PENENTU KADAR PERTUKARAN MATA WANG ASING SEMASA KRISIS

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Projek ini merupakan salah satu keperluan untuk

Ijazah Sarjana Muda Ekonomi dengan Kepujian

(Ekonomi Antarabangsa)

Fakulti Ekonomi dan Perniagaan

UNIVERSITI MALAYSIA SARAWAK

2013

DETERMINANTS OF EXCHANGE RATE DURING CRISIS

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This project is submitted in partial fulfillment of

the requirements for the degree of Bachelor of Economics with Honours

(International Economics)

Faculty of Economics and Business

UNIVERSITI MALAYSIA SARAWAK

2013

Pengesahan Pelajar

Saya mengakui bahawa Projek Tahun Akhir bertajuk

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Statement of Originality

The work described in this Final Year Project, entitled

"Determinants of Exchange Rate during Crisis"

is to the best of the author's knowledge that of the author except

where due reference is made.

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ABSTRACT

DETERMINANTS OF EXCHANGE RATE DURING CRISIS

By

TIU CHEE YANG

This dissertation examined the determinants of exchange rate during banking crisis and currency crisis periods where spans from 1990-2012. In this context, three macroeconomic variables were selected due to their controversial causality with the exchange rate and also based on their importance to the currency value: interest rate, stock prices and terms of trade. Furthermore, econometric techniques such as unit root test, Johansen cointegration test and Granger causality test were conducted to analyse the causality of selected variables with exchange rate. The empirical results show that the impact of stock prices on exchange rate during crisis shared the same weight with interest rate; their relationship is only evident in one economy. Meanwhile, TOT has no significant effect on the exchange rate in turbulent period. It is observed that traditional approach of stock prices and of TOT is more significant compared to the revisionist approach.

ABSTRAK

PENENTU KADAR PERTUKARAN MATA WANG ASING SEMASA KRISIS

Oleh

TIU CHEE YANG

Thesis ini mengkaji penentu kadar pertukaran mata wang asing semasa krisis perbankan dan krisis mata wang dalam tempoh 1990-2012. Tiga pembolehubah makroekonomi yang telah dipilih kerana hubungan kontroversi mereka dengan kadar pertukaran dan juga berdasarkan impak mereka kepada nilai mata wang: kadar faedah, harga pasaran saham dan kadar syarat perdagangan. Teknik- Teknik ekonometrik sebagai ujian struktur stokastik individu, ujian kopengamiran berbilang pemboleh ubah yang dicadangkan oleh Johansen dan ujian Penyebab-Granger telah dijalankan untuk menganalisasi hubungan mereka. Hasil kajian menunjukkan bahawa kesan kenaikan harga pasaran saham pada kadar pertukaran mata wang asing semasa krisis berkongsi berat badan yang sama dengan kadar faedah; hubungan mereka hanya terbukti dalam satu ekonomi sahaja. Selain itu, kadar syarat perdagangan tidak mempunyai apa-apa kesan yang ketara ke atas kadar pertukaran mata wang asing dalam tempoh krisis. Teori tradisional harga saham dan kadar syarat perdagangan adalah lebih berarti berbanding dengan teori revisionis.

ACKNOWLEDGEMENT

I am very appreciated to my supervisor, Dr. Evan Lau for his constructive guidance, assistance, crucial advice, suggestions, critical comments and time spent throughout the completion of this final year project. I am really grateful to have him as my supervisor.

I also thankful to my faculty, Faculty of Economics and Business (FEB) as they had provided me a lot of facilities and resources to assist me throughout my study. Thanks to all my friends who had lend a hand in completing this study.

Last but not least, I would to give deepest gratitude to my family particularly, Sharon who always encourage me to moving forward and her support. Really thanks a lot to her patient and willingness to spend her time on me.

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ABBREVIATION

AFC	Asian financial crisis
CPI	Consumer price index
GARCH	Generalized autoregressive conditional heteroscedasticity
GDP	Gross domestic product
GFC	Global financial crisis
GMM	Generalized method of moments
IFS	International financial statistics
IMF	International Monetary Fund
IRF	Impulse response function
PPP	Purchasing power parity
RMSE	Root mean squared error
TOT	Terms of trade
VAR	Vector autoregressive
VECM	Vector error correction mechanism

CHAPTER ONE

INTRODUCTION

1.0 Preface

This dissertation investigates the effects of selected macroeconomic variables on exchange rate during crisis by covering ten economies. These economies are the Canada, Japan, South Korea, Malaysia, Philippine, Russia, Sweden, Thailand, Turkey and United Kingdom (UK). In this chapter, background of study, problem statement, objectives of study, significance of study, organization of study and scope of study are presented.

1.1 Background of Study

Since the collapse of Bretton Woods monetary system that prevailed from 1945 to early 1970s, the exchange rate regime of the world had changed. Many countries are switching from fixed exchange rate system to free floating exchange regime, or at least managed floating exchange regime. Meanwhile, the innovations of technology, particularly on information technology (IT) had changed the ways on how the economy of the world carry on. This IT had accelerated the information sharing among the world and fasten the communication pace from one side of the world to another side. Following this development on the communication speed, it impacts importantly on trade pattern in the world and inevitable on the trade policies. During this period, many countries were adjusting their macroeconomic policies to their own interests by liberalized the movement of capital, labour and resources. As the result, countries in the world are moving closer, more integrated and more interdependent as

ever before. Nonetheless, there has disadvantages of the integration on stability of exchange rate and economic growth of the world; exchange rates are more volatile compared to the past and ensued more severe spillover effects to other economies if one economy had been shocked. The consequences of the crisis can been clearly observed from the three notorious crisis episodes happened in the past 30 years, known as Latin American debt crisis, AFC and GFC.

On the early 1980s, Latin American debt crisis or Latin's balance of payment crisis happened when the Latin American countries were unable repay their foreign debt to the foreign creditors. Those countries, notably Brazil, Argentina, and Mexico were accumulated huge sums of international loans since the 1960s and 1970s to support their import substitution industrialization strategy. They experienced a noticeable hiking rate on their external debt despite had ever enjoyed a high economic growth rate on the 1970. According to the statistics (Auerbach, 2012), from 1975-1983, the aggregate external debt of Latin America were rising from $75 billion to more than $ 315 billion (240 billion increased). However, their debt repayment grew only from $12 billion to $66 billion (54 billion increased) during 1975-1982. Their financial systems were very fragile and vulnerable when there has a volatility. Thus, the Latin American debt crisis was ensued as the United States (US) and Europe raising their interest rates to confront the impact of recession of the world economy in 1979. The raised on interest rates had increased the amount of interest on their external debt and finally some Latin countries were incapable to service the repayment on debt. On August 1982, after Mexico had declared that she was incapable to service its debt, panic was rose among the foreign investors and leads heavy capital outflows from the

country. Eventually, fear was spread among the Latin America countries (contagion effect) and exhausting foreign exchange reserves when the capitals were efflux from the region (Krugman, 1979). Consequently, the exchange rates of the Latin America countries were depreciated heavily and leave intense negative effects on their economies. After implementing a series of monetary policies, the exchange rates and economy of some countries were finally been stabilized and recovered.

At the second half of the twentieth century, a most notable geofinancial crisis i.e. AFC was occurred in the East Asian emerging countries (Thailand, Malaysia and Indonesia) and spread its impacts to the world. The crisis was occurred during the period of 1997-1998 and leaves long-lasting international economic and political effects to the world (Makin, 2009). In this crisis, Thailand was the first countries been speculated successfully on her currency at the July 3, 1997. Despite vigorous defence made by Thailand government through a series of monetary policies, the selling pressure on the baht proved to be overwhelming (Baig & Goldfajn, 2002, p. 38) and lastly forced the authorities switch their pegged exchange regime to free floating exchange regime. Continuation of the speculative attack on her neighbour countries' currencies and contagion effects of the devaluation of Thai baht had made the neighbours (Malaysia, the Philippines, Indonesia and South Korea) experienced depreciation/devaluation on their currency with varying degrees of severity. Following with this depreciation/devaluation, it raised a panic that the growth of the world economy will melt down and eventually spread the fear to other currencies. For instance, Hong Kong, Chinese Taipei and Singapore were affected indirectly through trade shocks that dampened or negated their previously strong growth rate (Makin,

2009, p.12). On the onset of the crisis, South Korea and Indonesia were sought for IMF assistances to defending their currency. By following the prescription of IMF, South Korea tightening her monetary policy and the won recovered quickly to a pre-crisis level. Conversely, the Indonesia still facing the problem of the depreciation despite implementing the same policy.

Ten years later after the AFC, the most notorious and influential crisis after the Great Depression befell on US and quickly spread its impacts to the world. The crisis is recognized as GFC and its impacts now still lasting on some countries. After the burst of US housing bubble and weak mortgage regulations, more and more banks were shortage in cash and bankrupt in due course. The event had already shocked the US economy severely. An addition of it, the bankruptcy of Lehman Brothers (4th largest investment bank in US) and emergency status of other US prominent and influential financial institutions (Citigroup, American International Group (AIG), Merrill Lynch, etc.) had raised a wave of fear among the investors in the world since these companies are multinational company and has many business in the world. Under this highly globalized integrated and interconnected financial markets in the world, the fear and suspicions on the structure and credibility of financial institutions was shrunk the equity, currency and property markets on major economies promptly and recessed the world economy in a deep. For example, the real GDP of Turkey contracted largely as 14.7 percent during the first quarter of 2009 (Alp & Elekday, 2011) while both the currency and the equity markets in South Korea plummet around 30 percent on 2008 (Alp, Elekday, & Lall, 2011). Furthermore, there has a large depreciation across the major economies' currency in recorded during the crisis period.

1.2 Problem Statement

Exchange rate is important to an economy as it has large impact on its country welfare in context of trade, investment and stability of economic activities, especially during the occurrence of crisis. Hence, it is meaningful to determine the actual causality direction and magnitude of the determinants of exchange rate. An economy can minimize the impacts of crisis and recover more quickly if make these clear. However, a general agreements on effects of the determinants are never achieved among the economists even though lots of empirical researches studying on it.

Interest rate is often viewed as a monetary policy as it regularly used by monetary authority to regulate the monetary system and defend the exchange rate during crisis. Notwithstanding with that, there is an argument on the sign of interest rate on exchange rate as a determinant of exchange rate. The relationship of interest rate and exchange rates could be confusing under complicated circumstances (Baig & Goldfajn, 2002). According to traditional theory, if there is a shock, a higher interest rate is expected to appreciate the currency value as it making speculation more costly and inducing the foreign capital (interaction of demand and supply of currency). This theory is widely accepted by economists before the occurrence of AFC[1]. Nevertheless, their relationship is became vague after the occurrence of AFC. In the AFC, South Korea, the Philippines and Thailand are successful to defend their currency value after raising interest rate (Brailsford, Penm & Lai, 2006) but the Indonesia was failed to stabilize the rupiah. Due to the deficiency of traditional theory in AFC, the revisionists

[1] Rooted from the Latin American debt crisis, Krugman (1979) is the most notably economist to support this advocate.

(Furman, Stiglitz, Bosworth & Radelet, 1998) argued that a higher interest rate would depreciates the currency value. They stipulated that a higher interest rate would generates a higher exchange risk premium, increasing the non-performing loan, reduces financial market confidence and thus depressing the economy and depreciating the currency.

Besides that, the causality direction and magnitude between exchange rate and stock prices are also debatable. On one hand, the conventional/flow oriented approach addressed that stock prices are positive correlated with the exchange rate as exchange rate is defined as domestic currency over foreign currency. The higher exchange rate (depreciation) would increase the international competitiveness of firm in trade, thus boosting the firm's profit and therefore the firm's share price. In other words, a depreciation of currency will lead to higher stock prices. On the other hand, portfolio/stock oriented model explained the reverse causality from the capital account of the balance of payment. The model stated that the exchange rate is negatively affected by the stock prices; higher stock price resulting exchange rate appreciated. Demand on domestic currency by foreign investors would increasing (lower exchange rate) as foreign capital are attracted by a persistent hiking of stock prices due to the profit.

Last but not least, it is general to acknowledge the role of exchange rate play on TOT. TOT is defined as the ratio of export price over the import price and exchange rate is defined as domestic currency over foreign currency. Their relationship is expected to be positively correlated; a depreciated currency will increasing TOT.

When the exchange rate (depreciation) become lower, the economy has more international competitiveness on trade now and thus raising the export. However, the effect of TOT on exchange rate cannot be unambiguously ignored (Amano & Norden, 1995). If there is an improving TOT, it indicated there has a higher demand for the country's currency. Resulted from the rising demand of currency, the exchange rate will become lower (depreciation) following the higher rate of TOT. Hence, it shows that the exchange rate is negatively explained by the TOT.

1.3 Objective

1.31 General Objective

The objective of this study is to investigate the causality direction and magnitude of the determinants of currency on exchange rate in turbulent period.

1.32 Specific Objective

i. To investigate relationship of interest rate and exchange rate during crisis.

ii. To examine dynamic linkage and magnitude of stock prices and TOT on exchange rate during crisis.

1.4 Significance of Study

During a crisis, a volatile exchange rate is very harmful on an economy in the context of trade, foreign investment and stability of economic activities. Hence, employing appropriate monetary policies to defend the depreciation of exchange rates is the ultimate goal for the policy makers. By implementing effective monetary policies, it helps the impacted economy adjusted back to the pre-crisis condition in a shorter period. In other words, accurate monetary policies can recovers an economy quickly after shocked. The infected economy can be stagnated and even grow negatively for years if using ineffective monetary policies.

On the other hand, cost of letting the currency to depreciate is higher and is more disastrous. As Gould and Kamin (2000) mentioned, without intervenes the depreciation of currency, it would not only causing higher inflation and depleting the foreign reserves, but would also depress the banking sector and economic activities. Consequently, unemployment rate hike sharply, capital outflowing and worsen the economy. Hence, it is vital to understand the determinants of exchange rate and apply them as monetary policies to defend the depreciation resulted from a crisis and maintain the stability of exchange rate.

In addition, this study is differs with the past empirical studies. Following the past studies, most of them are either investigated the time-series relationship between determinants of currency and exchange rate during tranquil period or assessed only on the effect of interest rates on exchange rates through many crisis episodes. In contrary

with them, this study is study on the relationship of exchange rates and its determinants during crisis episode.

1.5 Organization of Study

This dissertation is divided into five chapters which is introduction in chapter one, literature review in chapter two, methodology in chapter three, empirical result and discussion in chapter four and chapter five concludes. In the chapter one, the background of study, problems statement, objectives and significance of study are introduced. Empirical researches studied on the relationships between exchange rate and its determinants during crisis were reviewed in chapter two. Next, theoretical framework, testing procedures, sources of data and the definition of data are presented in chapter three. Chapter four shows the empirical estimation and discussion on it. Lastly, conclusion on whole study is provided on chapter five.

Moreover, ten economies which are adopting floating exchange regime were been selected as sample economies. Among these economies, five of them are emerging economies: Malaysia, Philippine, Russia, Thailand and Turkey while the remaining are advanced economies: Canada, Japan, South Korea, Sweden, and UK. Monthly data of exchange rate and its determinants during crisis episodes were acquired from 1990-2012. In addition, causality tests in VECM and in VAR were applied in this study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Preface

This chapter concluding the empirical studies on relationships of exchange rate and its determinants i.e. interest rate, stock prices and TOT during crisis. As interest rate is heavily used by monetary authority to stabilize the exchange rate during crisis, this chapter is more focus on the study which discuss their relationship. Their empirical relationship is contradictory and debatable among the economists after the happening of AFC. Apart from that, the causality between the stock prices and exchange rate is also arguable. The traditional approach stated that changes of exchange rate leads to variation of stock prices while the causality direction is reverse in the portfolio approach. Besides that, the causality of the TOT and exchange rate is also raising an issue recently. Conventionally, a depreciated exchange rate is expected to reduce the trade of trade. However, the revisionists stipulated that a higher TOT is expected to appreciate the exchange rate.

Therefore, to get a better understanding of the context on their relationship during crisis, summarization from the past empirical researches are presented in the next section. These empirical literature were categorized based on their estimation economy. Lastly, this chapter is recapitulated in concluding remarks.

2.1 Reviewed Literature

The past empirical literature was been reviewed and summarized in this section. Besides, these articles were grouped and organized into three categories based on their sample economies, which is developing economies, developed economies and panel economies. Lastly, summary of each of the article is presented in table form after each category.

2.1.1 Developing Economies

In year 1994, Arize (1994) determined the existence of long run causality linkage between exchange rate and TOT from 1973 to 1991 by using the quarterly data. His objective is to identify the existence of conventional relationship between exchange rate and TOT on nine Asian economies. By using Augmented Dickey-Fuller (ADF) unit root test, Engle-Yoo and Johansen cointegration test, he found that the variables are cointegrated as devaluation of currency enhanced the TOT (conventional approach) in most of the economies.

Two years later, Zhang (1996) analysed the association between TOT and exchange rate same like Arize's (1994) study but in the context of China. He conducting the study from 1991-1996 with monthly by employing similar econometric methodology. However, he reached out opposite findings with Arize's (1994) study where he cannot found any evidence of conventional causality direction. Conversely, his empirical estimation proved that TOT is strongly Granger cause the exchange rate.

Besides that, Basurto and Ghosh (2001) examined the impact of interest rate on exchange rate in currency crisis by revolved about the supply of money. They sampling Indonesia, Thailand and South Korea with monthly data available from IFS, IMF and Biropustat Statitistik from 1990 to 2000. They indicated that the effect of an increase of money supply can contradicts with the impact of an increase of interest rate, and thus, exchange rate would not be affected by interest rate when they are increased simultaneously. Besides, they stated that the standard monetary model of exchange rate determination used in this study can granted the reaction of exchange rate to an increase of real interest rate via the mechanism of risk premium. By applying VAR test, their findings support the conventional theory which a higher interest rate leads to an appreciation of the exchange rate during tranquil period and during the currency crisis.

At the same year, Deckle, Hsiao and Wang (2001) also published a research to investigate the validity of traditional approach: whether high interest rates appreciate exchange rates in the context of South Korea. By using high frequency data (weekly data) where acquired from Bloomberg and Bank of Korea, this study focus on relationship of nominal interest rate and nominal exchange rate during and after the AFC. Similar with Basurto and Ghosh (2001), methodology of a VAR was been employed in this study. In addition, their findings are also consistent to the findings of Basurto and Ghosh (2001) that the traditional effect of interest rate on exchange rate is holding in the crisis period.

Apart from that, Cho and West (2003) conducted an empirical research for the Philippines, Thailand and South Korea from year 1997 to year 1998. By obtaining weekly data from Bloomberg, they argued the reaction of exchange rate when exogenously increasing the interest rate. To test their relationship, they established a structural model in which exchange rates impacted by an interest rate shock and a risk premium shock. Based on the methodology of a VAR test and rolling regression, mixed results are obtained. It is revealed that conventional approach is held in the case of South Korea and the Philippines since the monetary shocks are dominating. However, depreciation of exchange rate would occurred in case of Thailand when there is an increase of interest rate as risk premium shocks is dominating. They concluded that their relationship may be is a time varying relationship.

On the other hand, Caporale, Cipollini and Demetriades (2005) were employing VECM and GARCH to determine the relationship of interest rate and exchange rate during turbulent period. They using the monthly data extracted from the Datastream beginning from 1991 to 2001 for 4 economies affected severely during AFC, i.e. Thailand, South Korea, Indonesia and the Philippines as their sample. In addition, the heteroscedasticity properties of the two financial series was been identified in order to resolve the endogeneity problem of interest rates in this relationship. As their results shown, a higher interest rate helped to defend the exchange rate during tranquil periods and it had the opposite effect on exchange rate during the crisis.

Furthermore, Brailsford et al. (2006) also addressing their attention to the effectiveness of interest rate as a monetary policy on currency values during AFC. They empirically re-investigated the effects of sharply higher interest rates on Asian exchange rates during the AFC from different perspective with other researchers, viz, contagion effects. The contagion effects origin from neighbours' currency-affected currency are under the investigation of this study. To achieve this objective, they focused on four economies which had adversely affected most in the crisis, that are Thailand, Malaysia, the Philippines, and South Korea by obtaining the daily data from Datastream and IFS, IMF from July 1997 July until July 1998. Other than that, three important findings were been reached through the methodology of VAR. First, a higher interest rate appreciated the Thai baht, the Korean won and the Philippines peso when there is a shock. Second, the significant causal relation is not found between the exchange rate and interest rate in case of Malaysia since the authority does not implement the tighter monetary policy actively. Lastly, the exchange rate movements was been affected more by currency contagion rather than rather than interest rate movements in this crisis.

Tabak (2006) found no long run equilibrium relationship between stock prices and exchange rate in Brazilian economy, using both the Engle-Granger and Gregory-Hansen cointegration test. He employed daily data and his sample period begun August 1, 1994 and finished May 14, 2002. However, short run linear causality linkage from stock prices to exchange rate is found by using the causality in VAR. Notwithstanding portfolio approach is evident in linear Granger causality test, the

non-linear causality test, GARCH, support the conventional approach in the short run: the changes in exchange rates lead to movement of stock prices.

By assigning international interest rate differential as endogenous variable, Bouvatier (2007) testing the impacts of risk premium during the 1997-1998 AFC. He tried to figure out the controversial issue that the capability of high interest rates to support the exchange rates based on mechanism of risk premium. Employing monthly data from 1994 to 2002 for the Philippines, Malaysia, Thailand and South Korea, VECM had been applied to get the effects of risk premium on currency values. The data was obtained from the IFS, IMF and from the Asia Regional Information Center. On basis of these results, he stipulated that high interest rates served to cease the depreciation of exchange rates though the interest rate cannot appreciate the exchange rates immediately. In other words, depreciation can be defended by higher interest rate.

Ooi, Wafa, Lajuni, and Ghazali (2009) investigated the dynamic linkage between exchange rates and stock prices on Malaysia and Thailand. By employing Johansen-Juselius test, Toda-Yamamoto's causality test and variance decomposition on daily series data, they analyse the relationship on pre-AFC and post-AFC. The estimation results proved that stock prices would affected exchange rate in both of these two economies. Notwithstanding that, the relationship existed in both pre-crisis and post-crisis on Thailand while it appeared on Malaysia only in post-crisis period.

At the same year, Rahman and Uddin (2009) also examined the causality between the stock prices and exchanges rates in Bangladesh, India and Pakistan. By using the monthly data of nominal exchange rate and stock prices, they were applying methodology like the unit root tests, cointegration test and Granger causality test. They found that there is neither short run nor long run relationship between the variables.

Moreover, Huang, Hueng and Yau (2010) made an attempt to study both traditional and revisionist views about the appropriateness of interest rate on exchange rate when there is a turbulent period. They assumed the relationship of interest rate and exchange rate to be time-varying as highlighted by Cho and West (2003). It means that exchange rates would be appreciated when there is an increase on interest rate. Notwithstanding with this, currency would be depreciated due to the increased risk premiums if the interest rates is rising too high. A time-varying-parameter model with GARCH disturbances has been implemented and the findings indicated that a higher interest rate is not an essential tool to stabilize the currency value.

Table 1: Developing Economies

Author(s)/ Year	Variables	Sample	Methodology	Findings
Arize (1994)	real effective exchange rate and terms of trade	quarterly data 1973Q1-1991Q1 Korea, India, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand Sources: 1. IFS, IMF 2. Direction of Trade Statistics, IMF	ADF test Engle-Yoo and Johansen cointegration test	Conventional relationship between TOT and real effective exchange rate was held in most of the sample economies.
Zhang (1996)	nominal and real exchange rate, TOT	monthly data 1991M1-1996M2 China Sources: 1. IFS, IMF 2. Statistical Yearbook of China, IMF 3. Monthly Statistics of China, IMF 4. Hong Kong Monthly Digest of Statistics	ADF test Engle-Granger, Johansen, Johansen-Jeselius cointegration test	Conventional causality direction of exchange rate and TOT were not proven but the revisionist approach is supported.

Table 1: Developing Economies (Continued)

Basurto and Ghosh (2001)	real exchange rates, real interest rate, risk premium	monthly data 1990M1-2000M6 Indonesia, Thailand, South Korea Sources: 1. IFS, IMF 2.Biropustat Statitistik	ADF test VAR Wald test	1. A higher interest rate leads to an appreciation of the exchange rate during tranquil period and during the Mexican currency crisis. 2. They also verified the positive relationship between risk premium and interest rate though there is a little evidence.
Deckle et al. (2001)	nominal exchange rate, nominal interest rate, corporate bankruptcies	weekly data 1997M9-1998M8 South Korea Sources: 1. Bloomberg 2. Bank of Korea	ADF tests Johansen cointegration test VAR and Hsiao's parsimonious VAR RMSE IRF	1. The traditional effect of interest rate on exchange rate is holding in the crisis period. 2. The revisionist view that a higher corporate bankruptcies caused by higher interest rate is not supported by this study.
Cho and West (2003)	exchange rates, nominal interest rates	weekly data 17Dec1997-23Dec1998 Philippine, Thailand, South Korea Source: Bloomberg	VAR rolling regression	1. It is revealed that conventional approach was held in the case of South Korea and the Philippines since the monetary shocks are dominating. 2. However, Thai baht depreciated when there is an increase of interest rate as risk premium shocks is dominating.

Table 1: Developing Economies (Continued)

Caporale et al. (2005)	bilateral nominal exchange rate, nominal interest rate	monthly data 1991M2-2001M10 Thailand, South Korea, Indonesia, the Philippines Source: Datastream	ADF tests VECM GARCH	A hiking interest rate helped to defend the exchange rate during tranquil periods and it had the reverse effect on exchange rate during the Asian crisis.
Brailsford et al. (2006)	nominal exchange rate, overnight interest rate differential with the US, producer price differential with the US	daily data 1July1997-1July1998 Thailand, Malaysia, the Philippines, South Korea Sources: 1.Datastream 2. IFS,IMF	ADF test Stock-Watson cointegration test VAR Univariate autoregressive systems Geweke's linear dependence RMSE	1. A higher interest rate can appreciated the Thai baht, the Korean won and the Philippine peso when there is a shock. 2. The significant causal relation is not found between the exchange rate and interest rate in case of Malaysia since the authority does not implement the tighter monetary policy actively. 3. The exchange rate movements was been affected more by currency contagion rather than rather than interest rate movements in this crisis.

Table 1: Developing Economies (Continued)

Tabak (2006)	nominal exchange rate, stock prices	daily data 1August1994-14May2002 Brazil Source: Bloomberg	ADF, KPSS and ZA unit root tests Engle and Granger cointegration test; Gregory and Hansen cointegration test VAR IRF GARCH	1. There is no long run equilibrium relationship between stock prices and exchange rate in Brazilian economy. 2. Linear causality linkage from stock prices to exchange rate is found in the short run; portfolio approach is evident. 3. Short run of non-linear causality connection from exchange rate to stock prices is proven.
Bouvatier (2007)	international interest rate differential, exchange rate risk premium (domestic credit growth rate, foreign liabilities/ assets, international reserves growth rate, ratio of M2 to international reserves)	monthly data 1994M1-2002M12 Philippine, Malaysia, Thailand, South Korea Sources: 1. IFS, IMF 2. Asia Regional Information Center	ADF test, Elliott-Rothenberg-Stock (DF-GLS) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Johansen-Juselius (JJ) cointegration VECM	1. A raise of interest rates would not appreciate the exchange rates immediately. 2. A high interest rates served to cease the depreciation pressure of exchange rates.

Table 1: Developing Economies (Continued)

Ooi et al. (2009)	nominal exchange rates, stock prices	daily data 1November1993-31August2003 Malaysia, Thailand Source: Datastream	ADF and PP tests JJ cointegration test Granger causality test in Toda-Yamamoto's procedure Variance decomposition analysis	1. Stock prices would affected the exchange rate in these two economies. 2. The relationship existed in both pre-crisis and post-crisis on Thailand while it appeared on Malaysia only in post-crisis period.
Rahman and Uddin (2009)	nominal exchange rate in US dollar, stock price index	monthly data 2003M1- 2008M6 Bangladesh, India and Pakistan	ADF and PP tests Johansen-Juselius cointegration test Granger causality test	There is neither short run nor long run relationship between the variables
Huang et al. (2010)	nominal exchange rate, short term interest rate	weekly data 1997M7-1998M12 Indonesia, South Korea, Thailand Source: Datastream	TVP model with GARCH disturbances	A higher interest rate is not act as an essential tool to stabilize these currencies' values.

2.1.2 Developed Economies

Amano and Van Norden (1995) employed monthly data to investigate the relationship of real exchange rate and TOT in Canada. Rather than just using these two variables, they incorporate the interest rate differential as stance of monetary policy to avert issues arise by unstable money demand function. By applying a cointegration approach, Phillips-Loretan non-linear least squares and forecasting encompassing tests for the period 1973-1992, their results proved the variables are cointegrated and causality is running from TOT to exchange rate. On the other hand, they stated that real exchange rate is sometimes but not often influenced by monetary policies.

Lane and Milesi-Ferretti (2002) examine the determinants of real exchange rate for the Ireland from 1970 to 1997 with yearly data. They advocated that long run real exchange rate is time-varying and incorporating the relative output levels, TOT and net foreign assets into their model. By conducting econometric techniques on the series, three conclusions were reached out based on their empirical results. First, relative output is strongly and positively correlated with the exchange rate. Second, there is little evidence that the on TOT are affecting the real exchange rate. Lastly, the real exchange rate is strongly influenced by the foreign asset position despite the sign is conflicting with the theory.

Besides that, Zettlelmeyer (2004) conducted a research to study the immediately impact of interest rate on the exchange rate for Australia, Canada and New Zealand, which spans from 1990 to 2000. In this research, he examined the initial reaction of

exchange rates to specific monetary policy (interest rate) actions as he mentioned that market is very sensitive the any changes of the policy. It presents that the dynamics of long run exchange rate adjustment is not included in this study. By using ordinary least squared (OLS) and *instrumental variables* (IV) regression, the findings support the conventional theory that increases the increase interest rate is effective to appreciate the exchange rate not matter in tranquil period or crisis period. However, the cost followed by high interest rates may be high and has negative effects on the health of economy.

On another research, Scholl and Uhlig (2005) analysed the impacts of interest rate on exchange rates by utilizing agnostic identification method. This method entails sign restrictions on the impulse reaction of chosen variables for several periods after the shock which it enables a much more direct connection between theory and the empirical application and thus can focus more on the interest rate shocks substantially. Rather than using classical approach, Bayesian approach was been applied in this research by using the monthly data for US, German, UK and Japan. Moreover, they were utilized the reduce-form of VAR test to conduct their research because the test does not require identification restrictions totally like structural VAR test. At last, they made a conclusion on their findings that exchange rate fluctuations may not much influenced by interest rate.

Stavarek (2005) examined the dynamic linkage among stock prices and effective exchange rates on Austria, France, Germany, UK, US, Poland, Czech Republic, Hungary and Slovakia for the period 1969-2003. By using monthly data,

their results support the stock oriented models and detected mostly unidirectional relationship from stock prices to exchange rate either in long run and short run. However, the effect is more significant in the old European Union member countries and US than new European Union member countries.

By referring to the Zettlelmeyer's study, Kearns and Manners (2006) conducted a similar study with him that investigates the impact of interest rate on exchange rate. Contrary with him, they were employing intraday data rather than using daily data. They stipulated that the intraday data could regulate the endogeneity problem and other factors which would bring their effects on both exchange rates and interest rates. In addition, temporal reaction of exchange rate can be observed when interest rate arises. Apart from that, the event-study approach and pooled regression were been applied. In the end, they found that the conventional theory is hold in these economies while the fluctuation of exchange rates is relies on expectation of market towards future monetary policy (interest rate).

Table 2: Advanced Economies

Author(s)/ Year	Variables	Sample	Methodology	Findings
Amano and Van Norden (1995)	bilateral real exchange rate, TOT, interest rate differential, CPI	monthly data 1973M1-1992M2 Canada Source: Bank of Canada Review	ADF, PP, KPSS unit root test Hansen, Johansen and JJ cointegration test error-correction model (ECM) VAR Phillips-Loretan non-linear least squares Forecasting encompassing tests	1. TOT is cointegrated with real exchange rate. 2. Exchange rate is affected by TOT but not the reverse direction. 3. Real exchange rate is sometimes but not often influenced by monetary policies.
Lane and Miles-Ferretti (2001)	real exchange rate, relative output levels, TOT, net foreign assets	yearly 1970-1997 Ireland Source: 1. IFS, IMF 2. Penn World Tables, World Bank	ADF and PP tests Johansen cointegration test ECM Phillips-Hansen fully modified ordinary least squares (FMOLS)	1. Relative output is strongly and positively correlated with the exchange rate. 2. There is little evidence that the on TOT are affecting the real exchange rate. 3. The real exchange rate is strongly influenced by the foreign asset position despite the sign is conflicting with the theory.

Table 2: Advanced Economies (Continued)

Zettlelmeyer (2004)	nominal exchange rate, stock market index, market interest rate	daily data 1990-2000 Australia, Canada, New Zealand Sources: 1.Bloomberg 2.Australian Financial Review 3. Toronto Financial Post 4. New Zealand Herald	OLS *IV* regression Hausman test	1. Support the conventional theory that increases the increase rates is effective to appreciate the exchange rate not matter in tranquil period or crisis period. 2. The cost followed by high interest rates may be high and has negative effects on the health of economy.
Scholl and Uhlig (2005)	bilateral exchange rates, monetary policy, industrial production index, money supply, CPI, government bond yield	monthly data 1975M7-2002M7 US, German, UK, Japan Sources: 1. Bank of England 2. IMF 3. Federal Reserve Bank, US	reduced-form VAR Variance decompositions IRF	Exchange rate fluctuations may not much due to the influence of monetary policy.

Table 2: Advanced Economies (Continued)

Stavarek (2005)	NEER, real effective exchange rate and stock prices	monthly data 1969M12-2003M12 Austria, France, Germany, UK, US, Poland, Czech Republic, Hungary, Slovakia Sources: 1. IFS, IMF 2. Morgan Stanley	ADF and PP tests Johansen's cointegration test VECM VAR	1. Stock prices are mostly unidirectional cause exchange rates in all countries either in long run and short run. 2. The effect is more significant in the old European Union member countries and US than new European Union member countries.
Kearns and Manners (2006)	bilateral exchange rates, bank bill interest rate, futures contracts on the three-month bank bill interest rate	intraday data 1980-1998 Australia, Canada, New Zealand, UK Sources: Bloomberg, Datastream, Central Bank of Australia, Canada and New Zealand, Reuters, Montreal Exchange, Sydney Futures Exchange and London International Financial Futures Exchange.	Event-study approach Pooled regression	Conventional relationship between interest rate and exchange rate is hold while the fluctuation of exchange rates is relies on expectation of market towards future interest rates.

2.1.3 Mixed Economics

Gould and Kamin (2000) analysed the influences of interest rate on exchange rates during crises. In this research they shed light on the effectiveness of interest rate to defend a depreciation of a floating exchange rate during financial and balance-of-payment crisis. They acquired the weekly data of the sample economies carried out unrestricted ECM to resolve the puzzling issue of effectiveness of monetary policy on exchange rates from the perspectives of creditworthiness and country risk. It is found that the international credit spreads and domestic stock prices have larger responsibility on the volatility of exchange rates rather than interest rates. Further than that, the authors pointed out that the interest rate has no significant effects on the exchange rates.

By conducting similar study as like as Gould and Kamin, Baig and Goldfajn (2002) extended their sample economies to more economies and to longer sample period. They investigated the interest rate and its causal relation with the exchange rate in the five Asian crisis economies, viz, Thailand, Malaysia, the Philippines and South Korea and compared with other crisis economies where spans 1980-1998. To better observe the stabilizing role of interest rate on currency values after a steep depreciation, high frequency data (daily observations) was employed. Contrary with Gould and Kamin (2000), they were utilizing the fixed effect panel regression model in this study and found empirical evidences to support the traditional theory. Nevertheless, they noted that the costs of high interest rates can be devastating in terms of output loss and bankruptcy of banking sector. Moreover, it is also revealed the complexity of the relationship of interest rate and exchange rates as other factors

(macroeconomic policies, policies and political condition) can confuse them. The effects of interest rate on exchange rates are difficult to recognize in such circumstances.

By using probit regressions, Kraay (2003) drawing his interest on the factors of defending speculative attack under a fixed exchange regime. He collected a large number of speculative attacks (not matter successful or not) as the sample in 54 advanced and emerging economies from 1975 to 1999. Besides, he obtained the monthly observation from the IFS, IMF and presents a striking deficiency of any orderly linkage whatsoever between interest rates and the consequences of speculative attacks. In order to quantify the effects of tight interest rates, he had manipulated the endogeneity of the reaction of monetary policy response. The findings revealed the interest rates are completely ineffective in during speculative attacks. He concluded that the high interest rates are neither increase the currency values nor further devalue it when there has speculative attacks.

Although many researchers had conducted their study on the relationship of exchange rate and tight monetary policy in the previous times, Goldfajn and Gupta (2003) were starting their research from another perspective. Their research is centred on the relationship of monetary policy and exchange rates when twin crisis (currency and banking) happening by comprising 80 economies within the period of 1980-1998. They had evaluate the effectiveness of tight monetary policy on exchange rate in a post-crisis period. Apart from that, they quantified the monetary policy and exchange rate as real interest rates and real exchange rates. After reviewing the results, they

concluded that a higher interest rate may increases the chance of a reversal of currency undervaluation through nominal appreciation when currency crisis and reducing the probability when banking crisis occurred simultaneously. However, an economy which has a weak bank sector may not be included in the statement mentioned above.

Coudert, Couharde and Mignon (2008) examined the linkage of real effective exchange rate (REER) and economic fundamentals comprising net foreign assets, TOT and PPP GDP per capita from 1980 to 2007. By employing yearly data with the panel methodology, they found that real exchange rates cointegrated with the tot in the long run. The value of currencies tended to decrease when there has a downward pressure on most commodity prices.

In the year of 2008, Eijffinger and Goderis (2008) studied on the impacts of interest rates on exchange rates in the period of currency crises via pooled regression. They applied the pooled OLS and system GMM estimation to 14 economies from 1986-2004 by using monthly data. As opposed with other studies, a model quantified four country-specific characteristics (domestic short-term corporate debt, quality of a country's institutions, external debt and capital account openness) was been formulated. They argued the importance of these characteristics on the effectiveness of interest rates during crises. At the end, they found that an economy with high domestic corporate short-term debt has greater contrary balance sheet effects under high interest rate condition. Besides that, the high interest rate is more effective in an economy which has high-quality institutions. Moreover, they also stated that the high interest rate are more effective if investors believe the economy with high external

debt is more credible. Last but not least, high interest rate are more effective in economies with low capital account openness. Therefore, they suggest that the effect of interest rate on exchange rate in an economy reckon on economic fundamentals and its credibility.

In another study conducted by Pennings, Ramayandi and Tang (2011), they identified the relationship of interest rates, exchange rates and stock markets during the GFC. The study is focus on the transmission from the central bank's policy rate to financial markets for eight open economies, namely Australia, Canada, South Korea, New Zealand, UK, Indonesia, Malaysia and Thailand by monthly observations over period of 2008 to 2010. They aimed to examine the immediately effect of an unexpected change in interest rate on the exchange rate and the stock market index. Rather than collecting real financial variables data like Goldfajn and Gupta (2003), they were employing nominal financial variables data because they highlighted that it can give an instant feedback of the publicly accessible information. By applying the same methodology (event study approach & pooled regression) and similar economies (Australia, Canada, New Zealand & UK) with Kearns and Manners (2006), their findings are quite similar with them. In overall, this study agreed with the conventional theory that exchange rate was been appreciated by increasing interest rate. However, the effect of interest rate has weaker effect on exchange rate during crisis than in tranquil period. Lastly, it is note that the effect of interest rate in emerging economy appeared less effective than in advanced economy.

Eijffinger and Karatas (2012) analysed the effect of interest rates on exchange rate in the crises episodes by riveted on the macroeconomic fundamentals of an economy. This study extracting the monthly data for fifteen emerging economies and 9 advanced economies from 1986 to 2009. By doing so, it can differentiated the effectiveness of monetary policy (interest rate) between these two kinds of economy as they have different economic qualities. After testing the data with pooled OLS and system GMM estimation, they concluded that the contractionary monetary policy (higher interest rate) is effective in the advanced economies and has reverse effect in the emerging economies during crises excluding GFC. However, they cannot find any evidence to prove the significance effect of monetary policy on exchange rate in GFC. They noted that there is no single monetary policy is appropriated for all economy to solve the problems brought by the crises.

Table 3: Mixed Economics

Author(s)/ Year	Variables	Sample	Methodology	Findings
Gould and Kamin (2000)	real bilateral exchange rate, differential interest rate against similar U.S. rates, differential inflation rates, credit spread, real stock return.	weekly data 1994-1998 Indonesia, Malaysia, South Korea, the Philippines, Thailand, Mexico Sources: 1. Bloomberg 2. Official data sources	ADF unit root tests Johansen cointegration tests Unrestricted ECM	1. International credit spreads and domestic stock prices have larger responsibility on the volatility of exchange rates rather than interest rates. 2. The interest rate has no significant effects on the exchange rates.
Baig and Goldfajn (2002)	nominal exchange, nominal interest rate	daily data 1980-1998 Thailand, South Korea, Indonesia, Malaysia, Philippines, Mexico, Chile, UK, Sweden, Brazil, Argentina Sources: 1. Bloomberg 2. Financial Times Currency Forecaster 3. Consensus Forecast 4. IFS, IMF	Fixed effect panel regression model IRF	1. Traditional relationship between exchange rate and interest rate was held. 2. Other factors of exchange rates can confuse the relationship between interest rate and exchange rate. 3. The costs of high interest rates can be devastating in terms of output loss and bankruptcy of banking sector.

Table 3: Mixed Economies (Continued)

Kraay (2003)	nominal exchange rates, nominal market interest rate, non-gold reserves and reserves	monthly data 1975M1-1999M4 54 economies Source: IFS, IMF	Probit Regressions	The interest rates are completely ineffective in during speculative attacks.
Goldfajn and Gupta (2003)	deviation of real exchange rate from equilibrium, real interest rates	monthly data 1980-1998 80 countries Sources: 1. IFS, IMF 2.World Bank's Global Development Finance database	Fixed-effects panel regression	A higher interest rate may increases the chance of a reversal of currency undervaluation through nominal appreciation when currency crisis and reducing the probability when banking crisis occurred simultaneously.
Coudert et al. (2008)	REER, net foreign assets, TOT, PPP GDP per capita	yearly data 1980-2007 68 countries Sources: 1. IFS, IMF 2. World Economic Outlook database, IMF	Levin-Lin, Breitung, Hadri, IPS and MW panel unit root tests Pedroni and Kao panel cointegration panel VAR IRF dynamic OLS	The real exchange rates cointegrated with the TOT in the long run.

Table 3: Mixed Economies (Continued)

Eijffinger and Goderis (2008)	change in exchange rate (nominal and real), monetary policy (country-specific interest rates and discount rate), real exchange rate overvaluation, inongold reserves as a percentage of total imports, a country's external payments position, the deviation of real per capita GDP growth, percentage change in real exports and imports, domestic short-term corporate debt, institutional quality, external debt, capital account openness.	monthly data 1986-2004 Argentina, Brazil, Finland, Indonesia, South Korea, Ireland, Mexico, South Africa, Thailand, Norway, Russia, Venezuela, the Philippines, Slovakia Sources: 1. International Country Risk Guide (ICRG) 2. IFS, IMF 3. World Development Indicators (WDI), World Bank 4. Thomson Financial's World-scope database 5. Datastream	Hausman tests Lagrange multiplier tests Pooled OLS System GMM Estimation Sargan tests	1. An economy with high domestic corporate short-term debt has greater contrary balance sheet effects if she raising interest rate. 2. High interest rate is more effective in an economy which has high-quality institutions. 3. High interest rates are more effective if investors believe the economy with high external debt is more credible. 4. High interest rates are more effective in economies with low capital account openness.

Table 3: Mixed Economies (Continued)

Pennings et al. (2011)	nominal exchange rate, stock market index, market interest rates, policy rates	monthly data 2008M1-2010M6 Australia, Canada, South Korea, New Zealand, UK, Indonesia, Malaysia, Thailand. Sources: 1. Bloomberg 2.Datastream 3. Central banks of government	Event study approach Pooled regressions	1. The exchange rate was appreciated by increasing interest rate. 2. The effect of interest rate is weaker during the crisis than in the tranquil periods. 3. The effects of interest rate on exchange rate in emerging economy appeared less effective than in advanced economy.
Eijffinger and Karatas (2012)	change in exchange rate (nominal and real), interest rate, GDP growth, exchange rate overvaluation, current account position, ratio of domestic short-term debt to total assets, institutional quality, short-term external debt position, stock prices, fiscal position, capital account openness index, central bank transparency	monthly data 1986-2009 24 economies: 15 emerging and 9 advanced Sources: 1. Datastream 2. IFS, IMF 3. WDI, World Bank 4. Political Risk Services (PRS) Group	Hausman tests Breush-Pagan Lagrange Multiplier tests Pooled OLS System GMM Estimation Sargan test Arrelano-Bond test	1. The high interest rate is effective in the advanced economies and has opposite effect in the emerging economies during crisis excluding GFC. 2. The interest rate has no significance effect on exchange rates in GFC both for advanced and emerging economies

2.2 Concluding Remarks

This chapter summarized the empirical studies on the relationship between the exchange rate and its determinants, viz, interest rate, stock prices and TOT. From the reviewed literature, it is noted that the impact of the determinants on exchange rate still puzzling. Some findings are supporting the conventional theory, other results are suggesting the revisionist approach and the rest stipulated that the variables have no causality at all.

For the relationship between interest rate and exchange rate, a vast of empirical findings are supporting the conventional approach where a higher interest rate would appreciating the exchange rate. It was been observed from the studies of Baig and Goldfajn (2002), Basurto and Ghosh (2001), Bouvatier (2007), Caporale et al. (2005), Deckle et al. (2001), Goldfajn and Gupta (2003), Kearns and Manners (2006), Pennings et al. (2011) and Zettlelmeyer (2004). Notwithstanding their agreement on conventional approach, Caporale et al. (2005) confirmed the revisionist view during AFC. Besides that, Goldfajn and Gupta (2003) empirically agreed on the revisionist view when there is an occurrence of twin crisis (banking crisis and currency crisis). However, some studies (Gould & Kamin, 2000; Kraay, 2003; Scholl & Uhlig, 2005) shown that the interest rate has no significant effect at all during crisis period. As Huang et al. (2010) stipulated that interest rate may not act as an essential tool to stabilize the currencies' values. Nevertheless, the dynamic linkage between the variables is still confusing as some studies (Cho & West, 2003; Eijffinger & Goderis, 2008; Eijffinger & Karatas, 2012) were obtaining the mixed results in crises episodes. The linkage appeared positive in some economies while it shown negative in some

economies. Apart from that, Brailsford et al. (2006) and Pennings et al. (2011) stressed that high interest rate is more effective in developed economies while Eijffinger and Karatas (2012) pointed out that high interest rate is only effective in the advanced economies on crisis period without including GFC.

As making stock prices as exogenous variable to exchange rate, Tabak's (2006) findings based on linear causality test seems to advocate the dynamic linkage between stock prices and exchange rate under stock oriented model. His findings were in line with other studies (Coudert et al., 2008; Gould & Kamin, 2000; Ooi et al., 2009; Stavarek, 2005) which also supported this approach. However, based on the results of nonlinear causality test, Tabak (2006) showed that conventional relationship between the variables was existed in the short run. On the contrary, Tabak (2006) concluded that there is no long run equilibrium relationship between stock prices and exchange rate. Meanwhile, Rahman and Uddin (2009) shared the same conclusion with him.

On the other hand, some researchers (Amano & Van Norden, 1995; Lane & Miles-Ferretti, 2001; Zhang, 1996) agreed on the revisionist theory between TOT and exchange rate. Amano and Van Norden (1995) and Zhang (1996) stipulated that exchange rate is affected by TOT but not the reverse direction. Nonetheless, Arize (1994) found strong empirical evidence on the causality direction run from exchange rate to TOT (conventional approach).

Apart from that, researchers are employing various kinds of methodology to examine causality between exchange rate and its determinants. There are three main

methods: VAR, VECM and panel regression. Most of the times series studies (Amano & Van Norden, 1995; Basurto & Ghosh, 2001; Brailsford et al., 2006; Cho & West, 2003; Deckle et al., 2001; Ooi et al., 2009; Scholl & Uhlig, 2005; Stavarek, 2005; Tabak, 2006) were utilised VAR to check the short run causality among the variables, especially during the crisis period. Regardless of that, Bouvatier (2007), Caporale et al. (2005) and Stavarek (2005) were conducting VECM in their study as VECM can analyse both the long run and short run relation among variables at once. Besides that, other researchers (Baig & Goldfajn, 2002; Coudert et al., 2008; Eijffinger & Goderis, 2008; Eijffinger & Karatas, 2012; Goldfajn & Gupta, 2003; Kearns & Manners, 2006; Kraay, 2003; Pennings et al., 2011; Zettlelmeyer, 2004) were using the panel regression to test the relationship as it can generalized the whole sample into one results.

In conclusion, effects of interest rate, stock prices and TOT on exchange rate in crises episodes are still ambiguous since there has had many contradicting findings existed in the reviewed literature. Although researchers had applying various methodology to analyse the causality, but general agreements on that still unreachable. Therefore, it is necessary to figure out their impact on exchange rate during crisis as it is important to an economy to cushion the impact of crisis and enable her recovering within a shorter period.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The theoretical framework which is the fundamental for this study had been discussed. The sources and description of data also mentioned. Moreover, the methodology that would employed in this study was presented in this chapter. ADF and PP unit root tests, Johansen cointegration test, Granger causality had been reported.

3.1 Data Description

Monthly analysis was performed on ten economies, which is 5 developing economies: Malaysia, Philippine, Russia, Thailand and Turkey; and 5 developed economies: Canada, Japan, South Korea, Sweden, and UK from 1992 to 2011. According to Klaassen and Jager (2011), monthly data can be informative to acquire a general outlook of a longer period around a crisis (p. 75). Apart from that, crisis periods are identified as combination of the period of banking crisis and currency crisis: banking crisis period is following the date in Laeven and Valencia (2012)'s study; currency periods are defined following Eijiffinger and Karatas (2012)'s approach[2] and Glick and Hutchison (2011)'s approach[3]. The crisis periods taken are

[2] The currency crisis periods are defined as the nominal change in currency to the year before have exceed minimum size of the acceptable depreciation, 5% for the developed and 10% for the developing economies (p. 950).

[3] After identifying each large change in currency pressure, any large changes in the following two years are treated as part of the same currency episode and skipped before continuing the identification of new crises (pp. 8-9).

documented in Appendix A. Stock prices index, TOT, NEER, nominal money market interest rates are extracted from the Datastream and Global Economic Monitor, World Bank. All variables are transformed into logarithms and details of the variables are documented in Appendix B.

The measurement of exchange rates that employed in this study is nominal effective exchange rate (NEER). NEER is the unadjusted weighted average value of home currency relative to all major currencies being traded within an index or pool of currencies (Nominal Effective, n. d.). A larger value means the domestic currency is appreciating while a smaller value means the domestic currency is depreciating. The effective exchange rate was been selected as it is more appropriate for this dissertation since all economies under estimation are highly open with foreign trade and investment. As stated by Pennings et al., (2011) nominal variables respond nearly immediately to publicly accessible information. On the contrary, most real variables only react with other long and variable variables lags to monetary policy (Pennings et al., 2011, p.1). Thus, the real exchange rate is not suitable for this study.

Apart from that, nominal interest rate are be used as the tool of monetary policy since most of the economies would not like the inflation to hike. The real interest rate is not been selected since the real interest rate may cause misleading results as it did not shows the immediate effects of the economy (Gould & Kamin, 2000). In this study, nominal money market interest rate were been employed since Goderis and Ioannidou (2008) pointed out that the best available indicator of monetary policy is not necessarily the identical across countries or time. Moreover, Baig and Goldfajn (2002)

stipulated that any of the interest rates can trace the major movements of monetary policy. The money market interest rates for each economy are documented in Table B1 in Appendix B.

3.2 Theoretical Frameworks

The determinants of exchange rate during crisis can be described by the following equation:

$$NEER = \beta_0 + \beta_1 INT + \beta_2 TOT + \beta_3 STOC + \mu_t \quad (1)$$

where NEER = nominal effective exchange rates

INT = nominal money market interest rates

TOT = terms of trade

STOC = stock prices

μ_t = error term

3.2.1 Interest rate

Interest rate is often viewed as a monetary policy as it regularly used by monetary authority to regulate the monetary system and defend the exchange rate during crisis. Notwithstanding with that, there has two theories regarding the effect of interest rate on exchange rate; traditional theory and revisionist theory.

3.2.1.1 Conventional Theory

There is a positive relationship between the interest rate and NEER. In other words, a higher interest rate will leads to appreciation of currency when there is a

shock. An increase of interest rate is expected to stabilize the exchange rate and enhance the confidence of investors on the impacted economy.

In a period when a crisis is happened, raising interest rate can stabilize the volatility of exchange rate. It made believed that speculation against the currency will become more costly for the speculators. The increase of the interest rate will directly hike the costs of speculative attack if the speculators shorting the domestic currency (borrowing domestic currency to invest in the foreign currency). Despite the speculators are not borrowing the domestic currency to buy the foreign currency, they may consider investing towards the domestic economy rather than speculating on domestic currency as increased interest rate affects their opportunity cost (Brailsford et al., 2006).

Besides that, hiking interest rate may increases the confidence of investors on an economy. It presents the commitment of the monetary authority to reduce inflationary expectations and avert a vicious cycle of inflation and exchange rate depreciation (Baig & Goldfajn, 2002; Gould & Kamin, 2000). In addition, the increase also implied that expected return in the country will be outperformed as the return is directly related with promised interest rate and the expected depreciation. By using the model of Baig and Goldfajn (2002), this relationship can be revealed clearly:

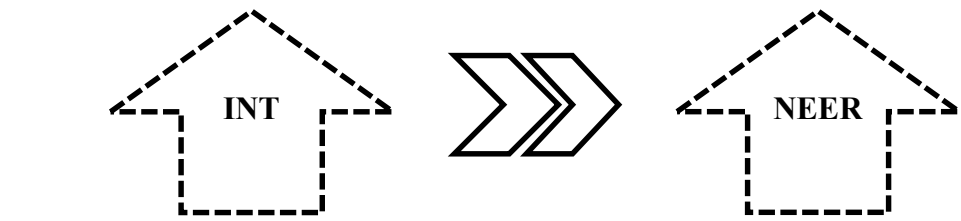
$$E[i] = i^* + E[\Delta e] = R \qquad (2)$$

where E[Δe] is the expected depreciation, E[i] is the expected return of an investment in the home economy, I^* is the safe return on an equivalent

international asset and R is the risk premium that is requested by risk averse foreign investors confronted with exchange rate volatility. (p.13)

In ceteris paribus basis, expected return on domestic economy must increase and higher than foreign economy when there is an increase in interest rate. When capital is inflows due to the higher interest rate, it would appreciate the currency instantly or limiting depreciation of exchange rate as the demand is increasing.

Figure 1: Conventional relationship between interest rate and exchange rate



3.2.1.2 Revisionist Theory

The theory stated that a high interest rate would depreciates currency values rather than appreciates it. In other terms, NEER is negatively affected by interest rate. Contrary with the conventional approach, the advocates (Furman et al., 1998) stipulated that, in crisis period, raising interest rate will generates a higher exchange risk premium and reduces financial market confidence and thus depreciate the currency.

The expected return on the domestic asset E[i] can be viewed as the product of the domestic interest rate, I, multiply by the probability of repayment, p:

p: E[i] = p (I) I (3)

and substituting equation (2) into (3):

$$p(I)I = i^* + E[\Delta e] + R \quad (4)$$

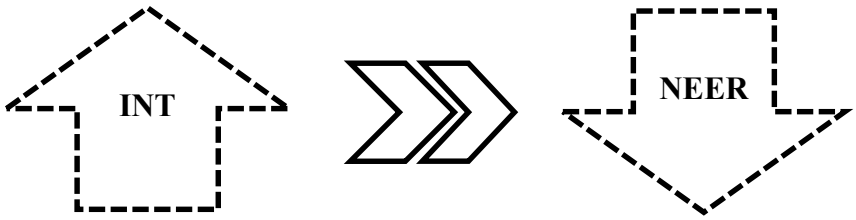
where p`<0, p``<0.

From the equation (4), it is know that when the interest rate climb too high, the probability of default would increase substantially in ceteris paribus condition. It indicated that if an economy has a large percentage of highly leveraged borrowers (greater country risk premium), the rise of interest rates implied that the economy will has a lower, probable negative, expected return to investors (Caporale et al., 2005). Thus, the raise would causes financial market confidence falling as it hike the probability of default; investors disappointed and worried about their future return. Finally, capital flew and the currency will depreciate more.

Moreover, it will be a burden to domestic firms to their leveraging activity if interest rate climbing, as their repayment on the debt is getting higher. The domestic firms will not willing to borrow more loan to finance their business as the cost is high. Thus, it depressing firms' activity and so on economy activity too. Besides that, banking system will be affected too as lesser firms are borrowing loan where the bank survived on that. On the other hand, some firms may unable to service their debt as the interest rate are hiking too high and hence bankrupt. Consequently, it will

increasing the non-performancing loan of the bank and worsens the health of banking sector. The latter have a compounding effect on the economy since problems in the banking system may lead to credit crunches, disintermediation and bad allocation of credit (Baig & Goldfajn, 2002, p.15).

Figure 2: Revisionist relationship between interest rate and exchange rate



3.2.2 Stock prices

Stock prices can signals the confidence of investors towards an economy. It is a good proxy for reveal the investors' expectations of future profitability in the economy (Gould & Kamin, 2000). As Eijffinger and Karatas (2012) indicated that it can shows the market players' appetite on the domestic assets (p. 952). So, stock prices can affects the exchange rate as it represents the demand of investors. Notwithstanding with that, there has two contradictory theories on the relationship of exchange rate and stock prices, viz, traditional approach and portfolio approach.

3.2.2.1 Conventional approach/flow oriented model

This theory stipulated that stock prices are negatively affected by the NEER through current account or trade balance performance. In other words, a depreciation of currency will lead to higher stock prices. As stated by the Dornbusch and Fischer

(as cited by Stavarek, 2005), international competitiveness of a company and trade balance of a country will be affected by exchange rate fluctuations and thus affecting the economic variables. Meanwhile, stock prices, generally defined as a present value of future cash flows of companies, should adjust to the economic perspectives (Stavarek, 2005, p. 141). It means that a depreciated exchange rate would increase the international competitiveness of firm in trade[4] (comparatively cheaper export in world), subsequently boosting the firm's profit and finally hike the firm's share price (Ooi et al., 2009).

Figure 3: Conventional relationship between stock prices and exchange rate

3.2.2.2 Portfolio approach/stock oriented model

This model demonstrated that NEER is positively influenced by the stock prices via transaction of capital account. Under a circumstance of globally differentiated portfolios and of exchange rates play as tools to balance the demand and supply of domestic and foreign assets, domestic stock prices are expected to have a positive

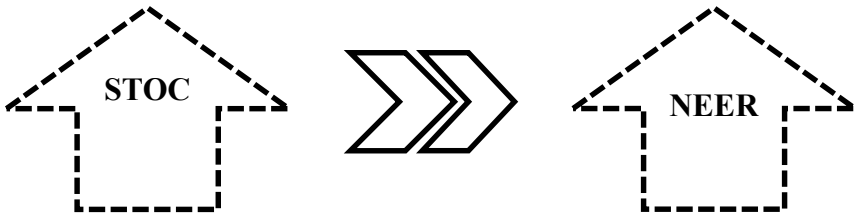
[4] Tabak (2006, p. 4) claimed that even firms that are not internationally integrated (low ratio of exports and imports to total sales and a low proportion of foreign currency-denominated assets and liabilities) may be indirectly affected.

effect on home currency. It can be explained into two manners, viz, direct and indirect manners.

In a direct manner, investors will be induced to purchase more domestic assets when stock prices are hiking. They will selling foreign assets to acquire home currency indispensable for purchasing new domestic stock. Thereby, it appreciates the home currency due to the increased demand of domestic currency (Stavarek, 2005).

Moreover, in that process, domestic interest rates will become higher as investors demand more on domestic currency. When the prices of domestic asset raise, it will increase the growth of wealth and further increase the demand for money by the investors (Rahman & Uddin, 2009, p.167). Eventually, it hiking the domestic interest rates. This increased interest rate will thus attract more foreign capital and so on the foreign demand for home currency (Krueger, as cited in Ooi et al., 2009). Finally, it appreciates NEER indirectly.

Figure 4: Portfolio's relationship between stock prices and exchange rate



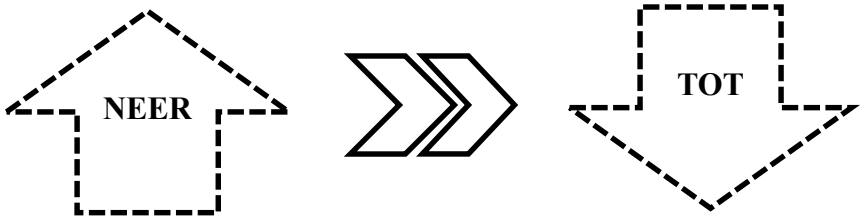
3.2.3 Terms of trade (TOT)

TOT is defined as the ratio of export price over the import price and can be one of the essential factors of exchange rate volatility (Eijffinger & Goderis, 2008). It can acts as an indicator of the current account of the countries (Feridun, 2004, p. 40). It is general to acknowledge the role of exchange rate play on TOT (traditional approach). However, the effect of TOT on exchange rate cannot be unambiguously ignored (Amano & Norden, 1995).

3.2.3.1 Conventional approach

The relationship of TOT and exchange rate is expected to be negatively correlated; a depreciated currency will increasing TOT. When the exchange rate (depreciation) become lower, the economy now gaining more international competitiveness on trade and thus prospering its export industry. Meanwhile, the depreciated home currency causes imported goods more expensive and thus people will likely to substitute the goods with the domestically produced goods (substitution effect) under ceteris paribus basis. By contrast, a lower NEER will leads to higher TOT.

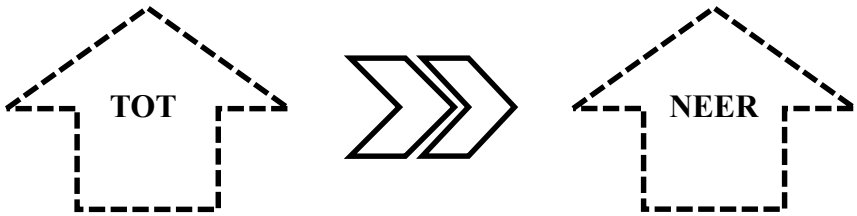
Figure 5: Conventional relationship between TOT and exchange rate



3.2.3.2 Revisionist approach

When TOT are improving (higher value), it indicated there has a higher demand for the home currency by foreign traders to pay for their commodities. Resulted from the higher demand of home currency, the exchange rate will become higher (appreciation). Hence, it shows that the exchange rate is positively explained by the TOT. In other words, a higher export would appreciate the NEER under ceteris paribus basis.

Figure 6: Revisionist relationship between stock prices and exchange rate



3.3 Testing procedures

This section introduce the methodology that would use to analyse the relationship of exchange rate and its determinants. These methodology including univariate unit root tests, cointegrating test and causality test based on VECM and VAR. All the tests are conducting by using the software of Eviews 4.

3.3.1 Univariate Unit Root Testing Procedure

Before proceeds to cointegration method, it is essential to verify that a series is stationary or not. It is important to examine the robustness of the integration properties of the variables to avoid superiority problems in regression (Granger & Newbold, 1974). Two unit root tests which share a common null hypothesis of a unit root are conducted. The first test is classical unit root test that is ADF unit root tests (Dickey & Fuller, 1979, 1981). The ADF test is based on the following regression:

$$\Delta y_t = \mu + \beta_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta y_{t-1} + \varepsilon_t \qquad (5)$$

where *t* is a linear time trend, Δ is the difference operator, β and γ are slope coefficients, and ε_t is the error term. The criterion selected for the ADF test is Akaike Information Criteria (AIC) proposed by Lutkepohl and Saikkonen (1999). They stated that employing AIC criterion for order selection may be a good compromise in a small sample simulation study (p. 26). It is suitable for this study since the crisis period are generally short.

Another unit root test for order of integration is Phillips and Perron (PP) (1988) unit root tests which it alters the test statistic so that no extra lags of the explained variable are required in the existence of serially-correlated errors. It is differ with ADF tests which using a parametric autoregression to estimate the ARMA structure of the errors in the test regression (Mahadeva & Robinson, 2004, p. 29). Besides that, PP test is also known as 'non-parametric' test since it presumes no functional form for the error process of the variable and applicable to compromise. According to Mahadeva and Robinson (2004, p. 29), P tests are robust to general forms of heteroskedasticity in the error term and also not to specify a lag length for the test regression. This test is based on the statistic:

$$\widetilde{t_a} = {t_a}^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{a}))}{2{f_0}^{1/2}s} \qquad (6)$$

Here $\hat{a}$ is the estimate,t_a, the t-ratio of α, *se* ($\hat{a}$) is coefficient standard error, *s* is the standard error of the test regression and $\gamma_0$is a consistent estimate of the error variance. The remaining term,f_0, is an estimator of the residual spectrum at frequency zero. The Newey-West using Bartlet kernel method is adopted to select appropriate lag length.

3.3.2 Cointegrating Test

In order to prove the existence of long run equilibrium among variables, the system-based cointegration method formulated by Johansen and Juselius (1990) is used in this study. As mentioned by Gonzalo (1994), this method is more robust than the Engle-Granger test as it does not count on the selection of normalisation. Besides that, Tang (2011, p. 205) stated that is not sensitive to the choice of dependent variables because it assumed that all variables are endogenous. The Johansen-Juselius cointegration approach can be employed as follow:

$$\Delta W_t = \Phi\, D_t + \Pi W_{t-1} + \Gamma_1 \Delta W_{t-1} + \cdots + \Gamma_{k-1} \Delta W_{t-k+1} + \mu_t \qquad (7)$$

where Δ is the first difference operator, W_t is (n-1) of endogenous and each of the A_i is an (n-n) matrix of parameters. The deterministic term D_t contains constants, a linear terms or seasonal dummies. Γ = - (I- $A1$ -…- A_i), (i=1, ... , k-1) and $\prod$ = - (I, A_1 -… A_k). This way of specifying the system contains information on both short and long run adjustments to changes in W_t, through the estimates of $\hat{\Gamma}$ and $\hat{\Pi}$, respectively. k is the lag structure and the error terms μ_t are assumed to be normally distributed and white noise.

Moreover, two likelihood ratio (LR) test statistics in this procedure are applied for the number of cointegrating vectors, viz, the trace test and the maximum eigenvalue test. The likelihood ratio statistic for the trace test is:

$$\tau_{trace}(r) = -T \sum_{i=r+1}^{p-2} \ln(1 - \lambda_i) \qquad (8)$$

where $\hat{\lambda}_{r+1}, \ldots, \hat{\lambda}_p$ are the smallest eigenvalues of estimated $p - r$. The null hypothesis for the trace eigenvalue test is that there are less than or equal to r cointegrating vectors against the alternative of at most r cointegrating vectors. On the other hand, the null hypothesis for the maximum eigenvalue test is that r cointegrating vectors are tested against the alternative of $r+1$ cointegrating vectors with the test statistic follow as:

$$\tau_{trace}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (9)$$

In addition, if the result of maximum eigenvalue tests is contradicts with the result of trace tests, maximum eigenvalue tests should be employed. This is because maximum eigenvalue tests seem to have smaller size distortions than the trace tests in specific situations (Lutkepohl, Saikkonen & Trenkler, 2002). Johansen and Juselius (1990) also stipulated that the results of the maximum eigenvalue test should be utilized if trace test and maximum eignevalue test yield dissimilar outcomes. It is because the power of maximum eigenvalue test is deem to be larger than the power of the trace test (Johansen & Juselius, 1990). In general, both maximum eigenvalue test and trace test share the same null hypothesis:

Null : has r cointegrating vector

Alternative : has $r+1$ cointegrating vector

3.3.3 Granger Causality Test

According to Granger (1986), Granger cause in at least one direction to hold the presence of long-run equilibrium relationship is existed if the variables are found to be cointegrated (Granger, 1986). Following with this, Granger causality test must be performed in VECM form to stay clear from problems of misspecification if the variables are cointegrated in the long run (Granger, 1988). Otherwise, standard first difference VAR model and standard Granger causality test should be experimented in the estimation. VECM is a restricted VAR designed for use with nonstationary series that are known to be cointegrated where it restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics (Eviews 4, 2002, p. 547). In other words, it used to differentiate between short run and long run Granger causality. To avert misspecification and neglect of the crucial constraints, the related error correction terms must be incorporated in the VAR. The presence of long run cointegrated linkage denotes that the residuals from the cointegration equation can be applied as an error-correction representation as follows:

$$\Delta NEER_t = \alpha_0 + \sum_{i=1}^{m} \beta_{1,i}\, \Delta NEER_{t-i} + \sum_{i=1}^{n} \beta_{2,i}\, \Delta INT_{t-i} + \sum_{i=1}^{o} \beta_{3,i}\, \Delta STOC_{t-i} + \sum_{i=1}^{p} \beta_{4,i}\, \Delta TOT_{t-i} + \mu_1\, ECT_{t-1} + \xi_1 \quad (10)$$

$$\Delta INT_t = \delta_0 + \sum_{i=1}^{n} \phi_{1,j}\, \Delta INT_{t-i} + \sum_{i=1}^{m} \phi_{2,i}\, \Delta NEER_{t-i} + \sum_{i=1}^{o} \beta_{3,i}\, \Delta STOC_{t-i} + \sum_{i=1}^{p} \beta_{4,i}\, \Delta TOT_{t-i} + \mu_2\, ECT_{t-1} + \xi_2 \quad (11)$$

$$\Delta STOC_t = \mu_0 + \sum_{i=1}^{o} \omega_{1,i}\, \Delta STOC_{t-i} + \sum_{i=1}^{m} \omega_{2,i}\, \Delta \mathrm{NEER}_{t-i} + \sum_{i=1}^{n} \omega_{3,i}\, \Delta INT_{t-i} + \sum_{i=1}^{p} \omega_{4,i}\, \Delta TOT_{t-i} + \mu_3\, ECT_{t-1} + \xi_3 \quad (12)$$

$$\Delta TOT_t = \theta_0 + \sum_{i=1}^{p} \gamma_{1,i}\, \Delta TOT_{t-i} + \sum_{i=1}^{m} \gamma_{2,i}\, \Delta \mathrm{NEER}_{t-i} + \sum_{i=1}^{n} \gamma_{3,i}\, \Delta INT_{t-i} + \sum_{i=1}^{o} \gamma_{4,i}\, \Delta STOC_{t-i} + \mu_4\, ECT_{t-1} + \xi_4 \quad (13)$$

where Δ is the first difference operator, $\alpha_0, \delta_0, \mu_0, \theta_0, \beta's, \phi's, \omega's\ and\ \gamma's$ are the estimated coefficients, *m*, *n*, *o* and *p* are the optimal lags of the series *NEER*, *INT*, *STOCK* and *TOT*, ξ_{it}'s are the serially uncorrelated random error terms while $\mu_1, \mu_2, \mu_3\ and\ \mu_4$ measure the reaction of *NEER* (*INT/ STOC/ TOT*) to a departure from equilibrium in a single period. In addition to the variables defined above, ECT_{t-1} is the one period lagged error-correction term derived from the cointegrating equation.

There are two sources of causation, i.e. short-run causality and long-run causality. The t-significance of the one period lagged error-correction term, ECT_{t-1} is normally used to determine the long-run causality and the speed of convergence to the long-run equilibrium if the system expose to shock. The standard first difference VAR model is employed when there is no long run cointegration. This simpler estimation of relationship is executable through the removal of ECT from the equations above. In short, it only comprises short run linkage information. The optimal lag in equations 10, 11, 12 and 13 are automatically selected by the software of EViews 4.

CHAPTER FOUR

EMPIRICAL ESTIMATION RESUTLS AND DISCUSSIONS[5]

4.0 Introduction

This chapter has reported the results of the methodology that are discussed in the chapter three. Besides that, the results for the selected ten economies are analysed based on their development status. It means that their results are categorized into developing economies and developed economies. In the first of this chapter, findings of unit root tests (ADF & PP) are presented before entering to the Johansen cointegrating tests. After the variables are found to be cointegrated in $I(1)$, then the series would proceeding to Granger causality in VAR if they are not cointegrated. If they are cointegtrated, Granger causality in VECM were conducted. After that, normalized cointegrating equations presented. Finally, all findings are summarized in conclusion.

4.1 Unit root tests

Regression results may be spurious if the variables has unit root (Granger & Newbold, 1974; Phillips, 1986). To avoid spurious estimation results, two unit root test was conducted to reaffirm the stationarity of the variables before proceeding any further approach. As Engle and Granger (1987) highlighted, only variables with the same order of integration could be examined for cointegration. These tests are ADF and PP unit root tests which to verify the stationarity or non-stationarity of the series of NEER, INT, STOC and TOT. The results of the unit root tests for developing

[5] The empirical analysis has been carried using the Eviews software in version 4.

economies are shown in Table 4 and Table 5 while for developed economies are presented in Table 6 and Table 7.

4.1.1 Unit root tests for developing economies

The results of unit root tests in levels form are reported in Table 4 while in first differences are shown in Table 5. Generally, all selected macroeconomic variables have unit roots at level form while they are stationary at the first differences. Although in the PP tests, the TOT in case of Philippine appeared stationary in level form but the ADF tests show it has unit root. Besides that, it is stationary in both of the ADF and PP tests at the first differences. Apart from that, the NEER in case of Thailand and the TOT in Turkey in ADF tests are stationary in level form but the PP tests proved that they are non-stationary. In addition, the variables are stationary at the first differences in both ADF and PP test. Hence, it can be concluded that all series are integrated of order one, $I(1)$, at 5 per cent significance level. It can proceeds to Johansen integration test. The results are consistent to Nelson and Plosser (1982)'s statement that most of the macroeconomic time series is stationary after first differencing but has unit root at level form.

Table 4: ADF and PP unit root tests (levels form) for developing economies

	Test Statistics			
	ADF_μ	ADF_τ	PP_μ	PP_τ
	Levels			
Malaysia[6]				
LNEER	-2.0481 (0)	-1.2938 (0)	-2.0454 (2)	-1.3042 (2)
LINT	-0.9125 (0)	-2.1734 (0)	-0.8658 (6)	-2.1292 (3)
LSTOC	-2.2719 (2)	-1.3665 (0)	-1.8643 (3)	-1.4470 (2)
Philippine				
LNEER	-1.7238 (0)	-3.0006 (7)	-1.6776 (1)	-2.1974 (1)
LINT	-1.8258 (0)	-1.9299 (0)	-1.9114 (1)	-2.0487 (1)
LTOT	0.4609 (8)	-0.8030 (8)	-3.6114 (1)*	-3.9330 (0)*
LSTOC	-1.9981 (0)	-1.9513 (0)	-1.9516 (1)	-2.02954 (1)
Russia[7]				
LNEER	-2.0540 (2)	-1.8973 (2)	-2.0524 (3)	-1.8588 (4)
LINT	-0.4690 (0)	-2.3855 (0)	-0.3552 (2)	-2.3855 (0)
LSTOC	-1.2307 (0)	-2.1200 (0)	-1.8213 (4)	-2.4288 (4)
Thailand				
LNEER	-3.4661 (8)*	-3.4624 (8)	-2.1838 (1)	-2.0627 (1)
LINT	-0.9742 (0)	-2.1832 (0)	-0.8025 (2)	-2.1302 (3)
LTOT	-0.8878 (1)	-2.2664 (1)	-0.3059 (3)	-1.6924 (3)
LSTOC	-2.1146 (1)	-2.2999 (1)	-2.1799 (1)	-2.3114 (0)
Turkey				
LNEER	-2.3074 (1)	-0.4899 (1)	-2.6092 (3)	0.1552 (1)
LINT	0.5272 (8)	-1.4007 (8)	-1.3512 (8)	-3.2723 (8)
LTOT	-2.3419 (0)	-3.6769 (0)*	-2.0010 (2)	-3.4158 (2)
LSTOC	-2.0281 (0)	-2.1505 (0)	-2.0426 (2)	-2.1902 (3)

Note: The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Refer to the main text for the notations. Asterisks (*) indicate statistically significant at 5 percent level. Figures in parentheses are the lag lengths. ADF and PP refer to Augmented Dickey-Fuller and Phillips-Perron unit root tests respectively. The optimal lag length for ADF test is selected using the AIC while the bandwidth for PP tests are selected using the Newey-West Bartlett kernel. The asymptotic and finite sample critical values for ADF and PP are obtained from MacKinnon (1996). Both the ADF and PP test examine the null hypothesis of a unit root against the stationary alternative. Δ denotes first difference operator.

[6] Data for TOT is unavailable.
[7] Data for TOT is unavailable.

Table 5: ADF and PP unit root tests (first differences) for developing economies

	Test Statistics			
	ADF_μ	ADF_τ	PP_μ	PP_τ
	First differences			
Malaysia[8]				
Δ LNEER	-5.9341 (0)*	-6.2958 (0)*	-5.9439 (3)*	-6.2944 (1)*
Δ LINT	-7.4279 (0)*	-7.3216 (0)*	-7.4396 (5)*	-7.3324 (5)*
Δ LSTOC	-5.0182 (0)*	-5.3240 (0)*	-4.9877 (1)*	-5.3057 (1)*
Philippine				
Δ LNEER	-3.8896 (0)*	-3.8446 (0)*	-3.8451 (3)*	-3.8035 (3)*
Δ LINT	-4.7011 (0)*	-4.6080 (0)*	-4.7010 (0)*	-4.6080 (0)*
Δ LTOT	-4.1288 (7)*	-4.6638 (7)*	-8.3453 (4)*	-8.2964 (4)*
Δ LSTOC	-4.4525 (0)*	-4.3670 (0)*	-4.4525 (0)*	-4.3670 (0)*
Russia[9]				
Δ LNEER	-5.5146 (1)*	-5.5256 (1)*	-3.5602 (23)*	-3.7290 (26)*
Δ LINT	-7.5214 (0)*	-7.5096 (0)*	-7.5378 (2)*	-7.5585 (3)*
Δ LSTOC	-3.8426 (0)*	-3.9435 (0)*	-3.9771 (3)*	-4.0762 (3)*
Thailand				
Δ LNEER	-3.4848 (6)*	-3.4489 (6)	-5.3861 (1)*	-5.4018 (2)*
Δ LINT	-9.8805 (0)*	-9.7302 (0)*	-9.4529 (2)*	-9.3183 (2)*
Δ LTOT	-3.9005 (0)*	-4.0357 (0)*	-3.9005 (0)*	-4.0357 (0)*
Δ LSTOC	-6.0622 (0)*	-5.9654 (0)*	-6.7189 (3)*	-6.6654 (3)*
Turkey				
Δ LNEER	-6.7519 (0)*	-7.2231 (0)*	-6.7519 (0)*	-7.0944 (4) *
Δ LINT	-4.9334 (7)*	-5.2797 (7)*	-14.4588 (8)*	-14.6829 (8)*
Δ LTOT	-11.1215 (1)*	-11.0787 (1)*	-15.1452 (12)*	-15.2276 (12)*
Δ LSTOC	-11.0400 (0)*	-11.1276 (0)*	-11.0413 (2)*	-11.1304 (2)*

Note: The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Refer to the main text for the notations. Asterisks (*) indicate statistically significant at 5 percent level. Figures in parentheses are the lag lengths. ADF and PP refer to Augmented Dickey-Fuller and Phillips-Perron unit root tests respectively. The optimal lag length for ADF test is selected using the AIC while the bandwidth for PP tests are selected using the Newey-West Bartlett kernel. The asymptotic and finite sample critical values for ADF and PP are obtained from MacKinnon (1996). Both the ADF and PP test examine the null hypothesis of a unit root against the stationary alternative. Δ denotes first difference operator.

[8] Data for TOT is unavailable.
[9] Data for TOT is unavailable.

4.1.2 Unit root tests for developed economies

The results of unit root tests in levels form are reported in Table 6 while in first differences are shown in Table 7. Generally, all selected macroeconomic variables for developed economies have unit roots at level form while they are stationary at the first differences. Although in the PP tests, TOT (Canada) and the NEER (South Korea) that allow for a drift and deterministic trend appeared stationary in level form but the ADF tests show it has unit root. Besides that, they are stationary in both of the ADF and PP tests at the first differences. Apart from that, the INT and TOT (Japan) that allow for a drift and deterministic trend and INT (South Korea) that allows a drift term in ADF test are stationary in level form but the PP test proved that they are non-stationary. In addition, the variables are stationary at the first differences in both ADF and PP tests. Lastly, the results in ADF tests appeared that NEER (Sweden) and INT (South Korea) that allow drift and deterministic trend are non-stationary in first differences. However, these variables in the model allows a drift term and PP tests suggested they are stationary. Therefore, it can be concluded that all series are integrated of order one, I (1), stationary at 5 per cent significance level. All series can progress to Johansen integration test. The results are consistent to Nelson and Plosser (1982)'s statement.

Table 6: ADF and PP unit root tests (levels form) for developed economies

	Test Statistics			
	ADF_{μ}	ADF_{τ}	PP_{μ}	PP_{τ}
		Levels		
Canada				
LNEER	-0.7013 (0)	-1.8648 (0)	-0.6998 (2)	-2.1126 (3)
LINT	-2.0471 (2)	-2.9106 (2)	-2.3158 (4)	-3.2512 (4)
LTOT	-0.9822 (0)	-2.7781 (6)	-1.3687 (3)	-4.7323 (3)*
LSTOC	-0.8807 (0)	-2.0225 (0)	-0.9403 (1)	-2.4670 (2)
Japan				
LNEER	-1.6040 (4)	-1.7439 (4)	-1.7996 (4)	-1.8680 (4)
LINT	-0.8174 (0)	-3.6459 (5)*	-0.8197 (2)	-2.5494 (0)
LTOT	-2.0634 (1)	-4.1517 (11)*	-1.7953 (4)	-1.9696 (4)
LSTOC	-0.9972 (1)	-1.3077 (1)	-0.8787 (4)	-1.2267 (4)
South Korea				
LNEER	-2.8269 (2)	-2.3218 (2)	-2.6698 (1)	-4.2332 (3)*
LINT	-6.8978 (6)*	-1.9962 (8)	-1.1425 (3)	-1.4728 (4)
LTOT	-0.5869 (0)	-2.8008 (0)	-0.3269 (8)	-2.5809 (8)
LSTOC	-1.9298 (1)	-1.2091 (0)	-1.4441 (2)	-1.4271 (2)
Sweden				
LNEER	-1.7674 (3)	-1.7838 (1)	-2.4746 (3)	-1.7070 (1)
LINT	-1.6984 (3)	-1.5031 (2)	-2.8441 (4)	-2.8969 (1)
LTOT	-0.2502 (0)	-2.1829 (0)	-0.4460 (2)	-2.2229 (1)
LSTOC	-2.4743 (0)	-1.9885 (0)	-2.5694 (3)	-1.9750 (3)
UK				
LNEER	-0.9688 (1)	-2.303 (1)	-1.1184 (2)	-1.9737 (3)
LINT	-1.7532 (4)	-1.8016 (4)	-2.9210 (4)	-3.2430 (4)
LTOT	-2.0354 (0)	-3.2741 (0)	-1.9558 (1)	-3.2355 (11)
LSTOC	-1.5761 (0)	-2.2420 (0)	-1.5761 (0)	-2.3032 (1)

Note: The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Refer to the main text for the notations. Asterisks (*) indicate statistically significant at 5 percent level. Figures in parentheses are the lag lengths. ADF and PP refer to Augmented Dickey-Fuller and Phillips-Perron unit root tests respectively. The optimal lag length for ADF test is selected using the AIC while the bandwidth for PP tests are selected using the Newey-West Bartlett kernel. The asymptotic and finite sample critical values for ADF and PP are obtained from MacKinnon (1996). Both the ADF and PP test examine the null hypothesis of a unit root against the stationary alternative. Δ denotes first difference operator.

Table 7: ADF and PP unit root tests (first differences) for developed economies

	Test Statistics			
	ADF_μ	ADF_τ	PP_μ	PP_τ
	First differences			
Canada				
ΔLNEER	-5.0815 (0)*	-5.0197 (0)*	-5.0713 (1)*	-5.0197 (0)*
ΔLINT	-3.0886 (0)*	-1.6538 (1)	-3.0672 (4)*	-4.0416 (4)*
ΔLTOT	-5.3688 (0)*	-5.1474 (0)*	-5.5634 (1)*	-5.2729 (1)*
ΔLSTOC	-4.6980 (0)*	-4.6485 (0)*	-4.6417 (5)*	-4.6427 (7)*
Japan				
Δ LNEER	-5.1705 (3)*	-5.1379 (3)*	-6.9061 (3)*	-6.8665 (3)*
Δ LINT	-9.2854 (0)*	-9.2382 (0)*	-9.2841 (3)*	-9.2357 (3)*
Δ LTOT	-5.0628 (1)*	-5.0537 (1)*	-5.2390 (3)*	-5.2957 (2)*
Δ LSTOC	-6.7704 (0)*	-6.7630 (0)	-6.7984 (2)*	-6.7339 (1)*
South Korea				
ΔLNEER	-7.0344 (1)*	-7.2996 (1)*	-9.5178 (4)*	-12.9589 (13)*
ΔLINT	-4.4503 (8)*	-1.6292 (6)	-5.3728 (3)*	-5.8431 (2)*
ΔLTOT	-5.6892 (1)*	-5.7420 (1)*	-6.5991 (11)*	-6.6156 (13)*
ΔLSTOC	-5.2997 (0)*	-5.3267 (0)*	-5.3912 (1)*	-5.4168 (1)*
Sweden				
Δ LNEER	-4.3622 (0)*	-1.2514 (0)	-4.3590 (1)*	-4.5634 (3)*
Δ LINT	-3.5156 (1)*	-4.1076 (1)*	-4.0087 (3)*	-4.8681 (2)*
Δ LTOT	-4.8584 (0)*	-4.9296 (0)*	-4.8519 (1)*	-4.9296 (0)*
Δ LSTOC	-5.9415 (0)*	-6.3807 (0)*	-5.9671 (4)*	-6.3726 (3)*
UK				
Δ LNEER	-6.9136 (0)*	-7.0601 (0)*	-7.2012 (5)*	-10.533 (12)*
Δ LINT	-8.1028 (0)*	-8.6360 (0)*	-7.7353 (4)*	-8.2538 (4)*
Δ LTOT	-7.3335 (0)*	-7.4978 (0)*	-7.4783 (6)*	-8.0070 (8)*
Δ LSTOC	-6.0622 (0)*	-5.9654 (0)*	-6.0640 (2)*	-5.9639 (2)*

Note: The subscript μ in the model allows a drift term while τ allows for a drift and deterministic trend. Refer to the main text for the notations. Asterisks (*) indicate statistically significant at 5 percent level. Figures in parentheses are the lag lengths. ADF and PP refer to Augmented Dickey-Fuller and Phillips-Perron unit root tests respectively. The optimal lag length for ADF test is selected using the AIC while the bandwidth for PP tests are selected using the Newey-West Bartlett kernel. The asymptotic and finite sample critical values for ADF and PP are obtained from MacKinnon (1996). Both the ADF and PP test examine the null hypothesis of a unit root against the stationary alternative. Δ denotes first difference operator.

4.2 Cointegration and Hypothesis Testing Results

Before proceeding to Johansen cointegration procedure, it is vital to determine the lag structure (k) for the VECM system as it has a large impact on the selection of number of cointegrating vectors in the system. For this reason, the optimal lag structure is automatically selected by the software, Eviews in version 4.

4.2.1 Cointegration test for developing economies

Table 8 reports the results of Johansen cointegration for developing economies with maximum eigenvalue tests and trace tests, at 5 per cent significance level. It is clearly shown that almost all economies cannot rejected the null hypotheses of maximum eigenvalue tests and trace tests. However, in the case of Russia, the results of the both tests are contradicting. The null hypothesis (r=0) in trace test is rejected and it cannot be rejected in maximum eigenvalue test. According to Lutkepohl et al. (2002), maximum eigenvalue tests seem to have smaller size distortions than the trace tests in specific situations. Johansen and Juselius (1990) also stipulated that the results of the maximum eigenvalue test should be utilized if trace test and maximum eignevalue test yield dissimilar outcomes. It is because the power of maximum eigenvalue test is deem to be larger than the power of the trace test (Johansen & Juselius, 1990). So, it can be concluded that there is no cointegrating vector between the variables in the case of Russia. Thus, there is no long run co-movement among the variables in all selected developing economies and proceed to Granger causality test in VAR.

Table 8: Johansen cointegration test for developing economies

Null	*Alternative*	*λ–max* *Johansen statistics*	*95% C.V.*	*Trace* *Johansen statistics*	*95% C.V.*
Malaysia			***k*=1 *r*=0**		
r = 0	r = 1	13.2811	20.97	21.5983	29.68
r ≤ 1	r = 2	6.0502	14.07	8.3171	15.41
r ≤ 2	r = 3	2.2669	3.76	2.2669	3.76
Philippine			***k*=1 *r*=0**		
r = 0	r = 1	21.8820	27.07	43.0239	47.21
r ≤ 1	r = 2	12.0046	20.97	21.1420	29.68
r ≤ 2	r = 3	5.8436	14.07	9.1373	15.41
r ≤ 3	r = 4	3.2937	3.76	3.2937	3.76
Russia			***k*=1 *r*=0**		
r = 0	r = 1	18.0699	20.97	*30.9766	29.68
r ≤ 1	r = 2	12.7767	14.07	12.9067	15.41
r ≤ 2	r = 3	0.1301	3.76	0.1301	3.76
Thailand			***k*=1 *r*=0**		
r = 0	r = 1	24.1607	27.07	40.1613	47.21
r ≤ 1	r = 2	11.5673	20.97	16.0007	29.68
r ≤ 2	r = 3	4.3127	14.07	4.4334	15.41
r ≤ 3	r = 4	0.1207	3.76	0.1207	3.76
Turkey			***k*=4 *r*=0**		
r = 0	r = 1	15.7273	27.07	39.9490	47.21
r ≤ 1	r = 2	13.5812	20.97	24.2220	29.68
r ≤ 2	r = 3	6.9470	14.07	10.6408	15.41
r ≤ 3	r = 4	3.6938	3.76	3.6938	3.76

Note: Asterisks (*) denote statistically significant at 5 percent level. *k* is the lag length and *r* is the cointegrating vector (s).

4.2.2 Cointegration test for developed economies

Table 9 reports the results of Johansen cointegration for developed economies with maximum eigenvalue tests and trace tests, at 5 per cent significance level. It is revealed that there is no long run relationship among the variables in case of Japan, Sweden and UK. However, there has one long run cointegrating vector in case of Canada as the null hypothesis (r=0) of both tests are rejected. Furthermore, the results based on maximum eigenvalue tests (according to Johansen & Juselius, 1990; Lutkepohl et al., 2002) suggest that there has two long run cointegrating vectors in case of South Korea. Hence, variables in Japan, Sweden and UK proceed to Granger causality test in VAR while variables in Canada and South Korea proceed to Granger causality test in VECM.

Table 9: Johansen cointegration test for developed economies

Null	*Alternative*	*λ–max* *Johansen statistics*	*95% C.V.*	*Trace* *Johansen statistics*	*95% C.V.*
Canada			***k*=1 *r*=1**		
r = 0	r = 1	*35.7804	27.07	*60.5667	47.21
r ≤ 1	r = 2	12.8169	20.97	24.7862	29.68
r ≤ 2	r = 3	8.6888	14.07	11.9693	15.41
r ≤ 3	r = 4	3.2805	3.76	3.2805	3.76
Japan			***k*=2 *r*=0**		
r = 0	r = 1	15.6741	27.07	36.7813	47.21
r ≤ 1	r = 2	15.3126	20.97	21.1072	29.68
r ≤ 2	r = 3	5.7895	14.07	5.7946	15.41
r ≤ 3	r = 4	0.0050	3.76	0.0050	3.76
South Korea			***k*=1 *r*=1**		
r = 0	r = 1	*35.1445	27.07	*76.4567	47.21
r ≤ 1	r = 2	*25.0337	20.97	*41.3122	29.68
r ≤ 2	r = 3	13.7188	14.07	*16.2785	15.41
r ≤ 3	r = 4	2.5597	3.76	76.4567	3.76
Sweden			**k=1 r=0**		
r = 0	r = 1	19.5852	27.07	39.2342	47.21
r ≤ 1	r = 2	11.4320	20.97	19.6490	29.68
r ≤ 2	r = 3	5.9579	14.07	8.2170	15.41
r ≤ 3	r = 4	2.2591	3.76	2.2591	3.76
UK			***k*=1 *r*=0**		
r = 0	r = 1	17.7603	27.07	40.8418	47.21
r ≤ 1	r = 2	13.8249	20.97	23.0814	29.68
r ≤ 2	r = 3	9.1910	14.07	9.2565	15.41
r ≤ 3	r = 4	0.0655	3.76	0.0655	3.76

Note: Asterisks (*) denote statistically significant at 5 percent level. *k* is the lag length and *r* is the cointegrating vector (s).

4.3 Causality analysis

4.3.1 Causality analysis for developing economies

The Table 10 has reported the results of Granger causality tests for selected developing economies, based on 5 per cent significance level. For each economy excluding Malaysia, there has at least one short run causality running among the variables. Based on the results, no evidence is found for the relationship of the variables in context of Malaysia.

For the case of Philippine, there has three direct uni-directional Granger causality running from LINT to LTOT, from LNEER to LTOT, and from LSTOC to LNEER. Besides that, LTOT is affected by LSTOC indirectly through LNEER. This means that in Philippine, TOT were affected by interest rate, exchange rate and stock prices while exchange rate was influenced by stock prices during the crisis period, at least in the short run. The causality directions are illustrated in Figure 7.

In the Russia, there has two uni-directional Granger causality running from LSTOC to LNEER and from LNEER to LSTOC. It implied in the short run, there has feedback relationship between the exchange rate and stock prices during turbulent period. The causality directions are showed in Figure 8.

Apart from that, LSTOC is affected by LTOT and LTOT is impacted by LNEER, in the crisis episode happened in Thailand. It inferred that the Thailand TOT is directly influenced by exchange rates and Bangkok's stock prices are indirectly affected by

exchange rate over the short periods. Their causality directions are presented in Figure 9.

Lastly, the results shown that LNEER in Turkey is impacted by all selected variables: LINT, LSTOC and LTOT during crisis period, in the short run. Moreover, it also proved that LTOT has its effect on LSTOC during the period. The causality directions of variables are demonstrated in Figure 10.

Table 10: Granger causality results for developing economies

Dependent Variables	*Δ LNEER*	*Δ LINT*	*Δ LSTOC*	*Δ LTOT*
		χ^2-statistics (p-value)		
Malaysia				
Δ LNEER	--	0.2600 (0.6101)	0.8218 (0.3647)	--
Δ LINT	0.6575 (0.4174)	--	1.1777 (0.2778)	--
Δ LSTOC	0.0519 (0.8197)	2.1764 (0.1401)	--	--
Philippine				
Δ LNEER	--	0.0065 (0.9356)	9.4645 (0.0021)*	0.7045 (0.4013)
Δ LINT	0.9629 (0.3265)	--	2.1282 (0.1446)	2.6394 (0.1042)
Δ LSTOC	0.2009 (0.6540)	1.2463 (0.2643)	--	0.0003 (0.9856)
Δ LTOT	4.8755 (0.0272)*	5.6171 (0.0178)*	2.1862 (0.1393)	--
Russia				
Δ LNEER	--	1.1664 (0.2801)	4.7533 (0.0292)*	--
Δ LINT	0.0000 (0.9998)	--	0.5427 (0.4613)	--
Δ LSTOC	8.6172 (0.0033)*	1.8377 (0.1752)	--	--
Thailand				
Δ LNEER	--	0.2076 (0.6486)	2.4696 (0.1161)	0.2347 (0.6280)
Δ LINT	0.3707 (0.5426)	--	1.2555 (0.2625)	0.4292 (0.5124)
Δ LSTOC	0.0259 (0.8721)	1.2656 (0.2606)	--	5.7990 (0.0160)*
Δ LTOT	9.1596 (0.0025)*	2.0356 (0.1537)	2.9381 (0.0865)	--
Turkey				
Δ LNEER	--	29.858 (0.0000)*	15.253 (0.0042)*	10.3354 (0.0351)*
Δ LINT	2.3853 (0.6653)	--	8.0954 (0.0881)	0.7001 (0.9513)
Δ LSTOC	7.2342 (0.1240)	3.8099 (0.4323)	--	9.6750 (0.0463)*
Δ LTOT	2.6995 (0.6093)	0.6420 (0.9583)	4.6316 (0.3272)	--

Note: Asterisks (*) indicate statistically significant at 5 percent level. The χ^2-statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term(s). Δ is the first different operator. Figures in parentheses are the *p*-values.

Figure 7: Philippine's short run causality direction

Direct: a) LSTOC → LNEER
b) LNEER→ LTOT
c) LINT → LTOT
Indirect: LSTOC → LTOT

Note: LSTOC→ LNEER implies one-way causality.

Figure 8: Russia's short run causality direction

Direct: a) LNEER→ LSTOC
b) LSTOC→ LNEER

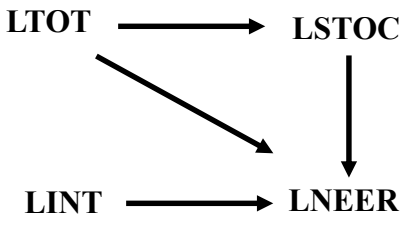
Note: LNEER→ LSTOC implies one-way causality.

Figure 9: Thailand's short run causality direction

Direct: a) LNEER→ LTOT
b) LTOT → LSTOC
Indirect: LNEER → LSTOC

Note: LNEER→ LTOT implies one-way causality.

Figure 10: Turkey's short run causality direction



Direct: a) LTOT → LSTOC
b) LTOT → LNEER
c) LSTOC → LNEER
d) LINT → LNEER
Indirect: LTOT → LNEER

Note: LINT→ LNEER implies one-way causality.

4.3.2 Causality analysis for developed economies

4.3.2.1 Long run Granger causality for developed economies

The results is reported in Table 11. For the case of Canada, the ECT shown that there is only one long run cointegrating vector when LINT acts as dependent variable as it is statistically significant at 5 per cent level. This implies interest rate is uni-directional Granger caused by the exchange rate, stock prices and TOT in the long-run. This is consistent with the earlier result of contegration test which there is only one cointegrating vector between the variables. Besides that, the speed of adjustment to long run equilibrium, as estimated by the ECT coefficient following a disturbance is 0.0192. The magnitude of the coefficients implied that Canada (1.92 %) required around 52 months (4.33 years) adjust to long run equilibrium due to short run adjustments. This suggests that LINT solely bears the responsibility of short run adjustment to bring about the long run equilibrium. In other words, the INT acts as the initial receptor of any exogenous shocks that disturb the equilibrium system.

For the Korea, the ECT shown that there has two long run cointegrating vector when LNEER and LTOT acted as dependent variable. They are statistically significant at 5 per cent level. This implies when exchange rate been the dependent variable, it would affected by the interest rate, stock prices and TOT in the long-run. At the same time, it also implied TOT is uni-directional Granger caused by the exchange rate, stock prices and interest rate over the long period. This is consistent with the earlier result of contegration test which there are two cointegrating vector between the variables. Apart from that, the adjustment speed of LNEER and LTOT to long run equilibrium, as estimated by the ECT coefficient following a disturbance is 0.0856

and 0.0523. The magnitude of the coefficients implied that LNEER (8.56 %) required around 12 months adjusted to long run equilibrium due to short run adjustments. Subsequently, the magnitude of LTOT (5.23 %) suggests that about 19 months are needed for the variable to stabilize in equilibrium over long run due to short run adjustments. This suggests that LNEER and LTOT are solely bear the responsibility of short run adjustment to bring about the long run equilibrium. In other words, the LNEER and LTOT are the initial receptors of any exogenous shocks that disturb the equilibrium system.

4.3.2.2 Short run Granger causality for developed economies

The Table 11 has reported the results of Granger causality tests for selected developed economies based on 5 per cent significance level. For each of the economy, there has at least two short run causality running among the variables. Some of the causality directions are consistent with the theories while some of them are contradictory.

In the Canada, it is found that there has four direct uni-directional Granger causality running in the short run: from LSTOC to LTOT, from LSTOC to LNEER, from LSTOC to LINT and from LNEER to LINT. The interest rate was affected by stock prices and exchange rate separately while exchange rate and TOT were been impacted by stock prices. This causality directions are illustrated in Figure 11.

For the case of Japan, there has three direct uni-directional Granger causality running from LINT to LNEER, from LSTOC to LINT, and from LSTOC to LNEER. This means that in Japan, exchange rate were directly affected by interest rate and stock prices while stock prices are influencing interest rates during the crisis period, at least in the short run. The causality directions are illustrated in Figure 12.

In the context of South Korea, there has two uni-directional Granger causality running from LSTOC to LNEER and from LNEER to LSTOC. It implied in the short run, there has feedback relationship between the exchange rate and stock prices during turbulent period. The causality directions are showed in Figure 13.

In the Sweden, there has three uni-directional Granger causality (running from LNEER to LINT, from LNEER to LTOT and from LTOT to LINT) and one bi-directional Granger causality (LNEER and LSTOC). The traditional views that TOT impacted by exchange rate are hold in the case of Sweden. However, the causality direction between exchange rate and stock prices is still vague since they were Granger cause to each other. The causality directions are showed in Figure 14.

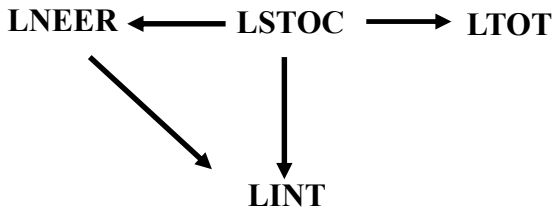
On the other hand, the results in case of UK shown that LNEER is directly impacted by interest rate while LTOT has its effect on LINT over short crisis period. It implied that LTOT has indirect effect on LNEER via LINT during the period. The causality directions of variables are demonstrated in Figure 15.

Table 11: Granger causality results for developed economies

Dependent Variables	*Δ LNEER*	*Δ LINT*	*Δ LSTOC*	*Δ LTOT*	*ECT*	
		χ^2-statistics (p-value)			*Coefficient*	*t-ratio*
Canada						
Δ LNEER	--	0.2007 (0.6542)	24.0018 (0.0000)*	0.7594 (0.3835)	0.0004	0.7690
Δ LINT	25.5905 (0.0000)*	--	9.4962 (0.0021)*	1.6957 (0.1929)	-0.0192	-6.8421*
Δ LSTOC	0.7278 (0.3936)	0.4450 (0.5047)	--	0.1461 (0.7023)	0.0012	0.8206
Δ LTOT	0.1381 (0.7102)	0.3447 (0.5571)	6.1059 (0.0135)*	--	0.0001	-0.1933
Japan						
Δ LNEER	--	6.9364 (0.0312)*	7.2883 (0.0261)*	0.2567 (0.8795)	--	--
Δ LINT	5.1722 (0.0753)	--	7.4314 (0.0243)*	0.3889 (0.8233)	--	--
Δ LSTOC	0.7646 (0.6823)	4.4251 (0.1094)	--	4.9021 (0.0862)	--	--
Δ LTOT	0.0756 (0.9629)	3.7641 (0.1523)	1.9348 (0.3801)	--	--	--
South Korea						
Δ LNEER	--	0.6008 (0.4383)	4.3890 (0.0362)*	0.0141 (0.9056)	-0.0856	-3.5759*
Δ LINT	2.1204 (0.1453)	--	0.6134 (0.4335)	0.0120 (0.9129)	0.0928	1.2615
Δ LSTOC	19.9760 (0.0000)*	1.7933 (0.1805)	--	0.3649 (0.5458)	0.1514	1.8379
Δ LTOT	0.1868 (0.6656)	2.1239 (0.1450)	0.8292 (0.3625)	--	-0.0523	-2.3057*
Sweden						
Δ LNEER	--	3.2134 (0.0730)	3.9152 (0.0479)*	0.7328 (0.3920)	--	--
Δ LINT	8.3229 (0.0039)*	--	1.1863 (0.2761)	6.3951 (0.0114)*	--	--
Δ LSTOC	7.0442 (0.0080)*	0.9820 (0.3217)	--	0.0127 (0.9104)	--	--
Δ LTOT	6.3521 (0.0117)*	2.2866 (0.1305)	1.8825 (0.1700)	--	--	--
UK						
Δ LNEER	--	5.4222 (0.0199)*	2.2693 (0.1320)	0.1040 (0.7470)	--	--
Δ LINT	1.5387 (0.2148)	--	1.9915 (0.1582)	5.5895 (0.0181)*	--	--
Δ LSTOC	0.2305 (0.6311)	2.4890 (0.1146)	--	0.6960 (0.4041)	--	--
Δ LTOT	1.7154 (0.1903)	0.0986 (0.7535)	0.6127 (0.4338)	--	--	--

Note: Asterisks (*) indicate statistically significant at 5 percent level. The χ^2-statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term(s). Δ is the first different operator. Figures in parentheses are the *p*-values and figures in brackets are *t*- statistics.

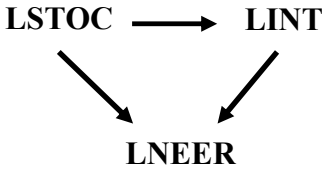
Figure 11: Canada's short run causality direction



Direct: a) LSTOC → LTOT
b) LSTOC→ LNEER
c) LSTOC → LINT
d) LNEER→ LINT
Indirect: LSTOC → LINT

Note: LSTOC→ LTOT implies one-way causality.

Figure 12: Japan's short run causality direction



Direct: a) LSTOC → LNEER
b) LINT → LNEER
c) LSTOC → LINT
Indirect: LSTOC → LNEER

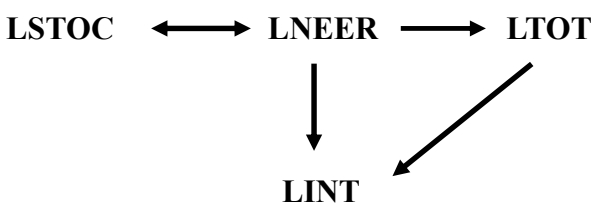
Note: LSTOC→ LNEER implies one-way causality.

Figure 13: South Korea's short run causality direction

Direct: a) LNEER → LSTOC
b) LSTOC → LNEER

Note: LNEER→ LSTOC implies one-way causality.

Figure 14: Sweden's short run causality direction



Direct: a) LNEER → LSTOC
b) LNEER → LINT
c) LNEER → LTOT
d) LSTOC → LNEER
e) LTOT → LINT
Indirect: a) STOC → LTOT
b) LSTOC → LINT
c) LNEER → LINT

Note: LSTOC→ LNEER implies one-way causality.

Figure 15: UK's short run causality direction

Direct: a) LTOT→ LINT
b) LINT→ LNEER
Indirect: LTOT → LNEER

Note: LTOT→ LINT implies one-way causality.

4.4 Normalized cointegrating equation

From the equation, the magnitude between the exchange rate and selected macroeconomic variables during crisis can be known. The selected economies are categorised into two groups, developing economies (Table 12) and developed economies (Table 13). The effect of each variable on exchange rate in each economy are discussed within the group when there is one per cent changes of exchange rate, based on 5 per cent significance level.

4.4.1 Developing economies

For the relationship between the exchange rate and interest rate, Philippine, Thailand and Turkey support the sign of the traditional view (positive related). However, the sign of revisionist view (negative correlated) is hold in case of Malaysia and Russia. Among the economies, the relationship is only statistically significant in Philippine and Malaysia where the interest rate has largest impact on exchange rate in the sample of Philippine (0.238%) while it has the least impact in Malaysia (0.155%).

Apart from that, there is a negative linkage between the exchange rate and stock prices in Malaysia, Philippine and Thailand where support the sign of the traditional view. Nonetheless, there is a positive linkage between the variables in economy of Russia and Turkey. From the Table 12, it shown that the dynamic linkage is statistically significant in all chosen economies excluding Russia. The effect of stock prices to the exchange rate is largest in Turkey (0.716%) while it is smallest in Philippine (0.190%).

Last but not least, TOT is negatively associated with the exchange rate in sample of Philippine and Turkey. Despite that, TOT has the positive association with the exchange rate in case of Thailand where the sign of revisionist theory is hold. The association is statistically significant in all selected economies. Amidst the developing economies, TOT has most significant largest weight on exchange rate in Turkey (4.362%) and has significant negligible weight in Philippine (0.682%).

Table 12: Normalized equation for developing economies

Economy	*LNEER*	*LINT*	*LSTOC*	*LTOT*
Malaysia	1.0000	- 0.1551*	- 0.2434*	--
Philippine	1.0000	+ 0.2380*	- 0.1898*	- 0.6815*
Russia	1.0000	- 0.0255	+ 0.0728	--
Thailand	1.0000	+ 0.0112	- 0.7072*	+ 2.1614*
Turkey	1.0000	+ 0.5036	+ 0.7156*	- 4.3619*

Note: Asterisks (*) indicate statistically significant at 5 percent level.

4.4.2 Developed economies

For the relationship between the exchange rate and interest rate, only sample of Sweden supports the sign of the traditional view (positive related). However, the sign of revisionist view (negative related) is hold in the rest of economies: Canada, Japan, South Korea and UK. Among the economies, their connection is statistically significant only in Japan, South Korea and Sweden. The interest rate has largest impact on exchange rate in Sweden (1.348%) while it has negligible impact in Japan (0.003%).

Apart from that, there is a negative connection between the exchange rate and stock prices in Canada, South Korea and UK where only the sign of the traditional

view is supported. Nonetheless, these variables are positively connected in Japan and Sweden. Despite of that, the connection is just statistically significant in case of Canada and South Korea. The effect of stock prices to the exchange rate is largest in South Korea (0.360%) and smallest in Canada (0.173%).

Last but not least, TOT is negatively related with the exchange rate in sample of Canada, Sweden and UK. In spite of that, TOT has the positive relationship with the exchange rate in case of Japan and South Korea where the sign of revisionist theory is hold. The relationship is statistically significant in all studied economies. TOT has greatest weight on exchange rate in Sweden (7.173%) and has smallest weight in Canada (0.827%).

Table 13: Normalized equation for developed economies

Economy	*LNEER*	*LINT*	*LSTOC*	*LTOT*
Canada	1.0000	- 0.0031	- 0.1727*	- 0.8268*
Japan	1.0000	- 0.0777*	+ 0.2566	+ 5.4683*
South Korea	1.0000	- 0.3174*	- 0.3599*	+ 1.2583*
Sweden	1.0000	+ 1.3477*	+ 0.5165	- 7.1726*
United Kingdom	1.0000	- 0.0866	- 0.0720	- 2.0519*

Note: Asterisks (*) indicate statistically significant at 5 percent level.

4.5 Conclusion

The findings of unit root tests, Johansen cointegration test, Granger causality in VAR and VECM and normalized cointegrating equation were presented in this chapter. For each selected macroeconomic variables within every economy either in developing economies or developed economies, all series are stationary in $I(1)$ and has unit root in level form. Both the ADF and PP unit root tests had proved the status of the series in $I(1)$.

After the unit root tests, all developing economies are not cointegrated in the long run as they cannot reject the null hypothesis of Johansen cointegration test at 5 per cent significance level. Notwithstanding all developing economies are proceeding to Granger causality in VAR, developed economies have different story after the cointegration tests. The results of the cointegration tests suggest that there is no long run cointegrating vector in the case of Japan, Sweden and UK. So, these economies were continuing to Granger causality in VAR. However, the relationship of the selected variables are cointegrated in the Canada and South Korea over long period. Then these two economies were moving to Granger causality in VECM.

In the ten economies studied in the short run, there has five economies proved that the relationship between exchange rate and TOT. The relationship is existed in three developing economy and in two developed economies. Their relationship is statistically significant in all economies mentioned above. Besides that, the dynamic linkage between stock prices and exchange rate is found in eight sample economies though only five of them are statistically significant. The dynamic linkage is hold in four developing group while the rest is located in developed group. Moreover, the causality from interest rate to exchange rate is only found in three sample economies where two in developed economies and one in developing economies. However, the causality is just statistically significant in one economy.

On the other hand, there is one long run cointegrating vector found in the case of Canada while the results also suggest that there has two long run relationship in the

South Korea. Among the three long run relationship, only the sample of Korea shows that the exchange rate has long run causality with other variables. Last but not least, it is importantly noted that there is neither short run or long run relationship among the variables are found in the case of Malaysia. The findings is consistent with the Brailsford et al. (2006) as they stated that authority of Malaysia does not implement tighter monetary policy during the crisis.

In the nutshell, the traditional view of the relationship between exchange rate and interest rate was held in the Turkey while revisionist theory is existed in Japan and UK. Notwithstanding with that, the relationship is just statistically significant in case of Japan where revisionist theory is supported. Apart from that, the conventional approach of the association between exchange rate and stock prices was held in Thailand, Russia, South Korea and Sweden but only statistically significant in Thailand and South Korea. Nevertheless, Japan, Russia, Turkey and Sweden supported the revisionist approach; it is just statistically hold in Turkey. The approach is also significant in Canada, Philippine and South Korea but it appeared opposite sign Lastly, conventional theory for the linkage between the exchange rate and TOT is statistically significant and evident in Philippine and Sweden; It exhibited in Thailand too but in different sign. On the contrary, the causality direction of revisionist theory is statistically significant in Turkey and UK but none of them showed the same sign as stipulated in the theory.

CHAPTER FIVE

CONCLUSION

5.0 Introduction

A summary of this study has been presented in this chapter. Moreover, the policy recommendation for the policy makers was suggested in latter part of this chapter. Other than that, the limitation on this study has been stated and the suggestion was given for the future study.

5.1 Conclusion

This dissertation examined the determinants of exchange rate during the banking crisis and currency crisis periods. In this context, three macroeconomic variables were selected due to their controversial causality with the exchange rate and also based on their importance to the currency value: interest rate, stock prices and TOT. Furthermore, this study contributes to the literature by carry out separate analysis within and between developing economies and developed economies to differentiate the causality of selected variables with exchange rate. Five economies in each group were chosen during the crisis happened within the period of 1990 to 2012.

In short, the relationship between the exchange rate and its selected macroeconomic variables are still controversial. The empirical findings appeared mixed between the traditional theory and revisionist theory. Most of the variables just have the short run relationship in most of the sample economies. However, the

variables have neither short run nor long run relationship in the case of Malaysia which is in line with the Brailsford et al.'s (2006) findings.

There is little consistent evidence regarding the impact of interest rate and exchange rate during the crisis period. Their relationship is just found in three economies over the ten economies studied; two is negative and in developed economies; one is positive and in developing economy. It is consistent with the studies of Cho and West (2003), Eijffinger and Goderis (2008), Eijffinger and Karatas (2012) where acquired a mixed result of the relationship. Among the three economies, the relationship is only significant in case of Japan. The insignificant of interest rate effects in other economies may interfered by other macroeconomic variables that will affect the exchange rate.

Besides that, the empirical findings suggested that stock prices impact the exchange rate significantly in positive way as stated in the stock oriented model. The findings is compatible with Coudert et al. (2008), Ooi et al. (2009), Stavarek (2005) and Tabak (2006). The relationship had been observed in the case of Turkey during the crisis period. The causality direction of stock oriented model was significantly observed in Canada, Philippine and South Korea but it appeared negative sign in these economies. As stipulated by Stavarek (2006), the negative sign may imply that stock prices and exchange rate are independent variables which are not influenced by same elements. Notwithstanding that, the traditional approach was significant seen in the Thailand and South Korea. It is important to note that the simultaneous feedback

direction between stock prices and exchange rate is significantly existed in South Korea.

In addition, the exchange rate would not be affected by TOT, as proven in the estimation results. This is differ with the findings of some researchers (Amano & Van Norden, 1995; Lane & Miles-Ferretti, 2001; Zhang, 1996) who support the revisionist theory. Although causality direction was showed in Turkey and UK but it appeared opposite sign with the revisionist theory. Other than that, the traditional theory – any changes in exchange rate will leads to variation of TOT was hold in the sample of Philippine and Sweden and in line with Arize's (1994) findings.

In conclusion, the impact of stock prices on exchange rate during crisis shared the same weight with interest rate; their relationship is only evident in one economy. Meanwhile, TOT has no significant effect on the exchange rate in turbulent period. It is observed that traditional approach of stock prices and of TOT is more significant compared to the revisionist approach.

5.2 Policy implication

The main policy implication according to the findings is that there is no one single policy valid for every economy due to their disparities in economic fundamentals. For the effect of interest rate on exchange rate, the impact is only significant in three economies out of ten economies and it is more significant in the developed economy rather than in developing economy. Moreover, the sign is totally different between the groups. The similar situation is also facing by the relationship between TOT and exchange rate and between stock prices and exchange rate. Thus, policy makers should be noted that the same policy applicable in the foreign economy might not work in their domestic economy. They should carry out the determinants of their exchange rate during crisis and stabilize it in order to recover more quickly from the consequences of the crisis or even prevent the happening of it.

Besides that, for those economies that have significant relationship between the stock prices and exchange rates, the authorities should improve the transparency and accountability of their financial market. It can prevent the volatility of their currency value and provide a stable investment environment to strengthen the confidence of investors, especially after impacted by crisis.

5.3 Limitation and the avenues for future research

For the further research, more determinants of the exchange rate should be incorporated as they might be important to influence the exchange rate such as foreign currency reserve, domestic money supply, inflation rate etc. As monetary authority probable would apply others monetary policy other than interest rate to stabilize their currency value or others fiscal policy to recover from the impact of crisis, these macroeconomic variables should be applied into model. Besides that, a higher frequency data (daily data/intraday data) and longer span of period should be employed to better observe their relationship. The monthly data is possible and incapable to reveal the relationship as monetary authority usually hike the interest rate overnight and just hold for few months to defend the exchange rate in the crisis period. In addition, non-linear relationship should be extended in the model since this study only emphasize on the linear relationships.

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APPENDICES

Appendix A

Table A1
Crisis episodes.

Economy	Period
Canada	2008M10-2011M07
Japan	1996M01-2003M05
Malaysia	1997M01-2000M09
Philippine	1997M07-2001M09
Russia	2008M01-2011M12
South Korea	1997M11-2001M11
Sweden	1992M12-1996M01
Thailand	1997M01-2000M12
Turkey	1995M01-2005M05
United Kingdom	1992M10-1996M01

Appendix B

Table B1
Nominal effective exchange rates (NEERs)

Economy	Nominal effective exchange rates	Source
Canada	NEER based on consumer price index	Datastream
Japan	Japanese yen NEER	Datastream
Malaysia	NEER based on consumer price index	Datastream
Philippine	NEER based on consumer price index	Datastream
Russia	NEER based on consumer price index	Datastream
South Korea	NEER	GEM
Sweden	NEER based on consumer price index	Datastream
Thailand	NEER index NADJ	Datastream
Turkey	Effective exchange rate: broad (41 partners) - nominal NADJ	Datastream
United Kingdom	NEER based on consumer price index	Datastream

Note: GEM is Global Economic Monitor, World Bank.

Table B2
Money market interest rates.

Economy	Money market interest rates	Code
Canada	CIDOR 1 month - middle rate	CIDOR1M
Japan	Uncollater. overnight - middle rate	JPCALLO
Malaysia	Interbank overnight - middle rate	MYIBKCL
Philippine	Lending - middle rate	PHLENDR
Russia	Deposit rate overnight - middle rate	RSDEPON
South Korea	Overnight call rate (brokered) - middle rate	KOCALLO
Sweden	Repo - middle rate	SDREPOR
Thailand	Interbank o/n (BT) - middle rate	THBTIBN
Turkey	Interbank overnight - middle rate	TKIBKON
United Kingdom	EURO-1m (ft/icap/tr) - middle rate	ECUKP1M

Note: All series are obtained from Datastream.

Table B3
Terms of Trade (TOT).

Economy	Terms of Trade	Code
Canada	TOT	-
Japan	Terms of trade index NADJ	JPTOTPRCF
Philippine	Terms of trade (disc.) NADJ	PHTOTPRCF
South Korea	Net barter terms of trade index (disc.) NADJ	KONETT00F
Sweden	Terms of trade NADJ	SDTOTPRCF
Thailand	Terms of trade index(disc.) NADJ	THTOTT95F
Turkey	TOT	-
United Kingdom	Terms of trade - export/import prices (bop basis) NADJ	UKTOTPRCF

Note: Series of South Korea and Turkey are obtained from Global economic monitor, World Bank while other series are retrieved from the Datastream.

Table B4
Stock prices.

Economy	Stock prices	Source	Code
Canada	Toronto stock exchange composite share price index (EP) NADJ	Datastream	CNSHRPRCF
Japan	Stock markets, us$	GEM	DSTKMKTXD
Malaysia	Stock markets, us$	GEM	DSTKMKTXD
Philippine	Stock markets, us$	GEM	DSTKMKTXD
Russia	MICEX share price index NADJ	Datastream	RSOSP001F
South Korea	KSE KOSPI index NADJ	Datastream	KOOSP001F
Sweden	share prices: AFGX index NADJ	Datastream	SDOSP001F
Thailand	Bangkok stock exchange price index (EP) NADJ	Datastream	THSHRPRCF
Turkey	ISE national 100 share price index NADJ	Datastream	TKSHRPRCF
United Kingdom	Market price index (EP)	Datastream	UKSHRPRC

Note: GEM is Global economic monitor, World Bank.