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匯率波動對泰國貿易的影響

Impact of Exchange Rate Volatility on Thailand's Trade Performance

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Narongsawas Chongwatpol

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ABSTRACT

許多學術研究人員，嘗試去研究，匯率波動對國際間貿易的影響。主因是匯率造成貨物訂價上的不確定性，也影響商品貿易交易的數量。

在這篇研究文章上，我們最主要探討的是：匯率的波動性對經歷亞洲金融風暴後的泰國，在貿易量上是否有任何影響。更進一步地，我們測試了泰國的匯率波動性，對其與三個主要貿易對手：美國、日本及台灣間的影響。

我們應用了 “augmented Dickey-fuller” 方法及 “Johansen cointegration” 方法，以探討國際貿易與其決定因素。結果是，五個案例顯示：匯率波動性確實相當程度影響泰國的進出口量。其中的四個案例顯示：匯率波動性對國際貿易造成負面的影響。

Impact of Exchange Rate Volatility on Thailand's Trade Performance

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ABSTRACT

Many researchers have tried to find the impact of exchange rate volatility on international trade. Because exchange rate variability can affect the volume of goods traded internationally by making prices and profits indeterminate or uncertain.

The question we have explored in this research is whether exchange rate volatility has had any detrimental impact on trade flows in Thailand during the post-Asian-crisis period. Furthermore this research tests the impact of exchange rate volatility on Thailand's bilateral trades with three major partners: United States, Japan, and Taiwan to understand more about the relations.

The augmented Dickey-fuller method and the Johansen cointegration method are applied to study the relationship between international trades and its determinants (including exchange rate volatility). Results, five cases indicate that exchange rate volatility significantly affected exports or imports of Thailand. Four cases out of these five cases indicate that exchange rate volatility adversely affected the international trade.

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CHAPTER I: INTRODUCTION

1.1 Background

One of the major concerns since the introduction of the flexible exchange rate has been whether the increase in exchange rate variability has affected the international trade flows. Higher exchange rate volatility leads to higher cost for risk–averse traders and to less foreign trade (Arize et al, 2000). In other words, greater exchange rate risk increases the uncertainty of trade profits, leading risk-averse traders to reduce trade.

Thus, the theoretical framework seems to indicate a negative relationship between international trade flow and exchange rate volatility. Some studies provided evidences that exchange rate variability does reduce the trade flow.

According to Arize (1998), knowledge of the degree to which exchange rate volatility affects trade is important for both exchange rate and trade policies. For example, if exchange rate volatility leads to a reduction in exports, trade encouraging programs that emphasized export expansion could be unsuccessful if exchange rate is volatile.

1.2 Economy of Thailand

The economy of Thailand is lower middle income industrial developing nation, heavily export-dependent, with exports accounting for 60% of GDP. The exchange rate had reached 37.00 Baht/US$ as of October 26, 2006, with GDP approximately US$ 200 billion. However, due to rapid appreciation in 2007, GDP was up around $230 billion. This keeps Thailand as the 2nd largest economy in Southeast Asia, after Indonesia. Thailand's GDP real growth rate is shown in Figure 1 below.

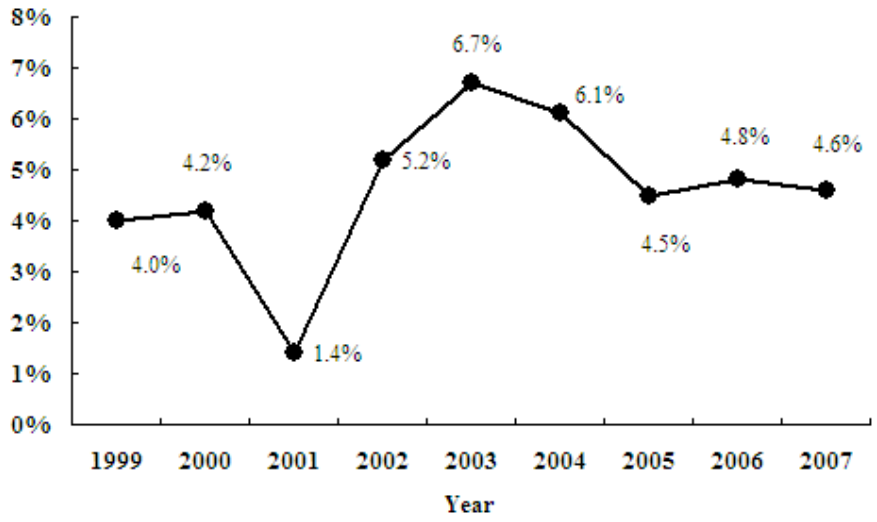


Figure 1. Thailand – GDP - Real Growth Rate

Thailand ranks 4th in income per capital in Southeast Asia after Singapore, Brunei, and Malaysia. It is also an anchor economy for the neighboring less developed countries of Laos, Burma, and Cambodia. Thailand's recovery from the 1997-98 Asian financial crisis relied on exports, largely on external demand. Thailand has a strong automotive export industry along with electronic goods manufacturing which has helped to strengthen the baht. Agriculture has always been traditional income generation; however it has declined in relative terms in recent years as overall exports increased. Tourism has been on the rise as well, but not without negative consequences. With the instability surrounding the recent coup, the GDP growth of Thailand has settled at around 4% from previous highs of 5%-7% under the previous administration, as locals and foreign companies hold back investment due to political uncertainty.

The spate of financial crises in emerging economies over the last decade has often resulted in the collapse of US dollar pegs. While pegs have sometimes been "hard," more often than not they have been "soft" in the sense of not being backed by any institutional arrangements. This was the case in Southeast Asia in 1997–1998. In

principle, Thailand and the other regional countries were supposed to have adopted basket pegged regimes, with the US dollar, Japanese yen and other currencies receiving weights consistent with their respective significance in economic linkages with the Southeast Asian countries. However, in reality, the US dollar had the overwhelming weight in reality, leading McKinnon (2001) and others to make frequent reference to the region's "dollar standard"

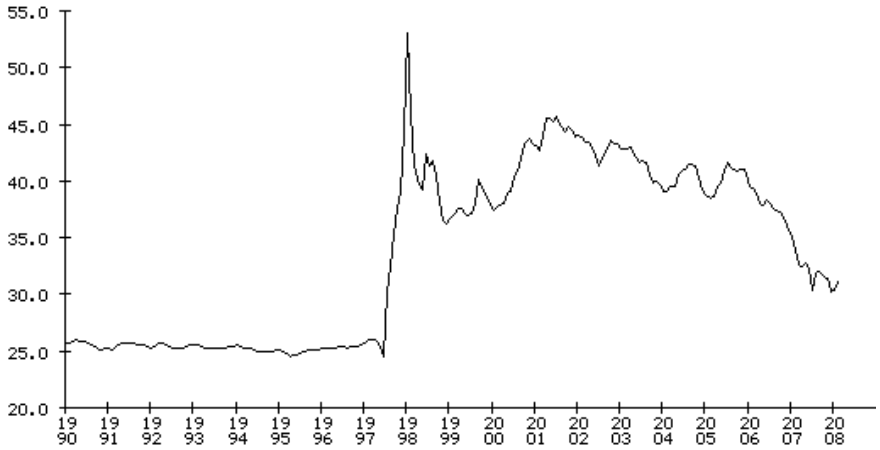


Figure 2. Thailand / US Foreign Exchange Rate: Thai Baht to One US Dollar

In 1997 Thailand faced exchange rate devaluation, whereas in 2006-2008 Thailand faced Baht appreciation. Baht appreciation and capital inflows make life more difficult for exporters because the goods they are trying to sell on international markets become more expensive, making it more difficult for them to compete with companies in other countries (assuming the exchange rates in these other countries don't appreciate also). On the other hand, large capital inflows at least mean that liquidity and credit is being injected into the Thai economy which is a lot better than quickly losing loanable funds the way that banks did in 1997.

1.3 Thailand's International Trade

In 2007, United States is Thailand's largest export market and 3rd largest supplier after Japan. The largest and 2nd largest import markets are Japan and China respectively as shown in Table 1.

Table 1: International Trade Partners

Destination of Exports	Share of Total	Origin of Imports	Share of Total
US	12.6%	Japan	20.3%
Japan	11.9%	China	11.6%
China	9.7%	US	6.8%
Singapore	6.3%	Malaysia	6.2%
Hong Kong	5.7%	United Arab Emirates	4.9%
Malaysia	5.1%	Singapore	4.5%
Australia	3.8%	Taiwan	4.1%
Indonesia	3.1%	Korea, South	3.8%
Others	41.8%	Others	37.9%

While Thailand's traditional major markets have been North America, Japan, and Europe, economic recovery among Thailand's regional trading partners has helped Thai export growth. Recovery from the financial crisis depended heavily on increased exports to the rest of Asia and the United States. Since 2005, the rapid increase in OEM export of automobiles for Japanese makes (especially Toyota, Nissan, and Isuzu) has helped to dramatically improve the trade balance, with over 1 million cars produced last year. As such, Thailand has joined the ranks of the world's top ten automobile exporting nations.

Machinery and parts, vehicles, electronic integrated circuits, chemicals, crude oil and fuels, and iron and steel are among Thailand's principal imports. The recent increase in import levels reflects the need to fuel the production of high-technology items and vehicles.

Thailand is a member of the World Trade Organization (WTO) and the Cairns Group of agricultural exporters. Thailand is part of the ASEAN Free Trade Area (AFTA) and has actively pursued free trade agreements with other countries. For example a China-Thailand Free Trade Agreement (FTA) commenced in October 2003. This agreement was limited to agricultural products initially, with more comprehensive FTA to be agreed by 2010. Thailand also has a limited Free Trade Agreement with India, which commenced in 2003; and a comprehensive Australia-Thailand Free Trade Agreement which started January 2005. Thailand started free trade negotiations with Japan in February 2004, and an in-principle agreement was agreed in September 2005. Negotiations for a US-Thailand Free Trade Agreement are underway, with the fifth round of meetings held in November 2005.

Although the economy has demonstrated moderate positive growth since 1999, future performance depends on continued reform of the financial sector, corporate debt restructuring, attracting foreign investment, and increasing exports. Telecommunications, roadways, electricity generation, and ports showed increasing strain during the period of sustained economic growth and may pose a future challenge. Thailand's growing shortage of engineers and skilled technical personnel may limit its future technological creativity and productivity.

1.4 Purpose of the Study

The purpose of the study is to investigate the effects of the exchange rate volatility on international trade of Thailand.

1.5 Objective of this Study

1. To understand Thailand trading characteristics.

2. To identify and analyze the impact of exchange rate volatility on overall international trade flows.
3. To identify and analyze the impact of exchange rate volatility on bilateral trades with three key major trading partners: United States, Japan, and Taiwan.

1.6 Thesis Structure

- Chapter 1 explains about the back ground, purpose and objectives of this study.
- Chapter 2 contributes to literature review of previous studies, and also provides the theories to support the testing of impact of each variable to international trades.
- Chapter 3 explains the methodologies used in this research and list the steps of testing procedures.
- Chapter 4 presents empirical results from using augmented Dickey-fuller tests and Johansen cointegration tests.
- Chapter 5 concludes the overall structure and essential testing results from this study. Moreover the recommendations related to this study and further study is also specified.

CHAPTER II: LITERATURE REVIEW

2.1 Exchange Rate Variability and the Effect on International Trade

Exchange rate variability is a source of concern because currency values partly determine the price paid or received for output and, consequently, this affects the profits and welfare of producers and consumers (Akhtar and Spence Hilton, 1984). In other words, exchange rate variability can affect the volume of goods traded internationally by making prices and profits indeterminate or uncertain. If the forward exchange market cannot be used (such as in emerging markets) to create hedge against exchange risk, economic agents will prefer domestic products over imported ones if it is unclear at the time a purchase order is placed what the exchange rate level will actually be when payment is due.

For some developed countries currencies forward markets can be used to reduce or hedge exchange rate risk but it has been proven that forward markets fail to completely eliminate exchange rate risk (Akhtar and Spence Hilton, 1984). Even if hedging in the forward markets (and futures markets) were possible, there are limitations (Arize et al., 2000). The size of the contracts is generally large, the maturity is relatively short, and it is difficult to plan the magnitude and timing of all international transactions to take advantage of the forward market. Failure to provide perfect hedge is compounded by the empirical fact that forward rates are a poor predictor of the future spot rates. Moreover any cost of forward hedging will reduce the international trade: importers who pay for the forward hedge will face higher prices for the foreign goods and exporters who incur these hedging costs will pass along the cost as higher prices (Choudhry, 2004). The end result in both instances is a reduction of trade. Moreover, exchange rate is a major determinant of the cost of the foreign products; prices of traded goods are more affected by exchange rate changes

than prices for local substitutes. A risk averse importer or buyer would prefer domestic markets to reduce the likelihood of future variations in outlays. The same holds for sales markets and exporters.

2.2 Literature Survey

Is currency volatility harmful to international trade? This seemingly straight forward question has been among the most mysterious to answer in international economics. Theory is extremely vague on this issue. Accordingly, as with most other things, it is an empirical issue. In the literature on the impact of exchange rate volatility on trade flows, McKenzie (1999) concluded that the empirical studies have had greater success in deriving a statistically significant relationship between volatility and trade. Calvo and Reinhart (2000) reviewed a more limited set of such studies and reach a similar conclusion. On the other hand a large number of these empirical studies have shown negative impacts of exchange rate volatility on total trade, exports and imports; some have also reported positive and insignificant consequences.

Table 2 shows a number of recent studies about the relationship between international trade and exchange rate volatility created by Siregar and Rajan (2002). Only Chowdhury (1993) and Caporale and Doroodian (1994) reported consistently adverse consequences of exchange rate volatility on exports and imports. Other studies, such as by Klein (1990), Mckenzie (1998), Bailey, Tavlas and Ulan (1987), Koray and Lastrapes (1989), Asseery and Peel (1991), Kroner and Lastrapes (1993), Mckenzie and Brooks (1997), Mckenzie (1998), Daly (1998), and Chou (2000), have found cases where a rise in exchange rate volatilities may have both positive and

negative implications on exports and imports, depending on products' and countries' cases.

Table 2: Empirical Studies of Exchange Rate Volatility and Trade Flow

References	Country	Type	Result	Relationship
Hooper and Kohlhagen (1978)	Germany, Japan, United Kingdom, United States, Canada, France (bilateral trade).	X	Significant (2 eq.) Significant (4 eq.) Insignificant (26 eq.)	Negative Positive
Rana (1981) 1960.1–1976.4	South Korea, Philippines, Thailand, and Taiwan (multilateral trade).	M	Significant (4 eq.) Insignificant (1 eq.)	Negative
IMF (1984)	United States, United Kingdom, France, Germany, Italy, Canada, and Japan (bilateral trade).	X	Significant (3 eq.) Significant (11 eq.) Insignificant (28 eq.)	Negative Positive
Kenen and Rodrik (1986)	US, Canada, Japan, Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland, UK (multilateral trade).	M	Significant (4 eq.) Insignificant (7 eq.)	Negative
Bailey, Tavlas and Ulan (1987)	Canada, France, Germany, Italy, Japan, UK, USA, Australia, New Zealand, Netherlands, Switzerland (multilateral trade)	X	Significant (3 eq.) Significant (5 eq.) Insignificant (34 eq.)	Negative Positive
Thursby and Thursby (1987)	Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, and United States (bilateral trade).	X	Significant (10 eq.)	Negative
Cushman (1988)	USA (bilateral trade).	X M	Significant (2 eq.) Significant (1 eq.) Insignificant (3 eq.) Significant (5 eq.) Insignificant (1 eq.)	Negative Positive Negative
Koray and Lastrapes (1989)	USA with UK, France, Germany, Japan, Canada (bilateral trade).	M	Significant (41 eq.) Significant (16 eq.) Insignificant (39 eq.)	Negative Positive
Lastrapes and Koray (1990)	USA (multilateral trade).	X,M	Significant (6 eq.) Insignificant (42 eq.)	Negative
Klein (1990)	USA with Netherlands, Canada, Japan, France, Italy, Germany (bilateral trade).	X	Significant (4 eq.) Significant (7 eq.) Insignificant (43 eq.)	Negative Positive
Asseery and Peel (1991)	Australia, Japan, UK, USA, West Germany (multilateral trade).	X	Significant (1 eq.) Significant (2 eq.) Insignificant (3 eq.)	Negative Positive

Table 2: Empirical Studies of Exchange Rate Volatility and Trade Flow (continued)

References	Country	Type	Result	Relationship
Bini-Smaghi (1991)	Italy, France, Germany (multilateral trade of the manufacturing sector).	X	Significant (13 eq.) Insignificant (11 eq.)	Negative
Chowdhury (1993)	Canada, France, Germany, Italy, Japan, UK, USA (multilateral trade).	X	Significant (7 eq.)	Negative
Kroner and Lastrapes (1993)	USA, UK, France, Germany, Japan (multilateral trade).	X	Significant (3 eq.) Significant (1 eq.) Insignificant (1 eq.)	Negative Positive
Caporale and Doroodian (1994)	USA to Canada (bilateral trade).	M	Significant (1 eq.)	Negative
Mckenzie and Brooks (1997)	German to USA (bilateral trade).	X M	Insignificant (4 eq.) Significant (4 eq.)	 Positive
Mckenzie (1998)	Australia (multilateral, bilateral and sectoral trade).	X M	Significant (4 eq.) Significant (5 eq.) Significant (1 eq.)	Negative Negative Positive
Daly (1998)	Japan (bilateral trade).	X	Significant (3 eq.) Significant (4 eq.) Significant (2 eq.) Significant (5 eq.)	Negative Positive Negative Positive
Chou (2000)	China (multilateral and sectoral trade).	X	Negative effect on total export, export of manufacture goods and mineral fuels. Positive effect on export of industrial materials.	
Aristotelous (2001)	UK to USA (bilateral trade). 1889—1999	X	Neither exchange-rate volatility nor the different exchange rate regimes had an effect on export volume.	

However, these conclusions cannot be seen as perfect. There are also a few studies which concluded that exchange rate volatility plays no significant role in explaining exports and imports. This includes a study by (Aristotelous, 2001) that finds exchange rate volatility has not had any significant impact on the performance of the British exports to the US during the period of 1889–1999. On the whole, the empirical literature has reaffirmed the unclear relationship between currency volatility and trade as indicated by the theoretical literature on the subject.

2.3 Volatility

The methods of measuring volatility have evolved over time to reflect new advances in econometric techniques. Nonetheless, there has not yet appeared a clearly main approximation for uncertainty. The most common is some measure of variance, but the exact construction of this measure differs from study to study. The volatility variable may be constructed as the standard deviation of a rate of change, or the level, of a variable; a moving standard deviation, or a within-period one; or employ the nominal, or the real, exchange rate.

2.4 Time-Series Testing Methodology

There are several preliminary steps to use time-series data in econometric analyses. Initially it is essential to determine the form in which the data can be used for any subsequent estimation; in many cases using macroeconomic data in their levels leads to serious econometric problems.

Time-series data typically contains a trend, which must be removed prior to undertaking any estimation. The traditional de-trending procedure separates the trend from the cyclical component of the series. This procedure is appropriate for trend stationary (TS) time-series. However, many macroeconomic time-series are difference stationary (DS). The main difference between these two types of time-series variables is the fact that TS type variables return to the deterministic trend function, whereas no such tendency exists with the DS type of time-series variables (Wassell and Saunders, 1998). DS type time-series are non-stationary and they contain unit roots. Figure 3 shows the graph of a non-stationary time series.

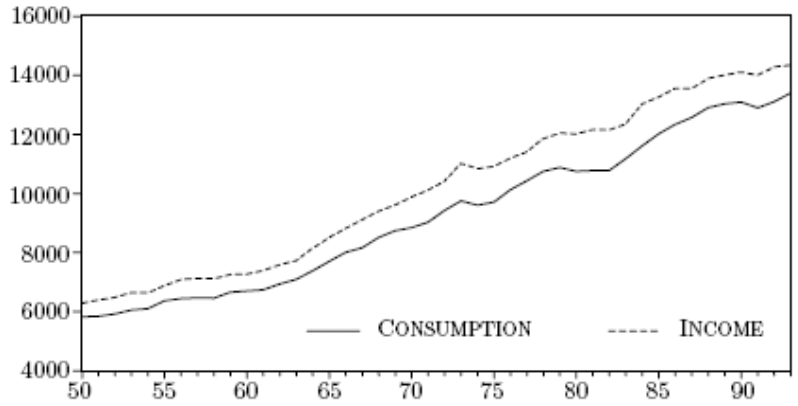


Figure 3. US Consumption and Income 1950 - 1993

The DS type sequences must be differenced prior to any meaningful econometric estimation. If ordinary least squares (OLS) estimation techniques are applied to indifference DS type sequences, resulting error terms are serially correlated. This renders any subsequent hypothesis tests unreliable.

The actual determination of whether a variable is TS or DS is based upon the results of unit root tests. Numerous unit root tests have been presented in economic literature; the most common test, and the one we utilize, is the augmented Dickey-Fuller test. If one can reject the null hypothesis that a series possesses a unit root, then the series is TS, or integrated of order zero (I(0)). If one cannot reject the null of a unit root, then the series is DS. Subsequent unit root tests on differenced DS series determine the form in which the data may be used in regressions. The most common occurrence is that first differences of DS series are stationary; in this case the series are said to be integrated of order one (I(1)) and no further differencing of the data or unit root testing is required.

When multiple individual time-series variables are found to be integrated of order one, an additional test is required to determine whether long-term relationships exist among the variables. Cointegration tests indicate the presence of such stable long-term relationships. Different estimation procedures are required for cointegrated

variables than for non-cointegrated DS series.

2.5 Cointegration

Cointegration is an econometric property of time series variables. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are cointegrated. For example, a stock market index and the price of its associated futures contract move through time, each roughly following a random walk. Testing the hypothesis that there is a statistically significant connection between the futures price and the spot price could now be done by testing for a cointegrating vector. (If such a vector has a low order of integration it can signify an equilibrium relationship between the original series, which are said to be cointegrated of an order below one.)

It is often said that cointegration is a means for correctly testing hypotheses concerning the relationship between two variables having unit roots (i.e. integrated of order one).

The usual procedure for testing hypotheses concerning the relationship between non-stationary variables was to run Ordinary Least Squares (OLS) regressions on data which had initially been differenced. Although this method is correct in large samples, cointegration provides more powerful tools when the data sets are of limited length, as most economic time-series are. The two main methods for testing for cointegration are the Engle-Granger two-step method and the Johansen procedure.

In practice, cointegration is used for such series in typical econometric tests, but it is more generally applicable and can be used for variables integrated of higher order (to detect correlated accelerations or other second-difference effects). Multi-

cointegration extends the cointegration technique beyond two variables, and occasionally to variables integrated at different orders.

However, these tests for cointegration assume that the cointegrating vector is constant during the period of study. In reality, it is possible that the long-run relationship between the underlying variables change (shifts in the cointegrating vector can occur). The reason for this might be technological progress, economic crises, changes in the people's preferences and behavior accordingly, policy or regime alteration, and organizational or institutional developments.

CHAPTER III: METHODOLOGY

The aim of this paper is to test these price, income, and volatility channels by estimating a set of export and import functions for Thailand. In particular, we are interested in understanding the implication of the volatility of Baht's real exchange rate on both the country's exports and imports. This is the basic question we try to answer in this paper. This paper will concentrate our analysis on the Asian crisis period and post crisis during 1997 January and 2007 December.

Chapter 3 is devoted to describing the data series and defining the various terms and variables to be used in the empirical analysis. After that we use augmented Dickey-fuller test to test the unit root of each variable. Johansen cointegration test is chosen to test relationship of each variable in each condition.

Impact of exchange rate volatility on Thailand's trade performance will be tested in two main sections. The first section is the test of overall performance of Thailand's trades due to the exchange rate volatility. The second section specifically tests the impact of currency volatility on Thailand's bilateral merchandise exports and imports to United States, Japan, and Taiwan which are Thailand's three key trading partners.

3.1 Model

There are two primary determinants of export and import demand (Dornbusch, 1988, and Hooper and Marquez, 1993). First, is the foreign income variable which measures the economic activity and the purchasing power of the trading partner country ("income effect"). Second, is the relative price or the terms of trade variable ("price effect"). As noted, exchange rate volatility is an additional factor that needs to be explicitly taken into account ("volatility effect"). Incorporating all of the

determinant factors, we can derive the following set of simple export and import-demand functions:

$$x_t = \alpha_{11} + \alpha_{21} y_t^{\text{foreign}} + \alpha_{31} p_t + \alpha_{41} V_t + \varepsilon_{1t} \quad (1)$$

$$m_t = \alpha_{12} + \alpha_{22} y_t^{\text{local}} + \alpha_{32} p_t + \alpha_{42} V_t + \varepsilon_{2t} \quad (2)$$

where x_t is the natural logarithm of export volume, m_t is the natural logarithm of import volume, y_t foreign is the natural logarithm of real foreign/world GDP, y_t local is the natural logarithm of domestic real GDP, p_t is the terms of trade, V_t is volatility of the real exchange rate.

The volume of exports (imports) to a foreign country (domestic country) ought to increase as the real income of the trade partner (domestic economy) rises, and vice versa. So we expect $\alpha_{21} > 0$and $\alpha_{22} > 0$. A rise (fall) in the terms of trade will cause the domestic goods to become less (more) competitive than foreign goods, therefore exports will fall (increase) and imports will rise (fall). So we expect $\alpha_{31} < 0$and $\alpha_{32} > 0$. As discussed previously, the impact of exchange rate volatility on exports and imports is ambiguous, i.e. α_{41} and α_{42} could either be positive or negative.

3.2. Data

All raw data are of monthly frequency except quarterly income variables and are taken from the International Financial Statistics (IMF, 2007), DataStream system and Bank of Thailand. To recap, this study covers the period from 1997 January until 2007 December.

3.3. Definitions

3.3.1. Trade volume

For total exports and imports we have adopted the series in quantity or volume

terms. According to Siregar and Rajan (2002), the trade volume is a more appropriate measure than value. While volume data for Thailand's aggregate exports and imports are available, this is not the case for bilateral trade. Thus, in order to obtain the volume of Thailand's trade with United States, Japan and Taiwan (which, as noted, is needed for the second set of tests), we divide the available value series of bilateral trade by an appropriate price index (both are in US dollars):

$$X_t^{US} = \frac{XVAL_t^{US}}{XP_t}, \quad X_t^{JP} = \frac{XVAL_t^{JP}}{XP_t}, \quad X_t^{TW} = \frac{XVAL_t^{TW}}{XP_t} \tag{3}$$

$$M_t^{US} = \frac{MVAL_t^{US}}{XP_t^{US}}, \quad M_t^{JP} = \frac{MVAL_t^{JP}}{XP_t^{JP}}, \quad M_t^{TW} = \frac{MVAL_t^{TW}}{XP_t^{TW}} \tag{4}$$

where $X_t^{US, JP, TW}$ in equation (3) are the quantity of Thailand's exports to US, Japan, and Taiwan respectively; $M_t^{US, JP, TW}$ in equation (3) are the quantity of Thailand's imports from US, Japan, and Taiwan respectively; $XVAL_t^{US, JP, TW}$ are the value of exports to US, Japan, and Taiwan; XP_t is Thailand's export price; $MVAL_t^{US, JP, TW}$ are the value of Thailand's imports from US, Japan and Taiwan; and $XP^{US, JP,TW}$ are the US, Japanese, Taiwanese export price (proxy for Thailand's import price from each trading partner).

3.3.2. Income

Quarterly real GDP of US, Japan, Taiwan, and Thailand (y^{US}, y^{JP}, y^{TW}, and y^{TH}) are used as proxies for their respective real incomes. As for the world real GDP or income, which is needed for the first set of tests, the series is the trade weighted sum of the GDP of Thailand's nine key trading partners.

3.3.3. Terms of trade

The bilateral terms of trade with US (p^{US}) is constructed as the ratio of Thailand's export price to the US export price (as a proxy for Thailand's import price from United States). As for the case of Japan and Taiwan, similar calculation is applied. As for the total terms of trade (p^{World}), the series is the total trade-weighted sum of terms of trade of Thailand against the country's nine key trading partners.

3.3.4. Volatility

The real exchange rate of Baht against the US dollar, Japanese yen, and new Taiwanese dollar are computed by multiplying the nominal exchange rate by the relative prices:

$$RER_t^{US} = NER_t^{US} * \frac{CPI_t}{CPI_t^{US}} \quad (5)$$

$$RER_t^{JP} = NER_t^{JP} * \frac{CPI_t}{CPI_t^{JP}} \quad (6)$$

$$RER_t^{TW} = NER_t^{TW} * \frac{CPI_t}{CPI_t^{TW}} \quad (7)$$

where CPI_t is the Consumer Price Index of Thailand and $CPI_t^{US,\ JP,\ TW}$ is the US, Japanese, and Taiwanese Consumer Price Index. An increase in $RER_t^{US,\ JP,\ TW}$ (real exchange rate) or $NER_t^{US,\ JP,\ TW}$ (nominal exchange rate) implies an depreciation in the Thailand Baht against the US dollar, Japanese yen, and new Taiwanese dollar. As for the real effective exchange rate (*REER*), the series is computed as the weighted sum of real exchange of Baht against key trading partners' currencies, viz. the US dollar, Japanese yen, Singapore dollar, British pound sterling, France franc, German DM, Dutch gulden, etc. The assigned weights to each real exchange rate represent the

trade share (imports and exports) of each of these economies in their total trade with Thailand.

There are many methods to calculate the volatility as stated in literature review section. In this paper, Moving Average Standard Deviation of the growth rate of exchange rate (ER) initially employed by Kenen and Rodrik (1986) is selected to measure the volatility. The formula is shown as follow:

$$V_t = \left[\frac{1}{m} \sum_{i=1}^{m} \left(\ln ER_{t+i-1} - \ln ER_{t+i-2} \right)^2 \right]^{1/2} \quad (8)$$

Where m is the order of the moving average and ln implies the log form of the series. Our estimations make use of m equal to 4 months for both REER and bilateral real exchange rate against the US dollar, Japanese yen, and new Taiwanese dollar[1].

[1] For our empirical tests, we also apply m = 6 months and m = 8 months. The results are largely consistent with m = 4 months.

CHAPTER IV: RESULTS

Thailand international trade has been increasing dramatically since 2001. Figure 4 shows that before 2001 Thailand's exports were quite stable with 60,000 million US dollars but it has risen about 2.5 times to 150,000 millions US dollars in 2007. The amount represented an annual growth rate of 17.5%, exceeding the target rate of 12.5%. Thailand's imports have also followed the exports trend and reach 140,000 millions US dollars in 2007.

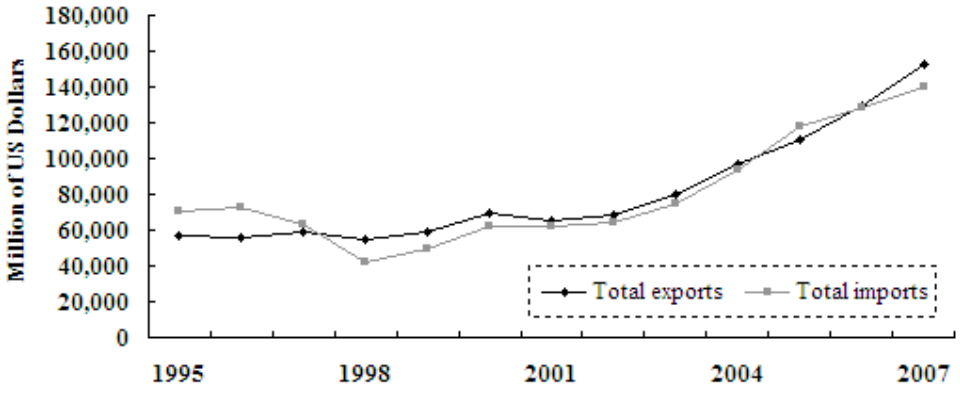
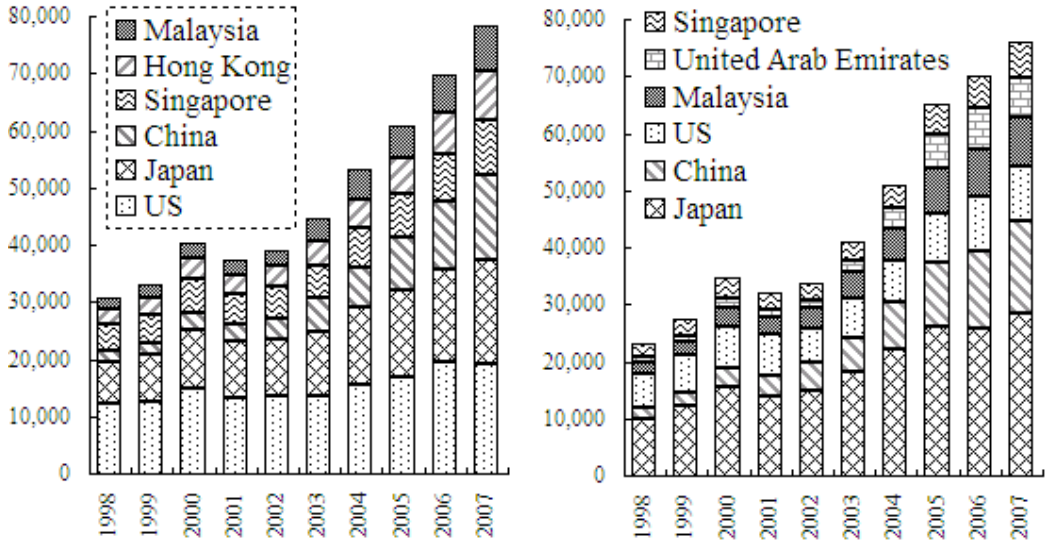


Figure 4. Thailand's International Trades

Exports have been set as a key engine for Thailand's economic growth 2008. Thailand will maintain its traditional export markets, as they have high purchasing power and accounted for 55% of Thailand's total exports. At the same time, it would strive to export more to new markets, such as China, India, and countries in the Middle East, which accounted for 45% of Thailand's international trade. Apart from these countries, special emphasis would be placed on ASEAN, Eastern Europe, and Africa. Figure 5 shows the Top 6 international trading partner. US are always the largest export destination but the growth rate of exports to US is very small comparing to the others especially Japan. So we expect that Japan will be the largest destination in the future. Furthermore Japan is the biggest import origin followed by China and US.



a) Export Destinations b) Import Origins

Figure 5. Top 6 Trading Partners (in Millions of US Dollars)

Next we are interested to know the main currencies used with those trading partners. The major currencies of trade receipts and payments listed in Table 3 and Table 4 are US dollar, Thai baht, Japanese yen, Deutsche mark, Pound sterling, Euro, Singaporean dollar, and others.

Table 3: Structure of Export Receipts (Percent share)

Currency	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
US dollar	92.0	90.6	87.6	87.0	85.7	84.7	84.4	81.7	81.6	81.7
Baht	2.1	2.6	3.7	3.9	4.0	4.3	5.0	6.3	6.9	6.9
Japanese yen	3.3	3.7	5.2	5.7	5.6	6.0	5.9	6.5	6.4	6.1
Deutsche mark	0.4	0.7	1.5	1.2	0.8	0.0	0.0	0.0	0.0	0.0
Pound sterling	0.3	0.4	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Euro	0.0	0.0	0.2	0.6	2.0	3.2	2.7	3.1	2.6	2.8
Singaporean dollar	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.5	0.5	0.4
Others	1.5	1.7	1.2	1.2	1.3	1.2	1.4	1.5	1.6	1.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 4: Structure of Import Payments (Percent share)

Currency	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
US dollar	80.4	80.7	79.2	79.0	77.9	77.2	76.0	75.5	78.2	79.2
Baht	1.7	1.7	2.2	2.4	3.5	4.4	5.6	4.9	4.5	4.7
Japanese yen	9.0	9.6	11.9	12.2	10.3	9.9	10.9	11.5	10.6	9.7
Deutsche mark	3.5	2.9	2.7	2.1	1.6	0.1	0.0	0.0	0.0	0.0
Pound sterling	0.8	0.6	0.4	0.4	0.5	0.3	0.3	0.4	0.4	0.3
Euro	0.0	0.0	0.3	0.9	3.5	5.2	4.3	4.6	3.7	3.5
Singaporean dollar	1.0	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.6	0.6
Others	3.6	3.7	2.5	2.2	2.0	2.2	2.2	2.3	2.0	2.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

For total exports and imports, US dollar has been a major currency using in bilateral trades accounting for 81.7% in exports and 79.2% in imports in 2006. Baht is the 2nd major currency in export receipts and the 3rd major currency for import payments. Japanese yen is also quite popular these days as the 3rd major currency in export receipts and the 2nd major currency for import payments. Many traders trend to diversify the risk of exchange rate volatility by not using only one currency. The trends in Table 3 show that US dollar usage has been decreased from 92% in 1997 to 81.7% in 2006 and expected to decrease more in the future. In contrast other currencies usages are in up trend. However the main currencies using for import payments does not change much except Deutsche mark and Euro.

Another observation is to investigate structure of export receipts and import payments in country level: United States, Japan, and Taiwan. The export receipts from US and Taiwan use US dollars as a major currency accounting more than 90% each year as shown in Table 5. The export receipts from Japan use about 60% of US dollar and 30% of Japanese Yen. New Taiwanese dollar is used in export receipts with Taiwan only which is less than 1% of total. However Thai bath is used less than 5% in export receipts.

Table 5: Structure of Export Receipts and Import Payments from Major Trading Partners

Structure of export receipts from major trading partners classified by currency (Percent share)																		
	Japan						Taiwan						United States					
Currency	2001	2002	2003	2004	2005	2006	2001	2002	2003	2004	2005	2006	2001	2002	2003	2004	2005	2006
USD	66.5	63.9	61.3	60.1	59.7	58.7	95.2	94.8	94.7	93.5	94.1	94.4	97.4	97.5	97.2	97.0	96.6	96.1
YEN	28.4	30.6	32.5	33.4	32.3	32.3	1.7	1.6	1.5	1.4	1.2	0.9	0.8	0.9	0.8	0.6	0.8	0.8
BAHT	5.0	5.4	6.1	6.2	7.3	8.5	1.9	2.7	2.9	4.5	4.0	4.2	1.4	1.4	1.6	2.0	2.3	2.9
TWD	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.5	0.3	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
EURO	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.2	0.3	0.2	0.3	0.1	0.1	0.1	0.2	0.2	0.1	0.1
SGD	0.0	0.0	0.0	0.1	0.5	0.4	0.1	0.2	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Structure of import payments from major trading partners classified by currency (Percent share)																		
	Japan						Taiwan						United States					
Currency	2001	2002	2003	2004	2005	2006	2001	2002	2003	2004	2005	2006	2001	2002	2003	2004	2005	2006
USD	47.6	45.5	41.7	43.0	47.0	46.8	94.8	92.8	94.6	94.6	94.9	95.4	96.1	95.7	96.1	95.9	96.4	95.4
YEN	42.3	42.3	43.7	44.5	44.1	44.1	1.4	1.3	1.3	1.5	1.4	1.3	0.6	0.5	0.4	0.5	0.3	0.3
BAHT	5.9	8.3	11.0	9.5	7.6	8.4	1.2	3.4	1.6	1.6	1.6	1.3	1.3	1.5	1.5	2.0	2.1	2.6
TWD	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.7	1.6	1.6	1.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0
EURO	1.1	2.8	2.5	2.3	0.8	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.8	1.3	1.1	0.7	0.6	0.8
SGD	1.3	1.1	0.9	0.6	0.4	0.5	0.3	0.4	0.5	0.3	0.2	0.3	0.3	0.4	0.3	0.3	0.3	0.3
Others	1.8	0.0	0.2	0.1	0.1	0.0	0.2	0.2	0.2	0.1	0.1	0.1	0.9	0.6	0.6	0.6	0.3	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The major currency use in import payment is also US dollar accounting about 45% from Japan and 95% from US and Taiwan. Thai bath is used the most in import payments from Japan about 10%. It is quite interesting that import payments from Taiwan use just only 2% of new Taiwan dollar.

Pound Sterling and Euro is not frequently used in Thailand because the major trading partners of Thailand are in Asia and America.

Structure of Export Receipts & Import Payments in 2006 braking down in region and individual country is presented in Appendix B.

4.1 Augmented Dickey-Fuller test Results

Before testing the cointegration of the international trades and the volatility of exchange rate, the stationary tests are conducted first.

Augmented Dickey-Fuller unit root test was chosen to test the stationary of each parameter. Table 6 presents the results for the ADF-unit root tests. The variables are separated into 4 sets as of Thailand, US, Japan, and Taiwan which will be use in cointegration test later. All variables are stationary at the first difference (I(1) variables) except the volatility indices which are all I(0). ADF statistics indicate result at 5 percent significance level at t&c test type (trend and constant).

Table 6: Augmented Dickey-Fuller test Results

Country	**Series**		**ADF Statistics**	**Lag**	**Order of integration**
Thailand	x^{total}	1st Difference	-4.185	2	I(1)
	m^{total}	1st Difference	-3.937	4	I(1)
	tot^{world}	1st Difference	-4.619	2	I(1)
	y^{world}	1st Difference	-11.124	1	I(1)
	y^{TH}	1st Difference	-7.969	1	I(1)
	V^{REER}	Level	-4.367	2	I(0)

Table 6: Augmented Dickey-Fuller test Results (continued)

Country	Series		ADF Statistics	Lag	Order of integration
United States	x^{US}	1st Difference	-4.037	2	I(1)
	m^{US}	1st Difference	-4.612	2	I(1)
	tot^{US}	1st Difference	-6.943	1	I(1)
	y^{US}	1st Difference	-7.969	1	I(1)
	V^{TH-US}	Level	-4.655	1	I(0)
Japan	x^{JP}	1st Difference	-4.554	4	I(1)
	m^{JP}	1st Difference	-4.219	2	I(1)
	tot^{JP}	1st Difference	-3.612	3	I(1)
	y^{JP}	1st Difference	-4.984	1	I(1)
	V^{TH-JP}	Level	-6.310	1	I(0)
Taiwan	x^{TW}	1st Difference	-3.872	1	I(1)
	m^{TW}	1st Difference	-3.772	3	I(1)
	tot^{TW}	1st Difference	-3.649	2	I(1)
	y^{TW}	1st Difference	-4.019	3	I(1)
	V^{TH-TW}	Level	-3.738	2	I(0)

Notes. ADF statistics indicates results at 5 % significance level.

Given the unit-root properties of the variables, the next step is to conduct three sets of Johansen cointegration test procedures on equation (1)&(2). The cointegration tests are divided into 4 tests to test the effects of exchange rate volatility in each condition.

- The impact of exchange rate volatility on Thailand's overall trade.
- The impact of exchange rate volatility on Thailand's bilateral trade with United States.
- The impact of exchange rate volatility on Thailand's bilateral trade with Japan.
- The impact of exchange rate volatility on Thailand's bilateral trade with Taiwan.

4.2 Cointegration test on Thailand overall trade

The test result for Thailand's total exports and imports are shown in Table 7 and Table 8. Trace statistic indicates 1 cointegrating equation at 1 percent significance level in both total exports and imports sections.

Table 7: Cointegration Test Results for Total Exports

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.2210	71.1336	53.12	60.16
At most 1 *	0.1158	39.1677	34.91	41.07
At most 2 *	0.1132	23.4138	19.96	24.60
At most 3	0.0608	8.0338	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$x^{Total} = -6.551 + 2.136y^{World} + 0.176p^{World} - 0.112V$

Standard error: (0.143) (0.259) (0.019)
Chi-square: (46.366) (3.039) (30.415)

Table 8: Cointegration Test Results for Total Imports

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.181234	66.17773	53.12	60.16
At most 1 *	0.146939	40.58327	34.91	41.07
At most 2 *	0.095356	20.24103	19.96	24.6
At most 3	0.056274	7.413654	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$m^{Total} = 1.694 + 1.378y^{World} - 1.564p^{World} - 0.802V$

Standard error: (1.228) (2.259) (0.171)
Chi-square: (5.092) (0.177) (7.124)

The main results are:

$$\text{Exports: } x_t^{Total} = -6.551 + 2.136y_t^{World} + 0.176p_t^{World} - 0.112V_t \quad (9)$$

$$\text{Imports: } m_t^{Total} = 1.694 + 1.378y_t^{World} - 1.564p_t^{World} - 0.802V_t \quad (10)$$

With regard to the export function in equation (9), we find the world income variables are significant at 1 percent level and have positive effect on exports as expected. On the other hand, the price variables turn out to be statistically insignificant at 5 percent level. At last, exchange rate volatility indices are significant and negative at 1 percent significant level.

With regard to the import function in equation (10), World income again shows the positive sign. Price proxies and volatility indices show the negative sign. Furthermore world income and volatility indices are statistically significant at 5 percent and 1 percent significant level respectively. However the price variable is insignificant.

The volume of exports (imports) to a foreign country (domestic country) ought to increase as the real income of the trade partner (domestic economy) rises, and vice versa. On the other hand, the price variable has no impact on international trades may be because export has been a major factor in Thailand for GDP increases, therefore the governments have provided some regulations and trade agreements with the trading partners to support international trades such as FTA with US and China. For that reason, price variables subsequently have no impact on international trades.

4.3 Cointegration test on Thailand's bilateral trade with US

Next we test each major trading partner. We begin with US which are number one export destination of Thailand. The average share of Thailand's trade with US during 1997-2007 is around 20% in exports and 10% in imports. Therefore, it is quite important to understand how exchange rate volatility may impact Thailand's trade vis-à-vis the US market.

Table 9 and Table 10 show the Johansen cointegration tests. Trace statistic indicates 1 cointegrating equation at 1 percent significant level in export section and at both 1 percent and 5 percent significant levels in import section.

Table 9: Cointegration Test Results for Exports to US

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.264427	76.26684	53.12	60.16
At most 1 *	0.168319	37.57154	34.91	41.07
At most 2	0.064773	14.349	19.96	24.6
At most 3	0.045832	5.911321	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$$x^{US} = 7.025 + 0.776y^{US} - 1.3116p^{US} + 0.009V^{TH\text{-}US}$$

Standard error: (0.079) (0.254) (0.022)
Chi-square: (15.353) (4.298) (7.213)

Table 10: Cointegration Test Results for Imports from US

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.229279	66.11968	53.12	60.16
At most 1	0.148771	33.56609	34.91	41.07
At most 2	0.084701	13.43181	19.96	24.6
At most 3	0.018771	2.368718	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$$m^{US} = -0.439 + 1.971y^{TH} - 1.187p^{US} - 0.667V^{TH\text{-}US}$$

Standard error: (0.638) (2.885) (0.231)
Chi-square: (14.12) (1.185) (2.132)

The main results are:

$$\text{Exports: } x_t^{US} = 7.025 + 0.776y_t^{US} - 1.3116p_t^{US} + 0.009V_t^{TH\text{-}US} \quad (11)$$

$$\text{Imports: } m_t^{US} = -0.439 + 1.971y_t^{TH} - 1.187p_t^{US} - 0.667V_t^{TH\text{-}US} \quad (12)$$

Equation (11) shows that rising of income variable and volatility of exchange rate has positive impact on export. On the other hand, rising of price variable has

negative effect on exports. The estimated coefficients for income and volatility terms are significant at 1 percent significant level and price variables are significant at 5 percent significant level. The signs of each coefficient match the expectation of export function as indicated before.

With regard to import function in equation (12), import performance is influenced positively by income variable with 1 percent significant level. However price proxies and volatility indices are statistically insignificant.

The reason why exchange rate volatility has no significant effect on import may be because of particular import products from US. Thailand has imported semiconductors, civilian aircraft, and parts for military equipment which cost more than $2 billions in 2005. These products are under special trading agreement between these two countries government policies. Therefore no matter how large the exchange rate variation was, the import amount from US did not vary much.

4.4 Cointegration test on Thailand's bilateral trade with Japan

The next observing country is Japan. Thailand and Japan has a very long relation of bilateral trade. As shown in Figure 5, Japan is the most important import origin and the 2nd largest export destination of Thailand. The following test results could be useful information for the importers and exporters to understand the impact of exchange rate volatility on bilateral trade with Japan.

The cointegration test results are shown in Table 11 and Table 12. There is only 1 cointegrating equation at both 1 percent and 5 percent significant level for both export and import demand functions.

Table 11: Cointegration Test Results for Exports to Japan

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.658348	70.29069	53.12	60.16
At most 1	0.326426	26.25819	34.91	41.07
At most 2	0.177294	10.05675	19.96	24.6
At most 3	0.048895	2.055348	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$x^{JP} = -36.830 + 8.573y^{JP} + 0.051p^{JP} - 0.386V^{TH\text{-}JP}$

Standard error: (1.207) (0.234) (0.038)
Chi-square: (2.090) (1.159) (5.587)

Table 12: Cointegration Test Results for Imports from Japan

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.968046	162.4439	53.12	60.16
At most 1 *	0.451896	38.47994	34.91	41.07
At most 2	0.236092	16.83349	19.96	24.6
At most 3	0.179868	7.138419	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$m^{JP} = -35.788 + 1.966y^{TH} + 5.679p^{JP} - 2.658V^{TH\text{-}JP}$

Standard error: (0.805) (2.817) (0.205)
Chi-square: (4.605) (0.637) (14.439)

The main results are:

$$\text{Exports: } x_t^{JP} = -36.830 + 8.573y_t^{JP} + 0.051p_t^{JP} - 0.386V_t^{TH\text{-}JP} \quad (13)$$

$$\text{Imports: } m_t^{JP} = -35.788 + 1.966y_t^{TH} + 5.679p_t^{JP} - 2.658V_t^{TH\text{-}JP} \quad (14)$$

From equation (13) & (14), volatility factors are significant at 5 percent significant level in export demand function and 1 percent significant level in import demand function. Therefore rising of exchange rate volatility is harmful to bilateral trades with Japan.

Thailand's income factors are statically significant at 5 percent level but Japan's income factors are insignificant. Moreover the cointegration tests indicate that price factors are insignificant in both export and import sections.

Unexpectedly, Japan income factors have no effect on export value. According to Japanese GDP history in last 10 years, the GDP growth rate is quite low comparing to other countries. This indicates that the increasing values of export to Japan are not because income factors but from other factors which were not observed in this study such as tariff rates, types of products and trade agreements.

4.5 Cointegration test on Thailand's bilateral trade with Taiwan

Two countries that already share a healthy amount of annual bilateral trade, Taiwan and Thailand are set to become even closer friends as a new era in textile trade begins and international trade and investment continue to grow. Taiwan is top ten trading partner with Thailand with more than US$ 3 billions of export value in 2007. This research could be useful for Thai and Taiwanese traders who want to bilateral trades between these two countries. The cointegration test results are shown in Table 13 and Table 14 below.

Table 13: Cointegration Test Results for Exports to Taiwan

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.17936	62.96292	53.12	60.16
At most 1 *	0.116131	37.46345	34.91	41.07
At most 2 *	0.106612	21.53881	19.96	24.6
At most 3	0.052788	6.996039	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$$x^{TW} = 4.132 + 4.003y^{TW} - 3.468p^{TW} + 0.316V^{TH\text{-}TW}$$

Standard error: (0.596) (0.804) (0.092)
Chi-square: (9.700) (1.391) (0.660)

Table 14: Cointegration Test Results for Imports from Taiwan

No. of cointegrating equation(s)	Eigenvalue	Trace Statistic	5 percent Critical Value	1 percent Critical Value
None **	0.213173	69.78353	53.12	60.16
At most 1 *	0.144367	39.09589	34.91	41.07
At most 2	0.086402	19.13886	19.96	24.6
At most 3	0.057442	7.572221	9.24	12.97

Notes. *(**) denotes rejection of the hypothesis at the 5%(1%) level. Chi-square critical values: at 1 percent = 6.6349; at 5 percent = 3.8415; at 10 percent = 2.7055

$$m^{TW} = 3.759 + 1.126y^{TH} - 0.168p^{TW} + 0.315V^{TH\text{-}TW}$$

Standard error: (0.390) (1.014) (0.091)
Chi-square: (9.258) (5.221) (1.401)

Trace statistics indicate that there is 1 cointegrating equation at 1 percent significance level in both export and import sections as shown in equation (15) & (16).

$$\text{Exports: } x_t^{TW} = 4.132 + 4.003y_t^{TW} - 3.468p_t^{TW} + 0.316V_t^{TH\text{-}TW} \quad (15)$$

$$\text{Imports: } m_t^{TW} = 3.759 + 1.126y_t^{TH} - 0.168p_t^{TW} + 0.315V_t^{TH\text{-}TW} \quad (16)$$

With regard to export functions, the estimated coefficients for the income terms are significant at 1 percent significant level with positive sign as expected. This means increasing in income terms can increase the export values. However volatility indices and price proxies are statistically insignificant. Therefore exchange rate volatility is not harmful export values to Taiwan.

With regard to import demand function, the income and price terms are significant at 1 percent and 5 percent significant level respectively. Furthermore the increasing of both terms positively affects import values as expected. Nonetheless the exchange rate volatility is statistically insignificant which means changing in exchange rate has no impact on import values from Taiwan.

The reasons why the exchange rate volatility has no effect on international trade with Taiwan may be because of particular types of trading products. Thailand major importing products from Taiwan are integrated circuits, micro-assemblies, data

processing machines and other electronic apparatus and components. Thailand's major exporting products to Taiwan are textile, electronic products and components, rubber and rubber products, sugar, starch and motorized vehicles and parts.

CHAPTER V: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Many researches have tried to find the impact of exchange rate volatility on international trade. Because exchange rate variability can affect the volume of goods traded internationally by making prices and profits indeterminate or uncertain based on theory. Many economists try to prove this theory by citing some countries as case studies. But the results are uncertain. Some researches indicated that there is impact of exchange rate volatility on international trade while other researches found the opposite. Some economists showed the positive impact on international trade but some found the negative impact. There is no definite result; it differs depending on country characteristics and type of trading products.

Thailand also faced the Asian crisis in 1997 with growth freezing of GDP, increasing debt, and other problems. Thailand's recovery from the 1997-1998 Asian financial crisis relied on exports, largely on external demand.

The question we have explored in this research is whether exchange rate volatility has had any detrimental impact on trade flows in Thailand during the post-Asian-crisis period. Because Thailand is heavily export-dependent, the results from this research could be beneficial knowledge to Thailand traders and could provide useful reference for appropriate trade policies. Furthermore this research tests the impact of exchange rate volatility on Thailand’s bilateral trades with three major partners: United States, Japan, and Taiwan to understand more about the relations.

The following table summarizes the regression results, out of eight regressions undertaken in this research; five cases indicate that exchange rate volatility significantly affected exports or imports of Thailand during 1997 to 2007 period. Four

cases out of these five cases indicate that exchange rate volatility adversely affected the international trade.

Cases	Exchange Rate Volatility	
A. With the world markets		
Total exports	Negative	Significant at 1%
Total Imports	Negative	Significant at 1%
B. With the US market		
Exports to US	Positive	Significant at 1%
Imports from US	Negative	Not significant
C. With the Japanese market		
Exports to Japan	Negative	Significant at 5%
Imports from Japan	Negative	Significant at 1%
D. With the Taiwanese market		
Exports to Taiwan	Positive	Not significant
Imports from Taiwan	Positive	Not significant

The adverse impact of exchange rate volatility on trade and the real sector may in part demonstrate the supposed "fear of floating" that seemed to characterize many emerging economies[2]. After Asian Crisis in 1997, many countries that used to adopt pegging exchange rate have changed to float or flexible exchange rate. However float exchange rates bring with them some other problems as this research shows. This surely has implications for the lasting issue of appropriate choice of exchange rate regime.

5.4 Recommendations

This research tested the impact of exchange rate volatility on international trade using income, price proxies, and exchange rate volatility as variables. There

[2] This term was popularized by Calvo and Reinhart (2001).

should be some other parameters that may also impact on international trade such as government policy or type of products etc. Further studies should take other factors to consideration because adding more terms may make the result more robust.

Another matter is about derivative product especially forward exchange market. As mention in literature reviews section that forward exchange markets and futures market in emerging markets cannot be used to create a perfect hedge against exchange risk due to prediction and cost. In Thailand derivative products start to get accepted recently, and traders may use them to reduce risk. Therefore, if the forwards and futures exchange market become more efficient and popular, the impact of exchange rate volatility may reduce. Further researches should also consider this aspect.

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APPENDIX A: Thailand's Key Economic Indicators

	2001	2002	2003	2004	2005	2006	2007
1. Population (millions)	62.31	62.80	63.08	61.97	62.42	62.83	63.04
2. GDP							
2.1 GDP at constant 1988 price (billion baht)	3,073.6	3,237.0	3,468.2	3,688.2	3,855.1	4,052.0	4,244.6
(% change)	2.2	5.3	7.1	6.3	4.5	5.1	4.8
Agriculture (billion baht) **	320.0	322.2	363.0	354.4	347.8	361.2	375.1
(% change)	3.2	0.7	12.7	-2.4	-1.9	3.8	3.9
Non-agriculture (billion baht) **	2,753.6	2,914.9	3,105.1	3,333.8	3,507.3	3,690.8	3,869.5
(% change)	2.0	5.9	6.5	7.4	5.2	5.2	4.8
2.2 GDP at current price(billion baht)	5,133.5	5,450.6	5,917.4	6,489.5	7,095.6	7,830.3	8,485.2
(% change)	4.3	6.2	8.6	9.7	9.3	10.4	8.4
2.3 GNP per capita (baht)	79,785	83,338	89,144	96,553	104,251	115,098	125,092
3. Inflation							
3.1 Headline Consumer Price Index (2002=100)	99.4	100.0	101.8	104.6	109.3	114.4	117.0
(% change)	1.6	0.7	1.8	2.7	4.5	4.7	2.3
' 3.2 Core Consumer Price Index (2002=100)	99.6	100.0	100.2	100.6	102.2	104.5	105.6
(% change)	1.3	0.4	0.2	0.4	1.6	2.3	1.1
4. External Account (billions of US$)							
4.1 Export	63.1	66.1	78.1	94.9	109.2	127.9	151.1
(% change)	-7.1	4.8	18.2	21.6	15.0	17.2	18.1
4.2 Import	60.6	63.4	74.3	93.5	117.7	126.9	139.2
(% change)	-3.0	4.6	17.4	25.7	25.9	7.8	9.6
4.3 Trade balance	2.5	2.7	3.8	1.5	-8.5	1.0	12.0
4.4 Current account balance	5.1	4.7	4.8	2.8	-7.9	2.2	14.9
(% of GDP)	4.4	3.7	3.3	1.7	-4.5	1.1	7.2
4.5 Net capital movement	-3.5	-1.8	-4.8	3.6	12.6	5.7	-0.9
- Private **3/**	-2.7	-3.4	-5.5	3.3	11.3	6.2	2.6
- Public	-0.3	-2.5	-1.9	-2.7	1.3	-0.9	-2.9

	2001	2002	2003	2004	2005	2006	2007
- BOT	-0.4	4.0	2.7	3.1	0.0	0.4	-0.6
4.6 Balance of payments	1.3	4.2	0.1	5.7	5.4	12.7	3.3
4.7 International reserves (billions of US$)	33.0	38.9	42.1	49.8	52.1	67.0	87.5
4.8 Swap Obligation (billions of US$)	2.1	0.5	-5.2	-4.6	-3.8	-6.9	-19.1
4.9 Total debt outstanding (billions of US$)	67.5	59.5	51.8	51.3	52.0	59.6	61.5
(of which : public debt **4/**)	28.3	23.3	16.9	14.9	13.5	13.1	11.6
4.10 Total debt service ratio (%)	20.8	19.6	16.0	8.5	10.8	11.3	11.1
of which : public (included BOT since 1997)	8.1	7.9	7.6	1.9	1.1	1.2	0.9
7. Exchange rate							
Baht : US$ (Reference rate) average 8/	44.5	43.0	41.5	40.3	40.3	37.93	34.56

APPENDIX B: Structure of Export Receipts and Import Payments, 2006

Partner Country	Structure of export receipts, 2006					Structure of import payments, 2006				
	USD	JPY	THB	Others	Total	USD	JPY	THB	Others	Total
Japan	58.7	32.3	8.5	0.5	100.0	46.8	44.1	8.4	0.7	100.0
	USD	JPY	THB	CAD	Others	Total	USD	JPY	THB	CAD	Others	Total
NAFTA												
- US	96.1	0.8	2.9	0.0	0.2	100.0	95.4	0.3	2.6	0.0	1.7	100.0
- Canada	96.3	0.2	2.0	1.1	0.4	100.0	88.3	2.3	1.1	7.8	0.5	100.0
- Mexico	93.0	1.1	5.4	0.0	0.5	100.0	94.5	0.4	4.2	0.0	0.9	100.0
Total	**96.0**	**0.8**	**2.9**	**0.1**	**0.2**	**100.0**	**95.0**	**0.4**	**2.6**	**0.4**	**1.6**	**100.0**

Partner Country	Structure of export receipts, 2006							Structure of import payments, 2006						
	USD	GBP	CHF	THB	EURO	Others	Total	USD	GBP	CHF	THB	EURO	Others	Total
European Union														
- Belgium	70.2	0.0	0.0	11.6	14.2	4.0	100.0	72.7	0.1	0.1	5.3	20.9	0.9	100.0
- Denmark	51.9	0.0	0.0	14.6	27.6	5.9	100.0	37.0	0.2	0.0	22.7	20.5	19.6	100.0
- France	67.5	0.0	0.0	7.9	22.2	2.4	100.0	62.6	0.3	1.1	6.9	28.4	0.7	100.0
- Germany	65.3	0.0	0.2	6.3	27.1	1.1	100.0	33.3	0.3	3.0	7.1	54.4	1.9	100.0
- Greece	46.4	0.0	0.0	17.9	28.2	7.5	100.0	71.8	0.0	0.0	5.8	19.1	3.3	100.0
- Ireland	93.5	1.2	0.0	1.2	3.6	0.5	100.0	64.5	0.4	0.0	23.7	10.1	1.3	100.0
- Italy	64.0	0.0	0.0	2.9	30.8	2.3	100.0	49.6	0.9	1.2	3.2	43.3	1.8	100.0
- Luxembourg	27.1	0.0	0.0	0.1	69.7	3.1	100.0	58.1	0.0	0.0	2.3	37.2	2.4	100.0
- Netherlands	88.3	0.0	0.0	3.8	7.1	0.8	100.0	60.0	0.1	1.2	2.3	33.9	2.5	100.0
- Portugal	42.6	0.0	0.0	7.4	46.9	3.1	100.0	68.9	0.3	0.0	0.7	29.9	0.2	100.0
- Spain	61.8	0.0	0.0	8.1	28.8	1.3	100.0	56.4	0.2	0.5	3.7	37.6	1.6	100.0
- United Kingdom	66.4	13.2	0.0	8.0	11.8	0.6	100.0	58.7	26.5	0.0	8.5	4.6	1.7	100.0
- Austria	63.2	0.0	0.1	8.7	26.9	1.1	100.0	30.3	0.1	0.5	1.1	66.5	1.5	100.0
- Sweden	66.1	0.0	0.0	10.1	12.9	10.9	100.0	53.4	0.1	0.4	15.5	19.7	10.9	100.0
- Finland	84.6	0.0	0.0	6.1	8.0	1.3	100.0	81.7	0.1	0.0	0.9	16.4	0.9	100.0
Total	**70.8**	**2.7**	**0.0**	**6.9**	**17.7**	**1.9**	**100.0**	**50.8**	**3.5**	**1.4**	**6.8**	**35.1**	**2.4**	**100.0**

Partner Country	Structure of export receipts, 2006							Structure of import payments, 2006						
	USD	GBP	CHF	THB	EURO	Others	Total	USD	GBP	CHF	THB	EURO	Others	Total
ASEAN														
- Singapore	91.8	1.2	3.2	3.5	0.1	0.2	100.0	87.7	0.7	4.9	5.8	0.3	0.6	100.0
- Indonesia	83.9	2.0	11.2	0.1	0.0	2.8	100.0	90.3	0.8	6.2	1.2	0.0	1.5	100.0
- Philippines	88.9	2.0	6.1	1.7	0.0	1.3	100.0	85.6	6.4	7.6	0.3	0.0	0.1	100.0
- Malaysia	87.1	1.1	8.5	0.2	2.8	0.3	100.0	87.6	0.7	4.4	0.5	6.3	0.5	100.0
- Brunei	49.5	1.9	36.6	9.8	0.0	2.2	100.0	99.8	0.0	0.0	0.0	0.0	0.2	100.0
- Cambodia	56.8	0.1	42.7	0.1	0.0	0.3	100.0	17.4	0.4	81.9	0.1	0.0	0.2	100.0
- Laos	39.4	0.0	60.4	0.0	0.0	0.2	100.0	62.3	0.0	28.7	0.0	9.0	0.0	100.0
- Myanmar	42.3	0.4	55.6	0.4	0.1	1.2	100.0	92.1	0.0	7.5	0.0	0.0	0.4	100.0
- Vietnam	91.2	0.9	6.5	0.1	0.0	1.3	100.0	95.2	2.6	1.8	0.1	0.0	0.3	100.0
Total	**84.3**	**1.2**	**11.7**	**1.3**	**0.7**	**0.8**	**100.0**	**88.0**	**1.2**	**5.9**	**1.8**	**2.5**	**0.6**	**100.0**