6.87	6.51	-8.62	-3.14
c_cad_i	-4.57	19.90	-10.64	-5.39	-2.88	-4.35	6.04	13.52	-9.92	-4.96
c_chf_i	-0.98	8.53	17.70	-18.15	1.03	-2.77	5.81	22.38	-13.02	5.44
c_eur_i	1.16	13.36	8.01	-18.09	-16.65	-4.56	5.41	23.80	-14.78	-8.43
c_gbp_i	2.12	5.82	-20.25	-9.29	-12.13	-2.26	6.99	22.27	-7.63	-0.88
c_jpy_i	-4.98	5.23	31.99	-22.70	3.82	2.97	-8.45	0.24	-15.04	3.51
c_nok_i	-1.24	17.92	-11.21	0.51	-8.27	-2.25	11.88	12.73	-20.35	-3.82
c_nzd_i	10.66	14.36	-14.26	4.41	-0.60	0.01	9.98	21.75	-4.56	-0.52
c_sek_i	2.96	8.53	-5.87	-11.85	-2.76	-3.20	9.77	21.63	-20.55	-6.78
c_usd_i	-1.56	3.60	10.20	-20.32	-8.86	-2.37	3.07	19.74	-2.14	3.73

Table A12 Carry trade Returns comparing to Individual Returns (G10 to ASEAN- 5)

ปี	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
DVB TR	3.57	8.59	-33.32	19.24	0.84	0.09	9.58	-2.84	0.47	-2.90
c_i_aud	-2.75	-14.46	10.35	-7.87	-6.43	-1.21	-6.87	-6.51	8.62	3.14
c_i_cad	4.57	-19.90	10.64	5.39	2.88	4.35	-6.04	-13.52	9.92	4.96
c_i_chf	0.98	-8.53	-17.70	18.15	-1.03	2.77	-5.81	-22.38	13.02	-5.44
c_i_eur	-1.16	-13.36	-8.01	18.09	16.65	4.56	-5.41	-23.80	14.78	8.43
c_i_gbp	-2.12	-5.82	20.25	9.29	12.13	2.26	-6.99	-22.27	7.63	0.88
c_i_jpy	4.98	-5.23	-31.99	22.70	-3.82	-2.97	8.45	-0.24	15.04	-3.51
c_i_nok	1.24	-17.92	11.21	-0.51	8.27	2.25	-11.88	-12.73	20.35	3.82
c_i_nzd	-10.66	-14.36	14.26	-4.41	0.60	-0.01	-9.98	-21.75	4.56	0.52
c_i_sek	-2.96	-8.53	5.87	11.85	2.76	3.20	-9.77	-21.63	20.55	6.78
c_i_usd	1.56	-3.60	-10.20	20.32	8.86	2.37	-3.07	-19.74	2.14	-3.73
c_m_aud	0.65	-6.11	17.58	-25.45	-3.68	-3.85	1.44	8.66	2.68	1.52
c_m_cad	7.35	-11.06	17.54	-12.38	6.58	0.77	2.42	1.19	4.04	3.46
c_m_chf	3.30	-0.86	-9.37	0.32	2.80	-1.11	2.95	-7.68	6.68	-7.45
c_m_eur	1.15	-5.07	-0.22	0.19	20.20	0.74	3.73	-9.24	8.45	6.29
c_m_gbp	0.32	3.29	27.07	-8.42	15.42	-0.66	0.88	-7.16	1.33	-0.50
c_m_jpy	7.44	2.65	-23.91	4.75	-0.41	-5.87	16.21	14.96	8.89	-4.92
c_m_nok	4.14	-9.99	19.48	-18.44	10.61	-0.28	-3.40	2.13	14.83	1.96
c_m_nzd	-7.18	-5.84	21.53	-22.03	3.04	-2.48	-2.40	-5.77	-1.37	-1.51
c_m_sek	-0.40	-0.86	14.16	-5.89	5.44	0.58	-1.29	-6.55	14.56	4.97
c_m_usd	3.78	5.54	-3.46	2.50	12.08	-1.02	5.77	-4.99	-4.14	-5.60
c_p_aud	2.69	8.35	12.97	-21.93	-6.62	2.03	5.45	9.94	10.85	6.22
c_p_cad	9.02	3.57	10.99	-8.67	5.29	6.12	7.11	2.47	11.70	9.37
c_p_chf	4.86	14.99	-14.32	1.96	0.80	4.05	7.51	-5.36	13.36	-1.27
c_p_eur	2.88	10.10	-6.30	3.55	17.94	6.09	8.28	-6.98	15.33	12.46
c_p_gbp	1.91	17.83	18.56	-1.45	12.67	4.42	6.26	-5.77	8.72	5.57
c_p_jpy	9.21	18.64	-30.97	7.69	-1.77	-0.27	20.57	16.09	17.52	0.44
c_p_nok	-4.58	-6.00	-11.47	13.60	-8.94	-4.68	-1.62	-3.06	-22.29	-8.43
c_p_nzd	7.52	-8.07	-13.39	22.20	3.30	2.83	2.13	9.06	-2.45	-4.12
c_p_sek	0.71	15.39	7.18	-2.71	3.99	5.29	3.83	-5.43	21.96	11.51
c_p_usd	5.58	19.95	-9.62	6.86	9.63	4.38	10.52	-3.64	3.59	0.64
c_s_aud	-1.70	-6.68	18.76	-24.72	-6.78	-4.30	1.86	10.17	3.81	1.56
c_s_cad	6.29	-11.53	19.72	-13.47	3.53	0.64	2.95	2.70	3.17	5.31
c_s_chf	1.37	-0.65	-6.07	-1.35	-1.12	-0.62	3.37	-5.74	4.99	-4.46
c_s_eur	-0.90	-4.60	2.78	-1.02	15.61	1.82	3.89	-7.42	7.06	9.44
c_s_gbp	-1.32	2.84	28.36	-8.52	12.30	-0.76	1.05	-5.47	2.16	0.34
c_s_jpy	4.01	-1.06	-20.32	4.33	-4.64	-6.37	18.06	16.09	8.21	-3.39
c_s_nok	1.99	-10.40	21.70	-18.35	7.91	-1.22	-3.11	3.97	13.65	4.32
c_s_nzd	-9.66	-5.90	23.53	-22.31	-0.51	-2.76	-2.13	-4.25	0.44	-2.09
c_s_sek	-1.83	-1.43	15.78	-4.94	2.06	-0.19	-1.00	-4.50	13.78	5.99
c_s_usd	2.30	4.63	-0.15	1.73	8.93	-1.14	5.83	-3.38	-3.72	-4.59
c_t_aud	0.26	-5.17	18.28	-21.81	-5.48	-5.97	0.80	8.49	8.05	7.33
c_t_cad	6.61	-10.41	18.10	-10.22	6.40	-1.61	2.25	0.96	9.26	10.08
c_t_chf	3.24	0.84	-10.24	3.57	1.71	-3.31	2.46	-7.08	11.19	-0.49
c_t_eur	1.06	-3.91	0.07	2.78	19.00	-1.26	3.09	-8.67	13.08	13.24
c_t_gbp	-0.09	3.63	27.49	-4.71	13.82	-2.67	0.76	-7.33	6.40	6.29
c_t_jpy	7.67	4.37	-24.18	6.76	-0.93	-7.80	16.18	14.24	14.78	1.42
c_t_nok	4.31	-8.58	19.93	-16.14	10.76	-3.55	-3.76	2.59	18.85	8.55
c_t_nzd	-7.95	-5.12	21.70	-16.43	0.94	-5.50	-2.36	-6.34	3.40	4.70
c_t_sek	0.18	-0.17	14.38	-2.88	4.66	-2.79	-1.63	-5.30	18.96	10.84
c_t_usd	3.84	5.81	-2.39	5.30	10.90	-3.09	5.31	-5.15	0.91	1.56

Table A13 Carry trade Returns comparing to Individual Returns (among ASEAN- 5)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
DVB TR	3.57	8.59	-33.32	19.24	0.84	0.09	9.58	-2.84	0.47	-2.90
c_m_t	0.03	-0.23	-1.11	-2.63	1.30	2.22	0.25	0.46	-5.54	-6.71
c_i_t	1.59	5.76	-13.78	163.76	-2.25	5.63	-7.69	-15.86	2.20	-3.47
c_p_t	1.50	2.39	4.21	2.63	-1.26	6.91	5.79	1.52	2.40	-1.51
c_m_s	1.39	1.30	-2.78	0.03	3.95	-0.31	-0.33	-1.47	0.24	-1.44
c_i_s	-0.51	-8.45	-11.38	19.52	0.25	4.10	-10.57	-14.93	3.23	3.35
c_p_s	3.20	16.22	-8.69	3.68	1.44	4.85	4.66	0.18	7.86	3.97
c_i_m	-1.85	-9.25	-7.14	17.85	-2.99	2.92	-8.27	-15.08	6.38	1.92
c_p_m	2.02	14.57	-6.77	5.04	-2.68	5.40	4.82	1.11	7.36	5.31

BIOGRAPHY

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