THE INCOME AND PRICE ELASTICITIES APPROACH TO TRILATERAL TRADE RELATIONSHIPS BETWEEN THE U.S., JAPAN, AND CHINA FROM Q1 1994 TO Q1 2003

By

JIHUA LI

A Thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Business Administration

Graduate School of Business
Assumption University
Bangkok Thailand

December 2003

THE INCOME AND PRICE ELASTICITIES APPROACH TO TRILATERAL TRADE RELATIONSHIPS BETWEEN THE U.S., JAPAN, AND CHINA FROM Q1 1994 TO Q1 2003

By

JIHUA LI

A Thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Business Administration

Examination Committee :

1. Dr. Tang Zhimin (Advisor) ....
2. Dr. Ismail Ali Siad (Member) ....
3. Dr. Michael Schemmann (Member) ....
4. Dr. Ioan Voicu (Member) ....
5. Assoc. Prof. Poonsak Sangsunt (MUA Representative) ....

Examined on : 8 December 2003
Approved for Graduation on :

Graduate School of Business
Assumption University
Bangkok Thailand
December
2003

Abstract

The objectives of this research are to find whether the US and Japan exports to China are determined by Chinese GDP growth and the value of Yuan, to find whether the US, China exports to Japan are determined by Japanese GDP growth and value of Yen and to find whether China, Japan exports to the US are determined by the US GDP growth and the value of Dollar.

Quarterly time series and cross-section data (from Q1 1994 to Q1 2003) are used to estimate the elasticities with linear regression method. F-test, T-tset, Residual-test and VIF are used to analyze the significance of the results of this research.

The results indicate that the China's real trade value has strong relationship with the change of the US and Japan's income. The income elasticity of demand for Chinese imports from the US is 0.519. The income elasticity for Chinese exports to the US is 3.854. Also, the income elasticity for Chinese imports from Japan is 0.796 and the income elasticity of demand for Chinese exports to Japan 4.316. The study also found that the Japanese goods have strong relationship with the change of the US income. The elasticity is 1.048.

Finally, this study found the Japan and the US real trade value has strong relationship with each other's real exchange rate. The price elasticities for the US Dollar against Japanese Yen is 0.354, for Yen against Dollar is 0.709 (absolute value). The sum of two price elasticities is larger than 1, and the Marshall Lerner Condition is hold.

Compared with the aggregate elasticities shown in some empirical studies, the higher income elasticities for Chinese exports to the US and Japan implicate that Chinese goods has strong competitiveness in the US and Japan market relative to other competitors.

This research found that the Japanese goods has less competitiveness in the US market relative to other competitors by comparing its income elasticity for exports to the US with the income elasticity for US aggregate imports.

The Japanese goods has less competitiveness than other competitors in the US and Chinese market and the U.S goods has less competitiveness than other competitors in the Chinese market are due to there is a reorganization of production on a worldwide basis.

The U.S and Japanese government should recognize this trend.

Japan must reform its financial market so that it can enhance the competitiveness of Japanese goods in the U.S and Chinese markets.

When Japan or the U.S regulates its trade deficit, they must consider that the relative price effect of devaluation should dominate the three effects: 1.The reverse absorption effect, 2.The pass-through effect, 3.The inflation effect, otherwise, the overall effects of devaluation on the trade balance become uncertain.

Acknowledgement

Acknowledgements are due to my family, in particular to my girl friend for her continuing encouragement.

I would like to acknowledge the contribution of my guide for my master thesis on the subject of international economy, which formed the basis of my academic knowledge.

Thanks are also due to Dr. Tang Zhimin who helped with advising, and the many organizations' publications for the reference material used.

I am also grateful to other judges for their willingness to pass this thesis.

TABLE OF CONTENTS

LIST OF TABLES

Page No

List of Tables

LIST OF FIGURES

Page No

List of Figures

Chapter 1

Introduction

1.1 Background of the Study

The common goals of the U.S, China, and Japan to achieve global economic integration led the three nations to realize that the optimal approach to preserve their respective national interests is to promote the globalization process, free trade, and reciprocal economic cooperation.

China became a high-economic growth country in recent decades after absorbing a large amount of export-oriented FDI from the U.S, Japan. World Trade Organization reported the gross value of China's import and export increased more than 20 percent in the year 2002, and thereby China has replaced the UK and ranked fifth in the international trade, only after the United States, Germany, Japan and France.[1]

The Japanese economy has been in trouble since the burst of its bubble economy in the early 1990s. Japan is still struggling to get out of a seemingly bottomless economic quagmire. However, there is no obvious sign indicate Japan experienced the economic crisis. Its living standard does not decline and people still have strong purchase power.[2]

The U.S. economy was unprecedentedly successful in the last decade of the 20th century: it was called a "new economy", implying that it had already overcome the fluctuations of the business cycle. However, with the burst of the bubble, the prospects of the U.S. economy today do not look as bright as they did in the 1990s.[3]

---

[1] World Trade Organization Report, April 23, 2003. www.wto.org

[2] Ministry of Economy, Trade and Industry, Japan. May 1, 2003. www.meti.go.jp

[3] US Census Bureau Economic Programs. August 22, 2003. www.census.gov

Table 1.1 gives real GDP growth rate in three countries.

Table1.1 Real GDP growth rate in three countries.

	Japan %	U.S %	China %
1973-79 (avg)	3.5	3.0	4.3
1979-89 (avg)	3.8	3.0	9.5
1989-99 (avg)	1.6	3.0	9.2
1990	5.3	1.8	3.8
1991	3.1	-0.5	9.2
1992	0.9	3.0	14.2
1993	0.4	2.7	13.5
1994	1.0	4.0	12.6
1995	1.6	2.7	10.5
1996	3.5	3.6	9.6
1997	1.8	4.4	8.8
1998	-1.1	4.3	7.8
1999	0.1	4.1	7.1
2000	2.8	3.8	7.9
2001	0.4	0.3	7.3
2002	0.3	2.4	8

* Note: the (avg) means the average growth rate

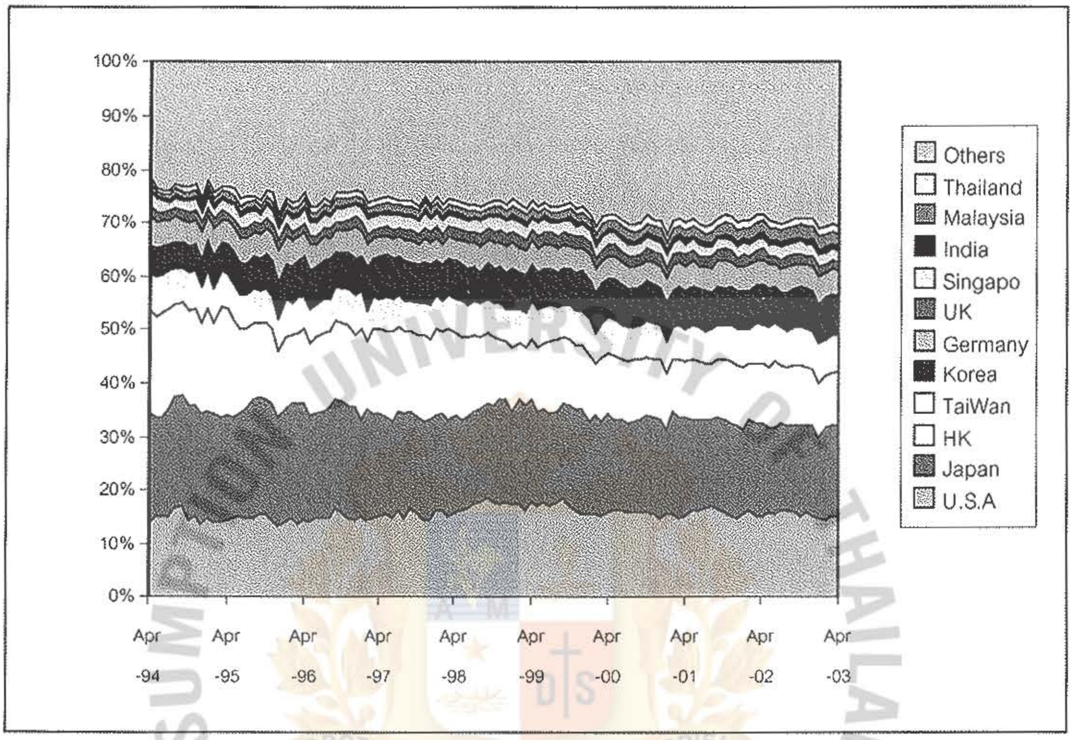
Source: Organization for Economic Co-operation and Development database, 2003

Trilateral trade relationship

The U.S. has provided its huge domestic market to the rest of the world, and been a main "absorber" of the manufactured exports made in East Asian economies, including Japan. For China, the most important two trade partners are the U.S and Japan.

Figure 1.1 gives the share of China main trade partners from April 1994 to April 2003. Japan and the U.S approximately account for 40% of Chinese imports and exports.

Figure 1.1 the share of main partners of Chinese foreign trade

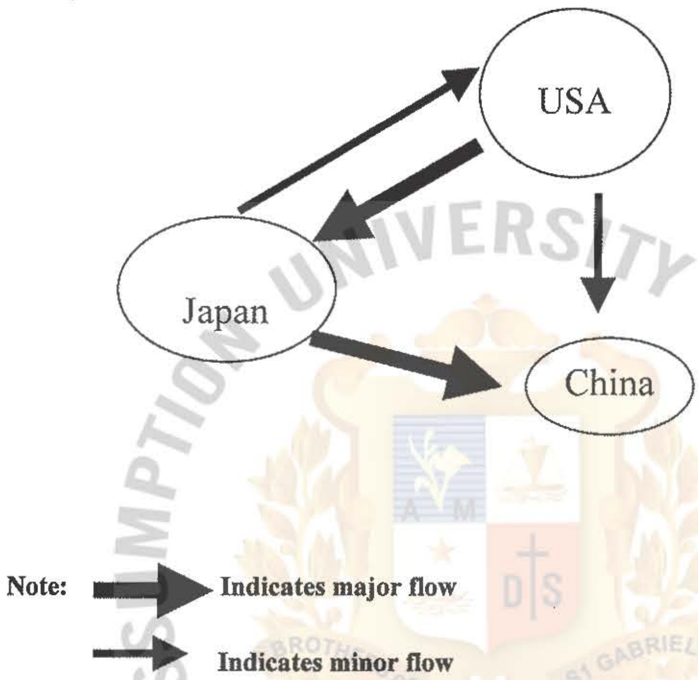


***Source*:** Computed data compiled from Census and Economic Information Center database, 2003

Zhang Li (2002) stated that China foreign trade partly depends on the huge demand of the U.S. market and stable supplies from Japanese industries. In some industries, China imported capital and intermediate goods from Japan, which were essential for their industrialization. Then, China inputted ample labor forces to assemble and process the imported materials, components. Finally, manufactured goods were exported to the U.S. market.

Grahame Thompson (1999) stated that a triangular relationship of technology transfer exists among the US, Japan, and China. The US has created various types of new scientific and technological knowledge, which has been diffused to other countries including Japan, China. Japan and China have developed their technological innovations and industrial growth based on this knowledge. Japan still continues to import advanced technologies from the US, but also supplies the US and China with industrial technology. This system is summed up in Figure 1.2.

Figure 1.2. Main technological flows in three countries



Source: "Economic Dynamism in the Asia-Pacific", Grahame Thompson (1998), page 261

Japan-US economic relationship

Japan-US bilateral economic relationship is very interdependent. This interdependency is evident in various way: the volume of goods and services that flow between two countries; the number of businesses established in each other's country; the amount of each other's stock purchase; or, in the vast number of tourists and students who visit and study in each other's nation. For example, Japanese automakers have 11 assembly and engine plants in the US. By JAMA (Japan Automobile Manufactures Association) statistics, 64% of all Japanese-brand cars and trucks sold in the US are now actually built in the US by American workers. Also, US carmakers and suppliers are now deeply invested in Japan: General Motors owns half of Isuzu, 20% of Fuji Heavy Industries.

However, trade frictions arose between the two countries for two decades, the US claimed that Japan's domestic market was closed in some industries, for example: retailing, banking, telecommunications. In the late of 1990s, individual trade frictions between the two countries have virtually ceased to be some political issues, but those did not shake the fundamental of two countries' relationship.[1]

Three countries' foreign exchange rate systems

US Dollar and Japanese Yen are not officially fixed but are determined by conditions of supply and demand in the foreign exchange market.

Chinese Yuan has been officially a managed float, often within a very narrow band, and Yuan has been on a general trend of slight appreciation.[2]

U.S and Japan urged China to let the Yuan trade freely in the Asia-Pacific Economic Cooperation summit. They said that the large trade deficit with China is due to Yuan is devaluated. However, Pacific nations, including South Korea and Taiwan, leave U.S and Japan to fight alone over Yuan policy.[3]

1.2 Statement of the Problem

It is not clear how three countries' GDP growth differential and their exchange rate impact their bilateral foreign trade. As a consequence, this study aims to give clear answers to this problem:

1. How does the Chinese economic growth and Dollar/Yuan affect the US exports to China?

[1] US census Bureau: Foreign Trade Statistics, August 22, 2003, www.census.gov
[2] International Monetary Fund, May 21,2003, www.imf.org
[3] Wall Street Journal, October 21,2003, http://online.wsj.com

2. Is the US GDP growth and value of US Dollar playing an important role in China exports to US?

3. Does the Japanese GDP growth and value of Yen affects the China exports to Japan?

4. How does the Chinese GDP growth and value of Yuan impact on the Japan exports to China?

5. Is the U.S economic growth and value of US Dollar playing an important role in Japan exports to US?

6. Is the US exports to Japan related to two determinants: Japanese GDP growth and value of Yen?

1.3 Research Objective

The objectives of this study are as follows:

1. To find whether the US exports to China is determined by Chinese GDP growth and value of Yuan.

2. To find whether the China exports to US is determined by US GDP growth and value of US Dollar.

3. To find whether the China exports to Japan is determined by Japan GDP growth and value of Yen.

4. To find whether the Japan exports to China is determined by China GDP growth and value of Yuan.

5. To find whether the Japan exports to US is determined by US GDP growth and value of US Dollar.

6. To find whether the US exports to Japan is determined by Japan GDP growth and value of Yen.

1.4 Scope & limitation

This study will be based on cross-section and time series data of the three countries from Q1 1994 to Q1 2003.

FDI flowing or multinational company (MNCs) have started to manufacture new products at plants in both advanced and less industrialized economies without any time lag. The value of no lagged MNCs (in foreign country) exports will be small partly investigated in imports.

1.5 Significance of the Study

The income elasticities (unstandardized coefficients between GDP and foreign trade) and price elasticities (unstandardized coefficients between exchange rate and foreign trade) was usefully exploited by policy authorities in recent decades. By comparison these coefficients, governments will consider whether or not change the trade and foreign currency policies.

For example, to reduce long-term trade deficits with China, the U.S and Japan urged China to revaluate Yuan since 2002 because there is a good indicator for the US and Japan policy authorities to assert that the US and Japanese goods have less competitiveness than other competitors in Chinese market: In long term, the income elasticity of demand for Chinese imports from the US, Japan is less than the income elasticity of demand for Chinese exports to the US and Japan.

1.6 Definition of Terms

CPI: The CPI or Consumer Price Index is a measure of the cost of goods purchased by average household. (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

GDP deflator: The GDP deflator is a measure of the cost of goods purchased by households, government, and industry. Differs conceptually from the CPI measure of inflation, but not by much in practice. (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

Income elasticity of demand for imports and exports: Assuming that all prices are constant, the change in quantity demanded of import and export goods relative to a change in income. (Economic Geography Glossary. http://faculty.washington.edu).

Price elasticity of demand for imports and exports: Measures the responsiveness of demand for import or export to a given change in price (real exchange rate). It is calculated by taking the percentage change in demand for imports or exports and dividing by the percentage change in price (real exchange rate). (Deninis R.Appleyard, 1995. "International Economics, second edition".)

Real GDP: The number reached by valuing all the productive activity within the country at a specific year's prices. When economic activity of two or more time periods is valued at the same year's prices, the resulting figure allows comparison of purchasing power over time, since the effects of inflation have been removed by maintaining constant price. (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

Real imports value: the imports value divided by import price deflator.

Real exports value: the exports value divided by export price deflator. (Deninis R.Appleyard, 1995. "International Economics, second edition")

Real exchange rate: the price of domestic goods relative to foreign goods-equivalently, the number of foreign goods someone gets in exchange for one domestic good-is called the real exchange rate. (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

Chapter 2

Literature Review

This chapter consists of three sections. The first section introduces some literatures to support framework. This section shows the key concepts of this study and the description of relationships between these concepts. The second section explains how literatures support the methodology. The third section displays the funding of these literatures. A summary is presented at end of this chapter.

2.1 Literature to Support Framework

2.1.1 Key concepts

Real GDP growth rate is a best indicator to evaluate a country's economic environment. It is possible for a country's GDP grow fast or slow as a result of other countries' real GDP growth speed if there are some widely trade relationships between these countries.

Bilateral real exchange rate in fact is a real price of all non-tradable and tradable goods a country compare with the other country. Its volatility directly affects the foreign trade value.

The elasticity (coefficient) approach says that the real value of exports and imports are each determined by the level of economic growth and relative prices. Typically, real import value (Q_m) is positively related to domestic income and negatively related to the relative price of foreign to domestic products (also known as the real exchange rate E). The real export value (Q_x) is similarly dependent on foreign income Y* and relative price (with a reversed sign E*). Thus, for imports,

$Q_m = Q_m(Y, E)$

and for exports,

$Q_x = Q_x(Y^*, E^*)$ (Ronald I. Mckinnon. 1997)

Krugman (1991) presented an observation with respect to American trade flows. In his "Mass. Ave" model (get the average value of the price or income elasticity which a region trades with other regions) representing theoretical and empirical conventional wisdom in the Washington, D.C, and greater Boston areas, net exports are "assumes at minimum to depend on domestic income, foreign income, and the real exchange rate", although additional arguments could easily be added. Krugman also cautions that the real exchange rate works with substantial lags. For the U.S economy, median estimates of long-run price elasticities are –1.1 for imports and –0.8 for exports.

Meredith (1993) and Golub (1994) have reviewed the empirical applications of the modern elasticities approach to Japan's trade flows. Meredith conveniently summarized past estimates by several authors of price and income elasticities of Japanese exports and imports. All estimates carry the expected signs. The price elasticity average over these estimates is –1.01 for exports and –0.61 for imports. The lower import elasticity is reasonable because Japan's imports have traditionally consisted of raw materials and energy, which are highly price inelastic.

The external adjustment with growth (EAG) model was proposed by Cline (1993). He revealed the structure of the modern elasticities approach even more clearly. The EAG model predicts bilateral trade flows among seventeen major countries or regions on the basis of coefficient estimates obtained from quarterly data over the period 1973-87. For each pair, the trade flow depends on the importer's real growth as will as eight quarterly lags of the bilateral and cross-country terms of trade. Model projections require the future paths of prices, real growth rates, and real exchange rates of relevant countries as exogenous inputs. The range of 102-112 yen to the dollar (in mid-1993 price) is considered to be consistent with the target current-account position of 1-2 percent of GDP by 1995-96. As do the IMF economists, Cline finds that trade volumes respond to price signals with a lag of about two years. The relationship looks particularly impressive when Japan's bilateral surplus with the United Stats since 1979 is plotted against the real yen-dollar rate lagged two years.

Abdelhak Senhadji and Claudio Montenegro (1998) estimated income and price elasticities of the export demand function for 53 industrial and developing countries, estimated within a consistent framework using time-series techniques that account for the nonstationarity in the data. The long-run price and income elasticities generally have the expected sign and, in most cases, are statistically signicant. The average long-run price and income elasticities are approximately –1 and 1.5, respectively. Of the 53 countries, 22 have point estimates of long-run price elasticity greater than 1, and for 33 countries the unit-price elasticity cannot be rejected. Thirty-nine countries have point estimates of the long-run income elasticity that are greater than 1 and for 35 countries the unit-income elasticity cannot be rejected. Thus, exports do significantly react to both movements in the activity variable and relative prices. These elasticities estimates are shown to have good statistical properties; in particular, they have a very small bias. While developing countries show, in general, lower price elasticities than developed countries, Asia has significantly higher price elasticities than both industrial and developing countries. Furthermore, Asia benefits from higher income elasticities than the rest of the developing countroes, corroborating the view that trade had been a powerful engine of growth in the region. Africa has the lowest income elasticities, reflecting largely the type of products the region exports.

Wen Hai (1998) stated that the increased US-China deficits in the 1990s reflects macroeconomic forces in the China and the US move in opposite direction, causing their respective overall trade balance to move in opposite direction. He also stated that the relocation of production of US imports from East Asia to China is accelerated.

Valerie Cerra and Anuradha Dayal-Gulati (1999) state that the econometric estimates of export and import equations provide evidence that Chinese trade flows have indeed become increasingly price sensitive (elasticity), owing to the gradual liberalization of the trade regime over time, and to the growing shares of foreign-funded enterprises and manufactures in total trade. Over the past 20 years, the Chinese authorities have undertaken wide-ranging reforms of their exchange and trade systems that have steadily reduced the role of planning and increased the importance of market forces. As these reforms have taken root, relative price and domestic and foreign demand would be expected to have played a bigger role in determining trade flows. Due to the 1983 reforms, the export equation was estimated over the period 1983-97. The relative price elasticity for China's export was about –0.3 and the income elasticity was about 2.8, both correctly signed and statistically significant, indicating clear shifts in these parameters. The relative price elasticity for import demand is about –0.4 and the income elasticity is about 1.4. The study suggested that the responsiveness of exports and imports to the effective exchange rate has increased over time in response to policy changes. The gradual liberalization of external trade restrictions and exchange controls, which is also reflected in the growing share of FFEs in total export and imports, appears to have made export and import behavior more responsive to market signals.

Vincent D (2000) examined the reason behind rising China, U.S trade imbalance and evaluated the impact of China's accession to the WTO on its trade with the U.S. This research adopted the annual data (1988-2000) to measure the impact and found a strong positive correlation between the bilateral trade performance of the U.S with China and the China-U.S economic growth differential and the real appreciation of the Yuan. Linear regression method was applied in this study. Johansen cointegration tests reveal that all bilateral export volumes are cointegrated with foreign incomes and real exchange rates. The large majority of coefficients are highly significant and all are correctly signed when significant. In particular, the income elasticities range between 0.51 and 0.78 for U.S exports to China and between 4.63 and 4.91 for U.S imports from China. Furthermore, the real exchange rate ealsticities range between 0.38 and 0.69(absolute value) for U.S exports to China and between 1.91 and 1.33 for U.S imports from China.

Menzie D.Chinn (2003) examined the stability of import and export demand functions for the United States over the 1975q1-2001q2 period. Using the Johansen maximum likelihood approach, an export demand function is readily identified. In contrast, there appears to be a structural break in the import demand function in 1995; specifications incorporating this break pass tests for cointegration, although the price elasticity is not statistically significant. Only when excluding computers and parts from the import series is a stable import demand function detected. The resulting point estimates do not exhibit the income asymmetry typically found in other studies of aggregate U.S trade flows. The sensitivity of exports to the real exchange is between 0.7 to 0.8 when using the CPI deflated measure, and slightly higher 0.8 to 0.9 when using the PPI deflated measure. Overall, income elasticity estimates are relatively robust. They range from 1.7 to 2.

Rohit Vanjani (2003) stated that Japanese trade in manufactured goods differs from the rest-of-the world average and from the U.S. He used a simple industry-level gravity model and 1981-1998 data to test. He constructed a measure of normalized imports by dividing bilateral industry-level imports by the importer's aggregate absorption and the exporter's industry output. He found that Japan imports less than other countries, but also exports less than other countries. Relative to the U.S., Japanese export performance is half as strong today as it was in the mid-1980s. Bilaterally, Japan's normalized imports from the U.S. are greater than U.S. normalized imports from Japan.

Zhongxia Jin (2003) stated that a cointegrated vector autoregression model was established to explore the relationships among real interest rates, real exchange rates and balance of payments in China based on China's experience between 1980 and 2002.Taking into account institutional changes, the empirical study shown that significant and usually non-monotonic interactions exist between these three variables. The paper discusses theoretical and policy implications of the empirical result.

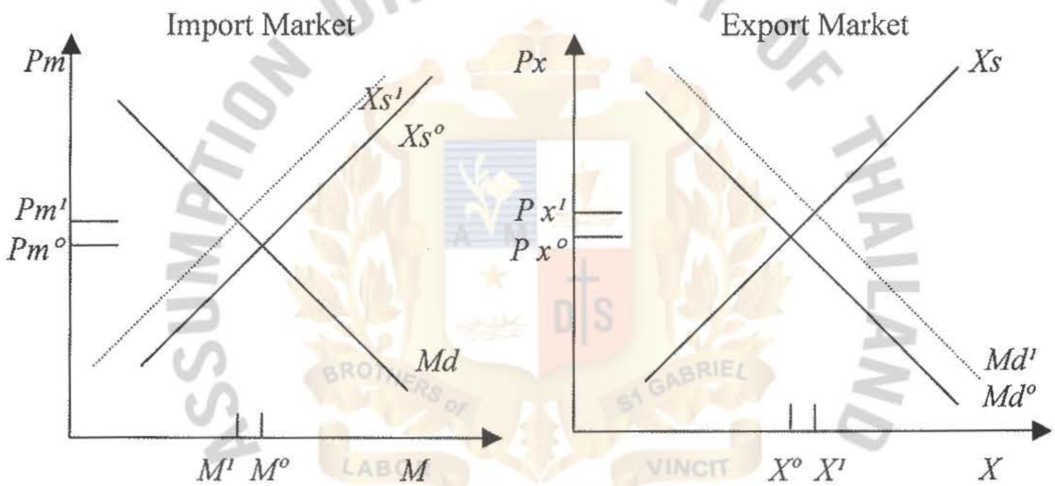
2.1.2 The relationship between key concepts.

The real foreign trade value has a relationship with real GDP growth is easier considered the effect on net exports (exports minus imports) first. Spending by consumers depends in part on their current incomes. When domestic income rises, consumers will spend more on all goods and services, including import. Thus, when domestic output (income) rise, net export must fall, other factors held constant.

Then, it is same effects of an increase in the real output of the country's trading partners, GDP *f* (foreign output or income). An increase in GDP *f* leads foreign consumers to increase their spending on all goods and services, including the exports of the domestic country. That is, an increase in the income of Japan would increase Japan's demand for U.S exports and raise U.S net exports. Note that the effects of changes in foreign income are the opposite of the effects of changes in domestic income. (Andrew B. Adel, Ben S. Bernanke, 2002).

Nominally, one country's import and export always keep equilibrium in short run. The following Figure 2.1 gives the equilibrium concept:

Figure2.1 Equilibrium in import and export



The domestic currency nominal depreciation will increase domestic export and decrease foreign country's export. Adversely, the nominal appreciation of domestic currency decrease domestic export and increase the foreign export. It is so-called BRM Model. (in domestic currency):

$B = PxXs - PmMd$ (Dennis R.Appleyard, 1995)

Where, $B=0$. (B means balance). Figure 2.1 shown the different movements of the supply s and demand d of domestic export X and import M.

An increase in the real exchange rate, E, is called a real appreciation. With a real appreciation, the same quantity of domestic goods can be traded for more of the foreign good then before because E, the price of domestic goods relative to the price of foreign goods, has risen. A drop in the real exchange rate, which decreases the quantity of foreign goods, that can be purchases with the same quantity of domestic goods, is called a real depreciation (Andrew B.Adel, Ben S. Bernanke, 2002).

2.2 Literature to support methodology

Krugman (1991), Meredith (1993), Golub (1994), Cline (1993), Valerie Cerra and Anuradha Dayal-Gulati (1999), Vincent D (2000) used the traditional export and import demand function, a log-linear function of the real exchange rate and real GDP variables. Multiple OLS model was employed in these papers.

Abdelhak Senhadji and Claudio Montenegro (1998) developed more advanced time series techniques for example the autoregressive distributed lag, that account for the nonstationarity in the data. And they used the Augmented-Dickey-Fuller Test for variables entering the export demand equation.

Menzie D. Chinn (2003) examined the stability of import and export demand functions for the US over the 1975q1-2001q2 period. By using the Johansen maximum likelihood approach, an export demand function is readily identified.

2.3 Empirical findings

Krugman (1991) found "Mass. Ave" model and then estimated the U.S. long-run price elasticities are –1.1 for imports and –0.8 for exports.

Meredith (1993) and Golub (1994) found that Japan's trade balance clearly responds to the traditional factors of income and relative price movement. The importance of exchange-rate changes, which affect the trade balance after about a two-year lag, is underlined. As for the long run, the authors asserted that shifts in the structural savings-and-investment balance (which is the ultimate determinant of net trade flows) must be manifested in the current account primarily through changes in the real exchange rate.

Cline (1993) found a 1 percent real appreciation of the Yen in 1993 is estimated to reduce Japan's current account surplus by $3 billion to $ 4 billion. And he found that trade volumes respond to price signals with a lag of about two years.

Abdelhak Senhadji and Claudio Montenegro (1998) found the average long-run price and income elasticities are approximately –1 and 1.5, respectively. Africa faces the lowest income elasticities for its exports, while Asia has both the highest income and price elasticities.

Valerie Cerra and Anuradha Dayal-Gulati (1999) found that the relative price elasticity for China's export was about –0.3 and the income elasticity was about 2.8, both correctly signed and statistically significant, indicating clear shifts in these parameters. The relative price elasticity for import demand is about –0.4 and the income elasticity is about 1.4.

Vincent D (2000) found a strong positive correlation between the bilateral trade performance of the U.S with China and the China-U.S economic growth differential and the real appreciation of the Yuan. The income elasticities range between 0.51 and 0.78 for U.S exports to China and between 4.63 and 4.91 for U.S imports from China. Furthermore, the real exchange rate ealsticities range between 0.38 and 0.69(absolute value) for U.S exports to China and between 1.91 and 1.33 for U.S imports from China.

Menzie D. Chinn (2003) found there is a statistically significant relationship between total exports of goods and services, U.S. income and the real exchange rate. The sensitivity of exports to the real exchange is between 0.7 to 0.8 when using the CPI deflated measure, and slightly higher 0.8 to 0.9 when using the PPI deflated measure. Overall, income elasticity estimates are relatively robust. They range from 1.7 to 2.

Summary

Authors	Objective	Methods	Finding	Framework
Krugman (1991)	To find American trade flow elasticity.	Log-linear regression	Price elasticity is –1.1 for imports and –0.8 for exports.	Ln (export) = Ln (income) + Ln (real exchange rate)
Cline (1993)	To find coefficient of seventeen major countries or regions	Log-linear regression	1 percent real appreciation of the Yen reduce Japan's current account surplus by $3 billion to $4 billion.	Ln (export)= Ln (Real GDP) +Ln (real exchange rate)
Meredith (1993) and Golub (1994)	To find Japan's trade flows elasticity.	Log-linear regression	Average estimate is –1.01 for exports and –0.61 for imports.	Ln (import)= Ln (income) + Ln (real exchange rate)
Valerie Cerra and Anuradha Dayal-Gulati (1999)	To find Chinese trade flows have indeed become increasingly price sensitive (elasticity),	Log-linear regression	The relative price elasticity for China's export was about –0.3 and the income elasticity was about 2.8. The relative price elasticity for import demand is about –0.4 and the income elasticity is about 1.4.	Ln (import)= Ln (income) + Ln (real exchange rate) Ln (export)=Ln (partner GDP)+ Ln (partner currency value)
Vincent D (2000)	To find economic correlation between US and China and the reason of trade imbalance.	Log-linear regression	Strong economic correlation between US and China	Ln (export)=Ln (partner GDP)+ Ln (partner currency value)
Abdelhak Senhadji and	To estimates export demand elasticities for developing and	ARDL	Africa faces the lowest income elasticities for its exports, while Asia has both the highest income	Log (export)=log (export lag 1)+ log (price) +log (GDP-export lag 1)
Menzie D. Chinn (2003)	To examines the relationship between U.S aggregation trade flows, real exchange rates and incomes.	Johansen maximum likelihood	A statistically significant relationship between total exports of goods and services, U.S. income and the real exchange rate.	Joselius and Juselius maxium likelihood model.

Chapter 3

Research Framework

This chapter is divided in four sections. The first section presents the framework of this study. The second section defines the variables. The third section displays the research hypothesis and the last section presents the expected outcome.

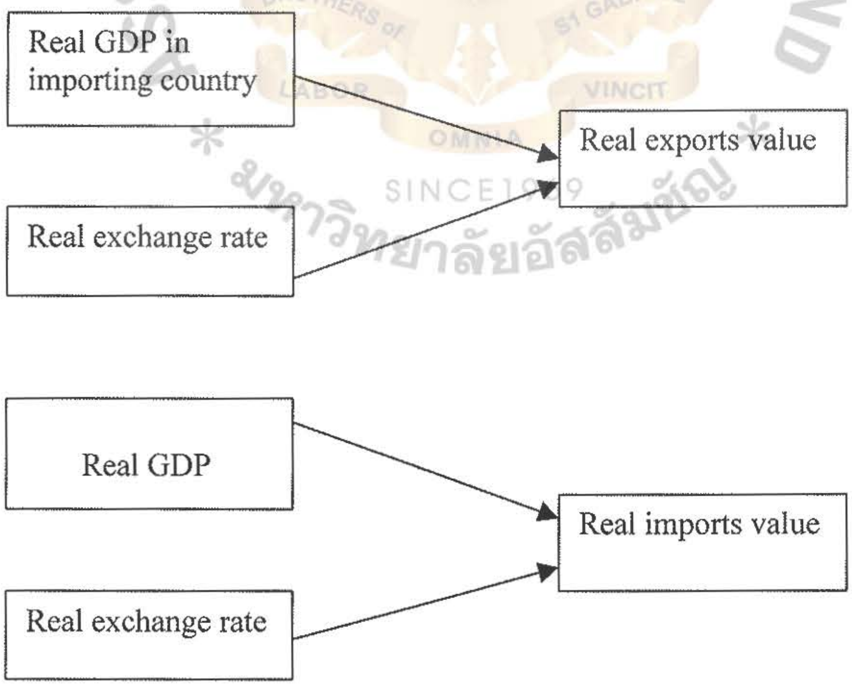
3.1 Diagram of framework

3.1.1 Theoretical Framework

Krugman(1991) confirms that this framework is useful for studying international trade relationships. The dependent variables are real imports and exports value. The independent variables are the real GDP in importing country and the real exchange rate.

Figure 3.1.1 Theoretical Model (Krugman 1991)

Independent Variables (X) **Dependent Variable (Y)**



Equations (Krugman 1991)

Ln (Real Exports Value) = $\alpha_0 + \alpha_1$ Ln (Foreign Real GDP) + α_2 Ln (Real Value of the Foreign Currency)

Ln (Real Imports Value) = $\beta_0 + \beta_1$ Ln (Domestic Real GDP) + β_2 Ln (Real Value of the Domestic Currency)

***NOTE:** the real export value is the real export from domestic country to foreign country.

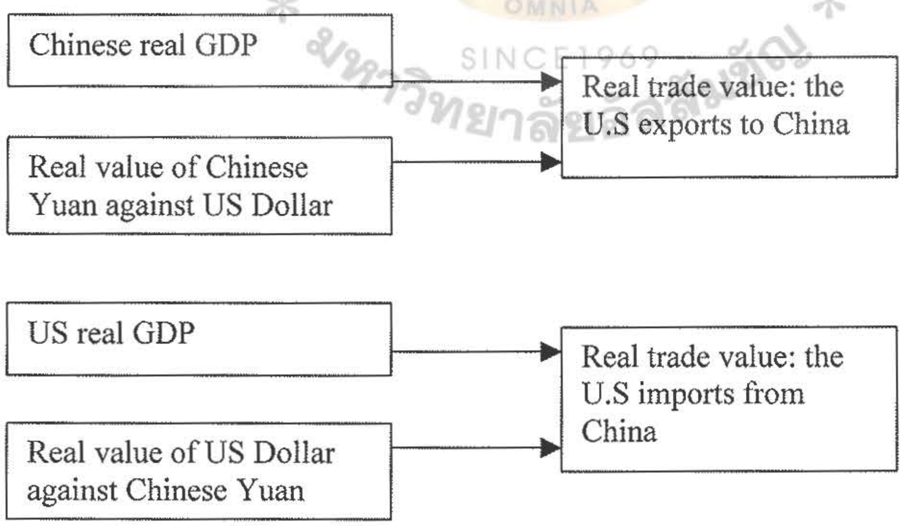
The real import value is the real import from foreign country to domestic country.

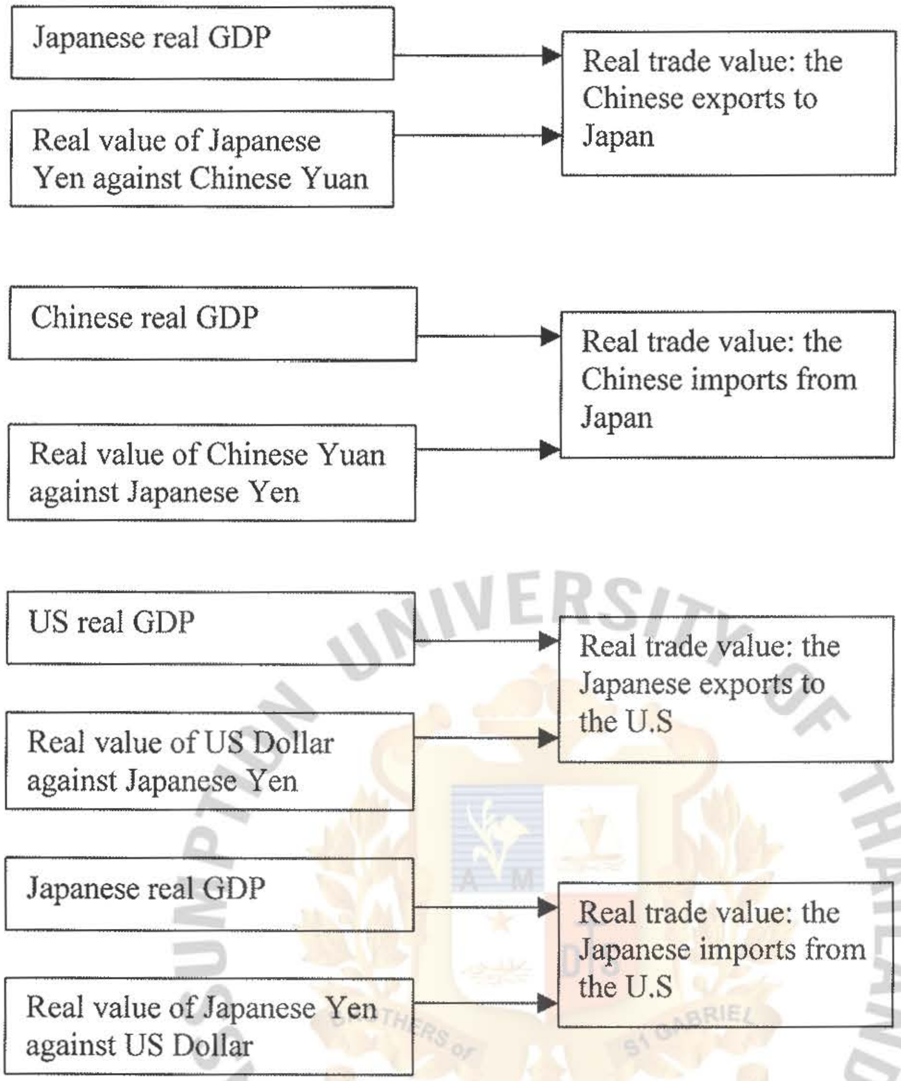
The real imports value is the real exports from foreign country to domestic country. The real exports value is the real exports from domestic country to foreign county. The Real GDP means domestic real income. The real exchange rate is the value of domestic currency while imports from foreign country or the value of foreign currency while exports to foreign country.

3.1.2 Conceptual Framework

Figure 3.1.2 The Conceptual Model

Independent Variables (X) **Dependent Variable (Y)**





The relationship of three countries, Japan, China and U.S can be obtained from above figure, which shown a model to explain the relationship between the dependent variable and independent variable. More specifically, domestic exports value should increase as foreign income rises, the foreign currency appreciates in real terms; adversely, domestic imports value should increase as domestic income rises, the domestic appreciates in real terms falls. These export and import models are captured by the following equations:

$$\text{Ln (USEXCH)} = \alpha_0 + \alpha_1 \text{Ln (REGDCH)} + \alpha_2 \text{Ln(REUSYU)} \quad (1)$$

USEXCH: real exports value US to China. REGDCH: Chinese real GDP. REUSYU: Dollar/Yuan

$$Ln(USIMCH) = \beta_0 + \beta_1 Ln(REGDUS) + \beta_2 Ln(REYUUS) \quad (2)$$

USIMCH: real imports value US from China. REGDUS: U.S Real GDP. REYUUS: Yuan/Dollar

$$Ln(CHEXJA) = \alpha_0 + \alpha_1 Ln(REGDJA) + \alpha_2 Ln(REYUYE) \quad (3)$$

CHEXJA: real export value China to Japan. REGDJA: Japan Real GDP REYUYE: Yuan/Yen

$$Ln(CHIMJA) = \beta_0 + \beta_1 Ln(REGDCH) + \beta_2 Ln(REYEYU) \quad (4)$$

CHIMJA: real import value China from Japan. REYEYU: Yen/Yuan

$$Ln(JAEXUS) = \alpha_0 + \alpha_1 Ln(REGDUS) + \alpha_2 Ln(REYEUS) \quad (5)$$

JAEXUS: real export value Japan to US. REYEYU: Yen/Dollar

$$Ln(JAIMUS) = \beta_0 + \beta_1 Ln(REGDJA) + \beta_2 Ln(REUSYE) \quad (6)$$

JAIMUS: real import value Japan from US REYUYE: Dollar/Yen

3.2 Definition of the Variables

This study includes three variables: dependent variable real foreign trade, two independent variables real GDP and bilateral real exchange rate.

Real trade value, as the dependent variable of this study, includes real import value from one partner country and real exports value to partner country. Real foreign trade value is an indicator for a country's economy. If the real trade value has large percentage of domestic output, it means that this country has integrated in partner's economy.

The first main independent variable is *Real Gross domestic product* (RGDP). GDP, or Gross Domestic Product, is a measure of how big an economy is. GDP (nominal) is annual aggregate money value of all final goods and services produced by the economy. It changes over time when the output of goods and services changes, and when the prices of these goods and services change. Economic growth occurs when the total output of goods and services increases. A change in GDP can be caused by a change in prices rather than a change in output. For correctly measure the economic growth, the inflation-adjusted GDP was introduced. (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

Real GDP is in effect nominal GDP after adjustment for inflation, and it is computed by dividing nominal GDP by the relevant price index. Namely, Real GDP is expressed in constant prices, for example in the dollar values of a particular year, which is known as the base period. Changes in real GDP are often referred to as volume increases in GDP, and are a measure of economic growth.

Bilateral real exchange rate as the second independent variable appeared in this study.

The price of domestic goods relative to foreign goods-equivalently, the number of foreign goods someone gets in exchange for one domestic goods- is called the *real exchange rate.*

In general, real exchange rate is related to the nominal exchange rate and price level.

E *nom*=the nominal exchange rate

P *for* =the price of foreign, measured in the foreign currency

P= the price of domestic goods, measured in the domestic currency

Real exchange rate, E, is the number of foreign goods that can be obtained in exchange for one unit of the domestic good. The general formula for the real exchange rate is:

E=(E *nom* P) / P *for* (Andrew B.Adel, Ben S.Bernanke, 2002. "Macroeconomics, fourth edition.")

In defining the exchange rate as the number of foreign goods that can be obtained for each domestic good, we assume that each country produces a single, unique good. The assumption that each country produces a single good (which is different from the good produced by any other country) simplifies the theoretical analysis. Of course, in reality countries produce thousands of different goods, so real exchange rates must be based on price indexes (such as the CPI) to measure P and P *for*. Thus the real exchange rate isn't actually the rate of exchange between two specific goods but instead is the rate of exchange between a typical basket of goods in one country and a typical basket of goods in the other country. Changes in the real exchange rate over time indicate that, on average, the goods of the country whose real exchange rate is rising or declining are becoming more expensive or cheap to the goods of the other country.

3.3 Research Hypothesis

Is there a significant relationship between the bilateral trade value and the real GDP, real bilateral exchange rate? To answer this question, some hypothesizes are as follows:

H1o: There is no significant relationship between the real U.S export value (to China), the China's real GDP, and the real exchange rate (US Dollar/Chinese Yuan).

H1a: There is a significant relationship between the real U.S export value (to China), the China's real GDP, and the real exchange rate (US Dollar/Chinese Yuan).

H2o: There is no significant relationship between the real U.S import value (from China), the U.S real GDP and the real exchange rate (Chinese Yuan/U.S Dollar).

H2a: There is a significant relationship between the real U.S import value (from China), the U.S real GDP and the real exchange rate (Chinese Yuan/U.S Dollar).

H3o: There is no significant relationship between the real China's export value (to Japan), the Japan's real GDP, and the real exchange rate (Chinese Yuan/Japanese Yen).

H3a: There is a significant relationship between the real China's export value (to Japan), the Japan's real GDP, and the real exchange rate (Chinese Yuan/Japanese Yen).

H4o: There is no significant relationship between the real China's import value (from Japan), the China's real GDP, and the real exchange rate (Japanese Yen/Chinese Yuan).

H4a: There is a significant relationship between the real China's import value (from Japan), the China's real GDP, and the real exchange rate (Japanese Yen/Chinese Yuan).

H5o: There is no significant relationship between the real Japan's export value (to U.S), the U.S real GDP, and the real exchange rate (Japanese Yen/US Dollar).

H5a: There is a significant relationship between the real Japan's export value (to U.S), the U.S real GDP, and the real exchange rate (Japanese Yen/US Dollar).

H6o: There is no significant relationship between the real Japan's import value (from U.S), the Japan real GDP, and the real exchange rate (US Dollar/Japanese Yen).

H6a: There is a significant relationship between the real Japan's import value (from U.S), the Japan real GDP, and the real exchange rate (US Dollar/Japanese Yen).

3.4 Expected outcome

The researcher expects that the above stated alternate hypothesis should be accepted. In this study, all real trade value has positive relationship with real GDP. Therefore, in equation (1)-(6): α_1 and β_1 is expected to > 0.

It is expected that in equation (1)-(6): α_2 and β_2 is expected positive or negative relationship with dependent variables. Namely, $\alpha_2 > 0$ or < 0. $\beta_2 > 0$ or < 0.

Chapter 4

Research Methodology

This chapter consists of four sections. The first section shows the data source, target population and sampling procedure. The second section describes how the data is collected. The third section explains how the data is measured. Data analysis is presented in the last section.

4.1Data Source:

To cater to the research objective, linear regression method and countries' macroeconomic database was used to analyze the correlation coefficient, all data combine time series and cross sections.

The data specifically includes three countries' GDP and bilateral import and export value, and their bilateral real exchange rates measured by quarterly standard deviations of monthly real exchange rates. Table 4.1 gives the source of the data.

Table 4.1 Data Source in this Study.

Data	Source
- Monthly import and export value - Quarterly GDP - Monthly spot exchange rate - GDP deflator - Import/export price deflator - CPI	Census and Economic Information Center (CEIC) Database

4.2 Data Collection:

Quarterly data from Q1 1994 through the Q1 of 2003 is available from CEIC database. Quarterly real GDP (in national currency) date from nominal GDP divided by deflator. Nominal quarterly bilateral trade data are compiled from monthly accumulation. Real quarterly bilateral trade data are converted to constant dollars using the quarterly US import/export price deflators (1995 = 100) in order to make quarterly real bilateral. The real exchange rate is calculated as quarterly standard of monthly real bilateral exchange rates.

4.3 Data Measurement

Table 4.2 Operationalization table of the independent and dependent variables

Variable to be tested	Operationalization	Measurement level
Dependent variable Real export value (export from domestic country to foreign country) Real import value (import from foreign country to domestic country)	Export value/ domestic export price deflator then sum quarterly. Import value/domestic import price deflator then sum quarterly.	Ratio Ratio
Independent variable Real GDP	Current GDP/GDP deflator	Ratio
Independent variable Real exchange rate	Spot exchange rate per month/ CPI per month (lagged one and show the difference) and then select quarterly.	Ratio

4.4 Data Analysis

4.4.1 Table of hypothesis & statistics

Table 4.3 Hypothesis & statistics

Hypothesis	Statistics used
Domestic real export value to foreign country has a relationship with foreign country's real GDP and real exchange value: $\alpha 1=0$ $\alpha 2=0$	Multiple regression
Domestic real import value from foreign country has a relationship with domestic real GDP and real exchange value: $\beta 1=0$ $\beta 2=0$	Multiple regression

4.4.2 Decision rule for interpretation

At the chosen level of significance=0.05, F-value is used to find if the relationship is statistically significant for the overall model.

1. If F table>F test then Accept Ho.
2. If t table>t value then Accept Ho.
3. If P value>0.05 then Accept Ho and if P value <0.05 then reject Ho.

If $\alpha 1 \neq 0$ $\alpha 2 \neq 0$ $\beta 1 \neq 0$ $\beta 2 \neq 0$, the hypothesis is rejected. That means independent variables can significantly explain dependent variable. If independent variable is excluded by Stepwise regression, it means there is no linear relationship.

4.4.3 Diagnosis of statistics methods

Multivariate OLS model detects positive or negative relationship between independent variables and dependent variable.

This study focuses on the multivariate correlation, which combines two variables to enhance the relationship to a dependent variable. The correlation coefficient thus describes to a linear relation relationship between variable. SPSS linear regression is used in this analysis.

The hypothesis is as follows:

(1) $Ln(USEXCH) = \alpha 0 + \alpha 1 Ln(REGDCH) + \alpha 2 Ln(REUSYU)$

Ho: $\alpha 1 = \alpha 2 = 0$ Ha: At least one correlation coefficient is not equal to zero ($\alpha i \neq 0$)

(2) $Ln(USIMCH) = \beta 0 + \beta 1 Ln(REGDUS) + \beta 2 Ln(REYUUS)$

Ho: $\beta 1 = \beta 2 = 0$ Ha: At least one correlation coefficient is not equal to zero ($\beta i \neq 0$)

(3) $Ln(CHEXJA) = \alpha 0 + \alpha 1 Ln(REGDJA) + \alpha 2 Ln(REYUYE)$

Ho: $\alpha 1 = \alpha 2 = 0$ Ha: At least one correlation coefficient is not equal to zero ($\alpha i \neq 0$)

(4) $Ln(CHIMJA) = \beta 0 + \beta 1 Ln(REGDCH) + \beta 2 Ln(REYEYU)$

Ho: $\beta 1 = \beta 2 = 0$ Ha: At least one correlation coefficient is not equal to zero ($\beta i \neq 0$)

(5) $Ln(JAEXUS) = \alpha 0 + \alpha 1 Ln(REGDUS) + \alpha 2 Ln(REYEUS)$

Ho: $\alpha 1 = \alpha 2 = 0$ Ha: At least one correlation coefficient is not equal to zero ($\alpha i \neq 0$)

(6) Ln (JAIMUS) $=\beta_0 + \beta_1$ Ln (REGDJA)+ β_2 Ln (REUSYE)

Ho: $\beta_1=\beta_2=0$ Ha: At least one correlation coefficient is not equal to zero ($\beta_i \neq 0$)

T test

T-test is conducted for all 3 variables to 95% confidence level. T statistic tests the significance of the slope that is equivalent to testing the significance of the correlation between dependent and independent variable.

F-test

F-test statistics is used to test the validity of the multivariate regression model for both dependent and independent variables. If p value is less than 0.05, Ho is rejected, showing F-test statistics is significant is significant which means that the multiple regression model is reliable. It shows that there is at least one independent variable that has relationship with dependent variable. On the other hand, if p value is more than 0.05, Ho cannot be rejected, showing F-test statistic is insignificant which means that the multiple regression model is not reliable so the model cannot be used to predict the relationship between dependent and independent variables.

Variables Selection: The stepwise selection

Stepwise selection begins like forward stepping, but at each step, tests variables already in the model for removal. This is the most commonly used method, especially when there are correlations among the independent variable.

VIF (variance inflation factor) is the reciprocal of tolerance. So, by definition, the variables here with low tolerance have large variance inflation factors. The calculations of the variance for the *i*th regression coefficient use VIF*i*, thus, its name. As the variance inflation factor increases, so dose the variance of the regression coefficient.

The Durbin-Waston test statistic tests the null hypothesis that residuals from an ordinary least-squares regression are not autocorrelationed against the alternative that the residuals follow an AR1 process. The Durbin-Waston statistic ranges in value from 0 to 4. A value near 2 indicates non-autocorrelation; a value toward 0 indicates positive autocorrelation; a value toward 4 indicates negative autocorrelation.

Chapter 5

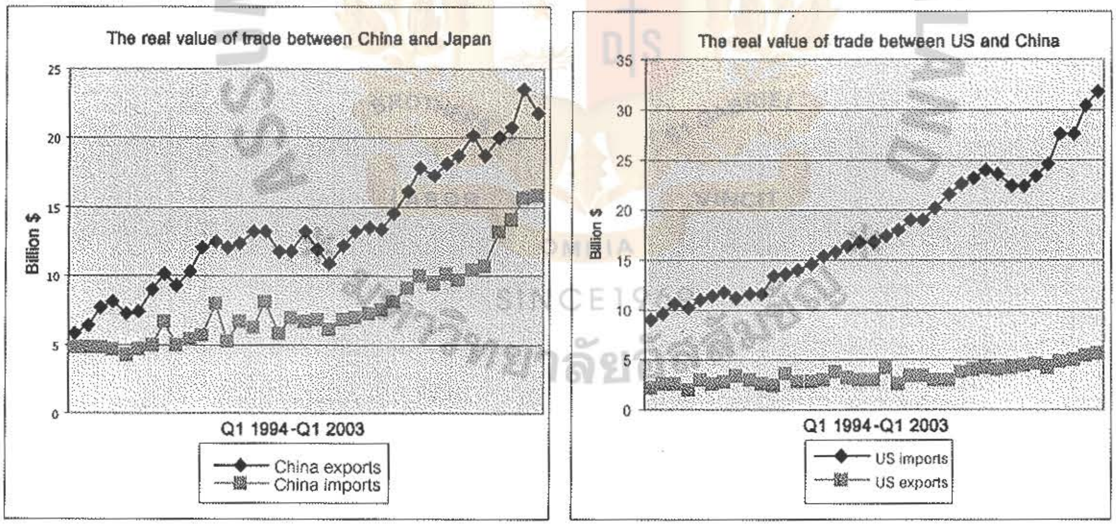
Data Analysis

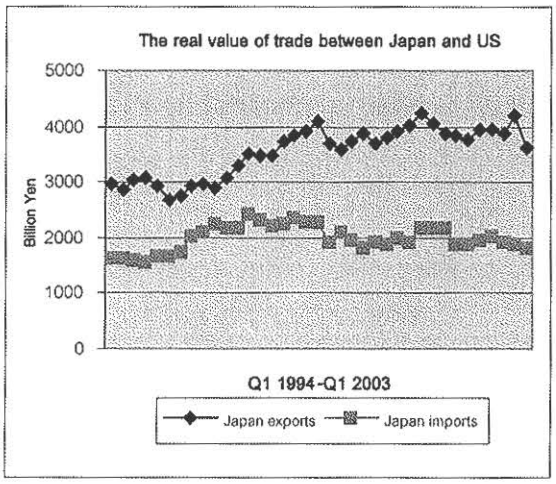
This chapter presents empirical results of the model shown in chapter three. This chapter is divided into four sections. The first section reintroduces the profile of the sample. The second section presents the final value of regression. The third section presents a diagnosis of methods. The last section explains the result.

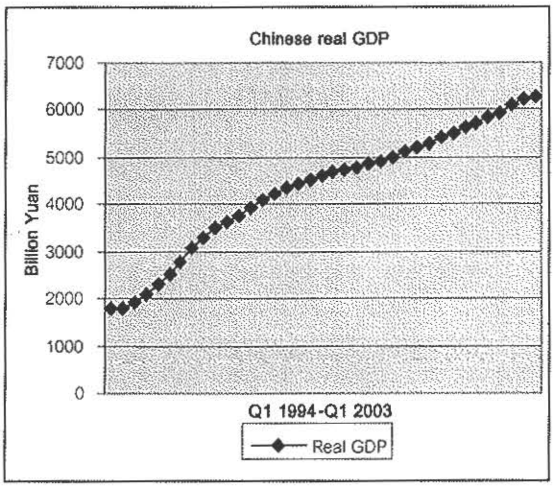
5.1 Profile of the sample

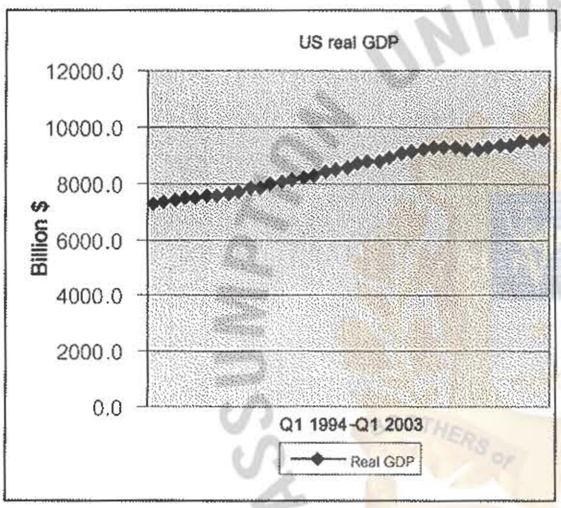
This section presents the real value for dependent and independent variables of 37 quarterly data from Q1 1994 to Q2 2003. The value is estimated by multiple OLS regression with stepwise method and all significant at 95% confidence interval. Figure 5.1 illustrates the seasonal adjusted data of three countries.

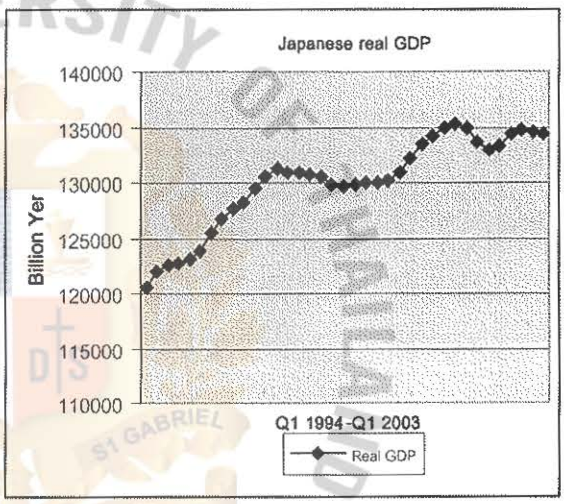
Figure 5.1 Profile of the Data

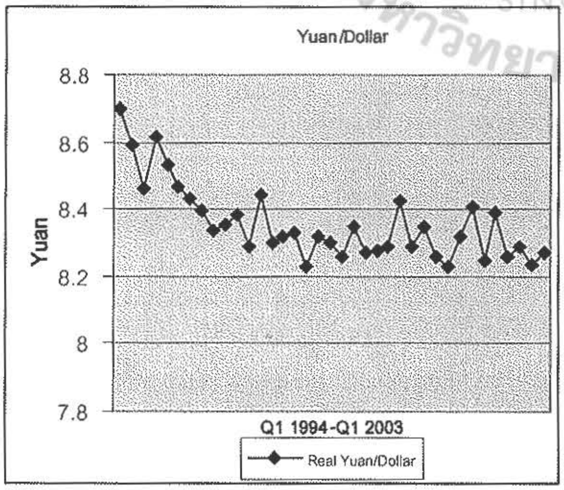


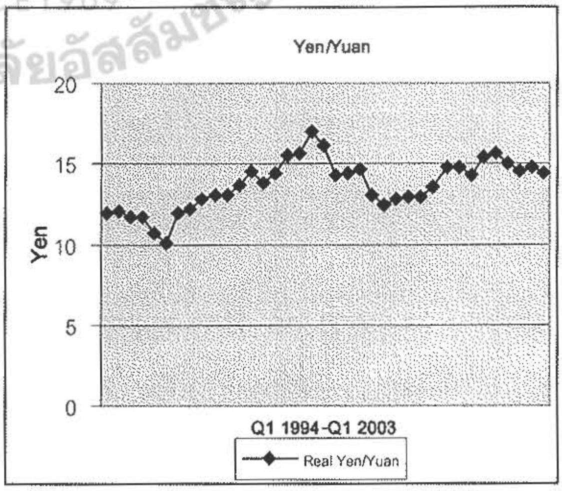

The real value of trade between Japan and US
5000
4000
3000
2000
1000
0
Billion Yen
Q1 1994-Q1 2003
Japan exports
Japan imports

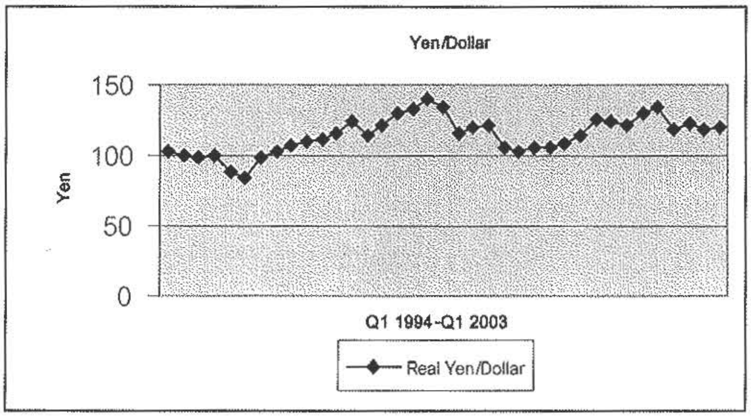

Chinese real GDP
7000
6000
5000
4000
3000
2000
1000
0
Billion Yuan
Q1 1994-Q1 2003
Real GDP


US real GDP
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Billion $
Q1 1994-Q1 2003
Real GDP


Japanese real GDP
140000
135000
130000
125000
120000
115000
110000
Billion Yer
Q1 1994-Q1 2003
Real GDP


Yuan/Dollar
8.8
8.6
8.4
8.2
8
7.8
Yuan
Q1 1994-Q1 2003
Real Yuan/Dollar


Yen/Yuan
20
15
10
5
0
Yen
Q1 1994-Q1 2003
Real Yen/Yuan



Source: Computed data compiled from Census and Economic Information Center database.

5.2 Test of hypothesis result

Equation (1), (2), (3), (4), (6), Model 1 is estimated as follows:

$$LNUSEXCH = 0.519\ LNREGDCH$$

USEXCH: real exports value US to China. REGDCH: Chinese real GDP. (1)

$$LNUSIMCH = -29.720 + 3.854\ LNREGDUS$$

USIMCH: real imports value US from China. REGDUS: U.S Real GDP. (2)

$$LNCHEXJA = -48.281 + 4.316\ LNREGDJA$$

CHEXJA: real export value China to Japan. REGDJA: Japan Real GDP. (3)

$$LNCHIMJA = -4.628 + 0.796\ LNREGDCH$$

CHIMJA: real import value China from Japan. REGDCH: Chinese real GDP. (4)

$$LNJAEXUS = -7.593 + 1.048\ LNREGDUS + 0.354 LNREYEUS$$

JAEXUS: real export value Japan to US. REGDUS: U.S Real GDP. REYEYU: Yen/Dollar (5)

$$LNJAIMUS = -0.709\ LNREUSYE$$

JAIMUS: real import value Japan from US REYUYE: Dollar/Yen (6)

Table 5.2.1 F-test

Equations	F	Significance
(1)	52.584	.000(a)
(2)	1320.931	.000(a)
(3)	25.541	.000(a)
(4)	80.130	.000(a)
(5)	105.387	.000(b)
(6)	31.951	.000(a)

Table 5.2.2 The results by OLS estimation.

Equation	Variables	Coefficient	T-statistic	Significance
(1)	LNREGDCH	.519	7.252	.000
(2)	(Constant)	-29.720	-30.992	.000
	LNREGDUS	3.854	36.354	.000
(3)	(Constant)	-48.281	-4.801	.000
	LNREGDJA	4.316	5.054	.000
(4)	(Constant)	-4.628	-6.254	.000
	LNREGDCH	.796	8.952	.000
(5)	(Constant)	-7.593	-8.809	.000
	LNREUSGD	1.048	9.236	.000
	LNREYEUS	.354	4.014	.000
(6)	LNREUSYE	-.709	-5.653	.000

From table 5.2.1:

Equation (1): Under model 1, F-test is 52.584 or P (F>52.584)=0.000. The null hypothesis is rejected due to significance=0.000 < 0.05. It means that there is at least one independent variable has relationship with dependent variable.

From the hypothesis, Ho: $\alpha_1 = \alpha_2 = 0$

Ha: At least one correlation coefficient is not equal to zero

($\alpha \neq 0$)

Equation (2): Under model 1, F-test is 1320.931 or P (F>1320.931)=0.000. The null hypothesis is rejected due to significance=0.000 < 0.05. It means that there is at least one independent variable has relationship with dependent variable.

From the hypothesis, Ho: $\beta_1 = \beta_2 = 0$

Ha: At least one correlation coefficient is not equal to zero

($\beta \neq 0$)

Equation (3): The null hypothesis is rejected due to significance=0.000 < 0.05.

Equation (4): The null hypothesis is rejected due to significance=0.000 < 0.05.

Equation (5): The null hypothesis is rejected due to significance=0.000 < 0.05.

Equation (6): The null hypothesis is rejected due to significance=0.000 < 0.05.

From table 5.2.2:

Equation (1): The null hypothesis is the U.S real exports value to China (LNUSEXCH) has no significant relationship with China's real GDP (LNREGDCH): $Ho_1: \alpha_1 = 0$. By using stepwise method, T-test is used to analyze which independent variable will be in the regression. It is found that only one variable included in the model is real Chinese GDP because its significance=0.000. It is less than 0.05. Ho_1 is rejected. It means that there is a significant relationship between the U.S real exports value to China and the real Chinese GDP.

The coefficient of LNREGDCH is positive. That means real Chinese GDP has a positive relationship with the real value of the U.S exports to China. The U.S exports increase as the Chinese real GDP increase. The coefficient indicates the change in dependent variable associated with one unit increase in independent variable holding constant all other independent variables in the equation. When the independent variable change one percent, it causes the dependent variable to change αi percent. One percentage increasing of real Chinese GDP causes the real value of the U.S exports to China to increase 0.519 percent. From this result, it implies that the Chinese real GDP strongly impacts on the U.S exports to China.

Equation (2): The null hypothesis is the U.S real imports value from China (LNUSIMCH) has no significant relationship with the U.S real GDP (LNREGDUS):

Ho2: $\beta_1=0$. It is found that only one variable included in the model is the U.S real GDP because its significance=0.000. It is less than 0.05.Ha1is rejected. It means that there is a significant relationship between the U.S real imports value from China and the real US GDP. The coefficient of LNREGDUS is positive. That means the U.S real GDP has a positive relationship with the U.S real imports value from China. The U.S imports increase as the U.S real GDP increase. One percentage increasing of the U.S real GDP causes the real U.S imports value from China increase 3.854 percent. From this result, it implies that the U.S real GDP strongly impacts on the U.S imports from China.

Equation (3): The null hypothesis is the China real exports value to Japan (LNCHEXJA) has no significant relationship with Japan's real GDP (LNREGDJA): Ho3:$\alpha_1=0$. It is found that only one variable included in the model is real GDP because its significance=0.000. It is less than 0.05.Ha1is rejected. It means that there is a significant relationship between the real value of China's exports to Japan and the Japanese real GDP.

The coefficient of LNREGDJA is positive. That means Japanese real GDP has a positive relationship with the real value of China's exports to Japan. China's exports to Japan increases as the Japanese real GDP increase. One percentage increasing of Japanese real GDP causes the real value of China's exports to Japan increase 4.316 percent. From this result, it implies that the Japanese real GDP strongly impacts on the real value of China's exports to Japan.

Equation (4): The null hypothesis is the China's real imports value from Japan (LNCHIMJA) has no significant relationship with China real GDP (LNREGDCH):

Ho4:β1=0. It is found that only one variable included in the model is China's real GDP because its significance=0.000. It is less than 0.05.Ha1is rejected. It means that there is a significant relationship between China's real imports value from Japan and Chinese real GDP.

The coefficient of LNREGDCH is positive. That means real China's GDP has a positive relationship with China real imports value from Japan. The China imports from Japan increase as the China real GDP increase. One percentage increasing of real China GDP causes the real China imports value from Japan increase 0.796 percent. From this result, it implies that the China real GDP has been strongly impacting on the China imports from Japan.

Equation (5): The null hypothesis is the Japanese real exports value to the U.S (LNJAEXUS) has no significant relationship with the U.S real GDP (LNREUSGD): Ho5:α1=0. The real exports value to China has no significant relationship with real exchange rate YEN/$ (LNREYENUS): Ho5:α2=0. It is found that two variables included in the model are the U.S real GDP and YEN/$ because their significance=0.000, less than 0.05. Two Ho5 are rejected. It means that Japanese real exports value to U.S has a significant relationship with the U.S real GDP and the real exchange rate YEN/$.

The coefficient of LNREUSGD is positive. That means real U.S GDP has a positive relationship with Japanese real exports value to U.S. The Japanese exports increase as the U.S real GDP increase. It means that there is a significant relationship between Japan's real exports value to U.S and the real U.S GDP.

The coefficient of LNREYEUS is positive. That means real exchange rate YEN/$ has a positive relationship with Japanese real exports value to the U.S. The Japan exports increase as the YEN/$ increase. One percentage increasing of the U.S real GDP causes the real Japan's exports value to increase 1.048 percent. From this result, it implies that the U.S real GDP and the YEN/$ strongly impact on the Japanese exports to U.S.

Equation (6): The null hypothesis is the Japan's real imports value from U.S (LNJAIMUS) has no significant relationship with Japanese real GDP (LNREJAGD), Ho6:β1=0. It is found that only one variable included in the model is the real exchange rate $/YEN because its significance=0.000. It is less than 0.05.Ha1is rejected. It means that there is a significant relationship between Japan's real imports value to U.S and the real exchange rate $/YEN.

The coefficient of LNREUSYE is negative. That means the real exchange rate has a negative relationship with Japan's real imports value from the U.S. The imports increase as the real exchange rate $/YEN decrease. One percentage increasing of real exchange rate $/YEN causes the real Japan's imports value from the U.S to decrease 0.709 percent. From this result, it implies that the real exchange rate has been strongly impacting on the Japanese imports from the US.

5.3 Diagnosis of methods result

The results of the OLS assumption are as follows:

Table 5.3.1 Validity of OLS

Equations	Durbin-Watson	Variance Inflation Factor (VIF)	Plot Spread
(1)	1.512	VIF is about 1	Perfect Form
(2)	1.767	VIF is about 1	Perfect Form
(3)	1.687	VIF is about 1	Perfect Form
(4)	1.667	VIF is about 1	Perfect Form
(5)	2.446	VIF is 1.470	Perfect Form
(6)	1.696	VIF is about 1	Perfect Form

From table 5.3.1, the validity of Ordinary Least Squares (OLS) Assumption is presented as follows:

* Durbin-Watson is used to test the Autocorrelation whether the error terms for different observations are correlated. The best value of D-W is between 1.5-2.5. It shows that e_i and e_j are independent of each other where e_i is random error of i and e_j is the

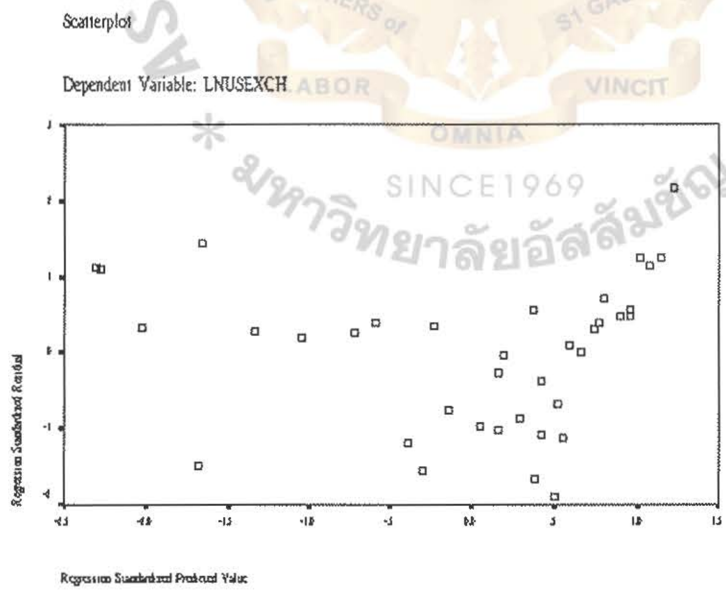
random error of j. If value <1.5 and close to 0, it shows that ei and ej have positive relationship. If value >2.5 and close to 4, it shows that ei and ej have positive relationship. The values of Wurbin-Watson included in 6 equations are between 1.5-2.5. It means ei and ej are not related in this model.

* Variance Inflation Factor (VIF) is used to test the Multicollinearity whether there is a relationship among independent variables. If VIF >5, it shows the high correlation among independent variables. VIF of independent variables is about 1.470 so it means that there is no relationship among independent variables in this model.

* Scatterplot is used to plot the spread to test the Heteroskedasticity whether the variance of the error term is constant for all observations. From the result show in figure 5.7, most observations of the error term are drawn from the distribution with the constsnt variance so there are no Heteroskedasticity.

Figure 5.2 Scatterplot

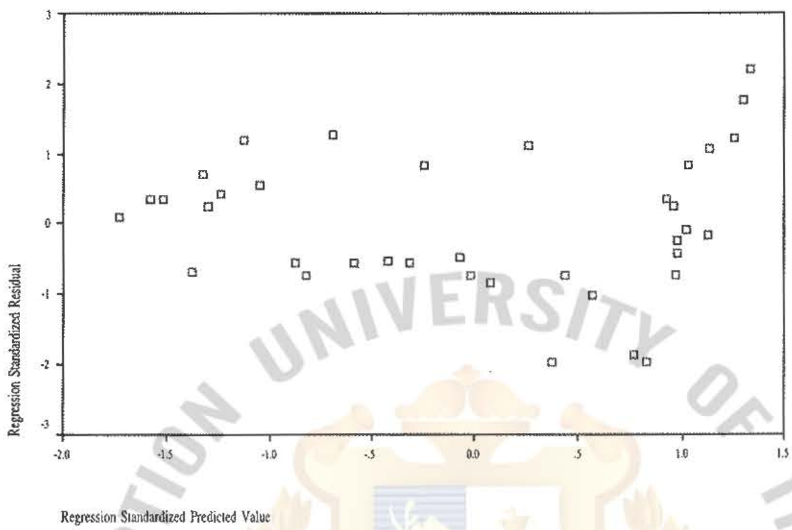
Equation (1)



Equation (2)

Scatterplot

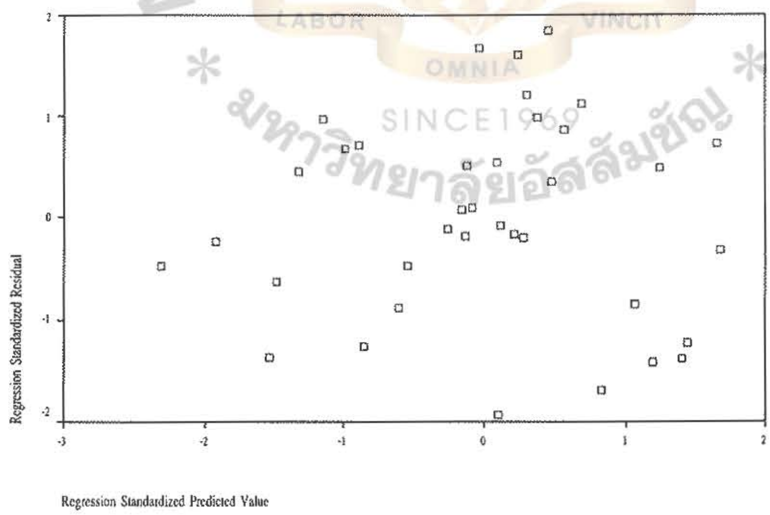
Dependent Variable: LNUSIMCH



Equation (3)

Scatterplot

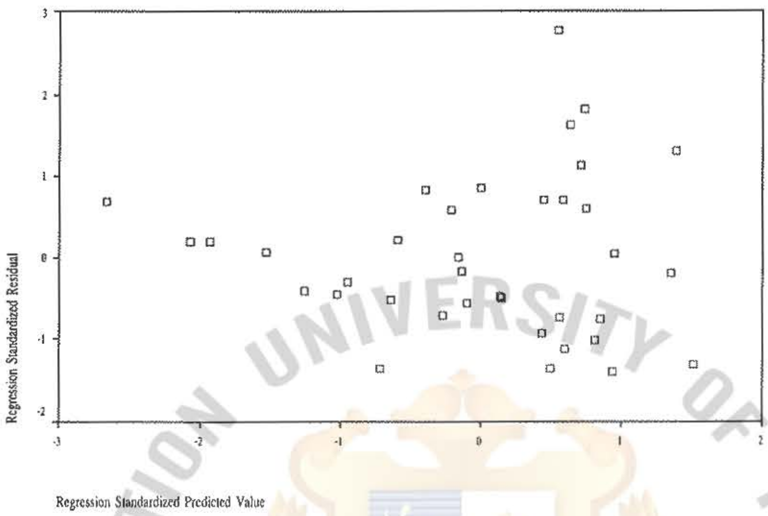
Dependent Variable: LNCHEXJA



Equation (4)

Scatterplot

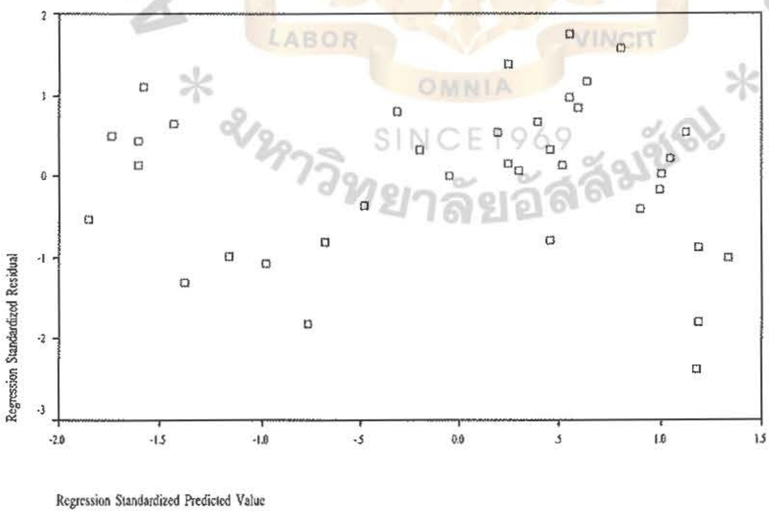
Dependent Variable: LNCHIMJA



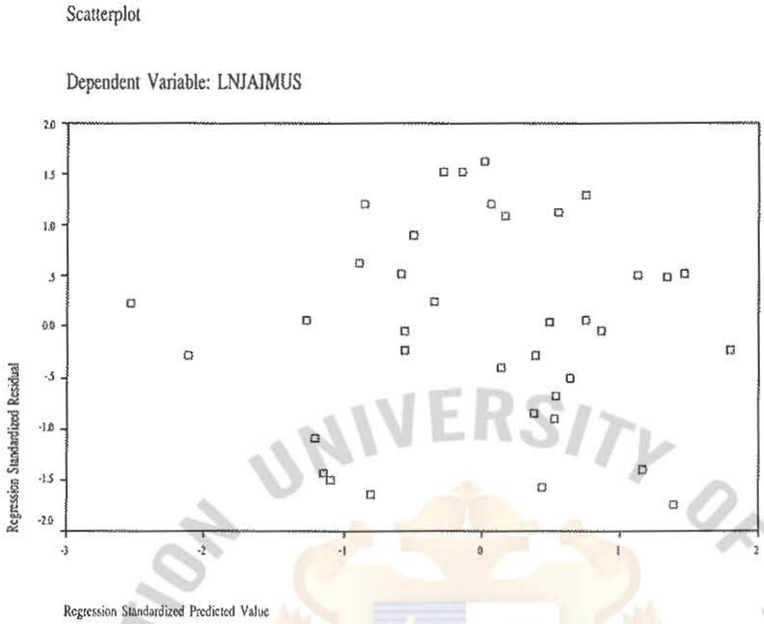
Equation (5)

Scatterplot

Dependent Variable: LNJAEXUS



Equation (6)



5.4 Explanation of the results.

Equation (1) and (2)

LNUSEXCH = 0.519 LNREGDCH

USEXCH: real exports value US to China. REGDCH: Chinese real GDP. (1)

LNUSIMCH = -29.720+3.854 LNREGDUS

USIMCH: real imports value US from China. REGDUS: U.S Real GDP. (2)

The income elasticity of demand for the US exports to China is 0.519, and the income elasticity for the U.S imports from China is 3.854. The results is similar to Vincent D (2000) estimated: the annually income elasticities range between 0.51 and 0.78 for U.S exports to China and between 4.67 and 4.91 for US imports from China. Basically, the long-term elasticity by using annual data is always larger than short-term elasticity by using quarterly data.

The income elasticity of demand for the US aggregated imports ranged 1.5 to 2, estimated by Josseph E. Gagnon (2003), is less than the income elasticity of demand for the US imports from China 3.854.That means rapidly growing US-China trade deficit (Chinese goods have become the largest component of America's trade deficit, jumped to \$103 billion in 2002.[1]) is due to the strong competitiveness of Chinese products in the US market relative to other importing nations. It also implies the strong demand of China goods by the US consumers relative to other imported goods.

The income elasticity of demand for the US exports to China 0.519 is less than the Chinese income elasticity for aggregated imports 1.4, which estimated by Valerie Cerra and Anuradha Dayal-Gulati (1999). It means that the penetration of the US goods into the Chinese market did occur at a slower speed than other foreign goods, and that the increasing the US trade deficit with China was due to a lack of demand of the US products in China's market by comparing with other importing countries.

Equation (3) and (4)

LNCHEXJA = -48.281+4.316 LNREGDJA

CHEXJA: real export value China to Japan. REGDJA: Japan Real GDP. (3)

LNCHIMJA = -4.628+0.796 LNREGDCH

CHIMJA: real import value China from Japan. REGDCH: Chinese real GDP. (4)

The income elasticity of Japanese aggregate imports 0.9, which estimated by Peter Hooper, Karen, Johnson and Jaime Marquez stated (1998), is less than the income elasticity of demand for Japan imports from Chinese 4.316. It means that Chinese product has strong competitiveness in the Japanese market relative to other importing nations. The income elasticity for Japan exports to China 0.796 is obviously less than the income elasticity for Chinese aggregate imports 1.4. That means the penetration of Japanese goods into the Chinese market did occur at a slower speed than other foreign goods. The

[1] National Center For Policy Analysis. August 14,2003. www.ncpa.org

increasing Japanese trade deficit with China was due to a lack of demand of Japanese products in China market relative to other importing countries.

Equation (5) and (6)

LNJAEXUS = -7.593+1.048 LNREGDUS+0.354LNREYEUS

JAEXUS: real export value Japan to US. REGDUS: U.S Real GDP. REYEYU: Yen/Dollar (5)

LNJAIMUS = -0.709 LNREUSYE

JAIMUS: real import value Japan from US REYUYE: Dollar/Yen (6)

The income elasticity of demand for the U.S imports from Japan 1.048 is less the income elasticity of the US aggregate imports range1.5 to 2. It means that Japanese goods penetrate into the US market is slower than other importing countries.

If demand for imports is also assumed to be relatively price elastic then the rise in the price of imports caused by the fall in the exchange rate will lead to a proportionately greater decrease in the quantity demanded of imports. This would also improve the balance of payments on current account. The importance of the price elasticity of demand for imports and exports is thus crucial.

If a balance of payments disequilibrium is to be restored then it is important that the coefficient for exports is greater than 1 and that the coefficient for imports is greater than 1. This is embodied in a condition called the Marshall Lerner Condition and this states that: "Provided that the sum of the price elasticity of demand coefficients for exports and imports is greater than one then a fall in the exchange rate will reduce a deficit and a rise will reduce a surplus.[1] "

If the Marshall Lerner Condition is not met and the sum of the price elasticity of demand for exports and imports is less than one, then a fall in the exchange rate will bring about a worsening of the balance of payments. The fall in the price of exports will lead to a proportionately smaller increase in the number of exports demanded and the rise in the price of imports will lead to a proportionately smaller reduction in the amount

1 =International Economics, second edition, 1995.

demanded. Both of these factors will contribute to a deterioration of the balance of payments.

In assessing the likely impact of a policy that will lead to a fall in the value of the currency consideration must be given to the price elasticity of demand for both the exports and imports.

The price elasticity of demand for the US import is 0.354 (absolute value) and for exports to Japan is 0.709. The sum of these two elasticities is larger than 1. The result is that the US and Japan will reduce current accounts surplus if the US and Japan appreciate their currencies, and will reduce deficit if the US and Japan depreciate their currencies.

Chapter 6

Conclusions and Recommendation

This chapter is divided into three sections. The first section is the summary of findings. The second section is implications. The last is the recommendation.

6.1 Summary of Findings

From the results of the analysis in Chapter 5, there are seven variables can be employed in explaining the dependent variables. Table 6.1 illustrates these findings.

Table 6.1 Summary of finding

Equations	Hypothesis	T- Test	Level of significance	Unstandardized Coefficients	Results
(1)	H1o: There is no significant relationship between the real U.S export value (to China) and the China's real GDP.	7.252	.000	.519	rejected
(2)	H2o: There is no significant relationship between the real U.S import value (from China) and the U.S real GDP.	36.345	.000	3.854	rejected
(3)	H3o: There is no significant relationship between the real China's export value (to Japan) and the Japan's real GDP.	5.054	.000	4.316	rejected
(4)	H4o: There is no significant relationship between the real China's import value (from Japan) and the China's real GDP.	8.952	.000	.796	rejected
(5)	H5o: There is no significant relationship between the real Japan's export value (to U.S) and the U.S real GDP.	9.236	.000	1.048	rejected
	H5o: There is no significant relationship between the real Japan's export value (to U.S) and the real exchange rate (Yen/Dollar).	4.014	.000	.354	rejected
(6)	H6o: There is no significant relationship between the real Japan's import value (from U.S) and the real exchange rate (Dollar/Yen).	-5.653	.000	-.709	rejected

The regression equation in Table 6.1 can be presented as follows:

LNUSEXCH = 0.519 LNREGDCH

USEXCH: real exports value US to China. REGDCH: Chinese real GDP. (1)

LNUSIMCH = -29.720+3.854 LNREGDUS

USIMCH: real imports value US from China. REGDUS: U.S Real GDP. (2)

LNCHEXJA = -48.281+4.316 LNREGDJA

CHEXJA: real export value China to Japan. REGDJA: Japan Real GDP. (3)

LNCHIMJA = -4.628+0.796 LNREGDCH

CHIMJA: real import value China from Japan. REGDCH: Chinese real GDP. (4)

LNJAEXUS = -7.593+1.048 LNREGDUS+0.354LNREYEUS

JAEXUS: real export value Japan to US. REGDUS: U.S Real GDP. REYEYU: Yen/Dollar (5)

LNJAIMUS = -0.709 LNREUSYE

JAIMUS: real import value Japan from US REYUYE: Dollar/Yen (6)

The main objectives of this study have been achieved. The coefficient (income elasticities for three countries) has a positive sign as expected. It means that the increase in income of three countries will cause the increase in each other's trade (Except the Japan imports from US due to the trade protection.).

The study find there exists price elasticities between US and Japan. The sum of these elasticity is large than 1, so, a full in the exchange rate will reduce a deficit and a rise will reduce a surplus.

The study does not find the variable Japan imports from US has relationship with Japanese real GDP. The reason is that Japan maintains opaque protection of its markets, while America maintains its relatively transparent openness. C.Fred Bergsten (1998) stated that Japanese market access limitation have a large and disproportionate impact on the United States because of the sectoral composition of the two economies and the interaction of their governments' policies.

The results of this study indicate that there is no statistically significant relationship between real value of Chinese trade and the real exchange rate against US Dollar and Japanese Yen. The reason is that the sample size is small. Vincent D (2000) successfully used the annual data (1988-2000) to estimate the price elasticity. Valerie Cerra and Anuradla Dayal-Gulati(1999) used the quarterly data (1983-97) and successfully estimate the aggregate price elasticities for China imports and exports.

6.2 Implication

The income elasticity of demand for the US import from China 3.854 is larger than the income elasticity for the US aggregated imports ranged 1.5 to 2. It means that Chinese goods has more competitiveness than other competitors in the US market. The income elasticity of demand for the US exports to China 0.519 is less than the Chinese income elasticity for aggregated imports 1.4. It does not mean that the US goods lacks competitiveness in China market. The correct explanation is due to a lack of demand of the US products in China market by comparing with other importing countries.

The income elasticity of demand for Japanese imports from China 4.316 is much larger than the income elasticity for Japanese aggregated imports 0.9. It means that Chinese goods has more competitiveness than other competitors in Japanese market. The income elasticity for Japanese exports to China 0.796 is less than the income elasticity for Chinese aggregated imports 1.4, but it does not mean that Japanese goods lack competitiveness in China's market. It is due to a lack of demand of Japanese products in China's market by comparing with other importing nations.

The income elasticity for Japan exports to US 1.048 is less than the income elasticity for the US aggregate imports ranged 1.5 to 2. It means that Japanese goods penetrate into the US market is slower than other importing countries.

The price elasticity of demand for the US imports is 0.354 (absolute value) and for exports to Japan is 0.709. The sum of two elasticities is larger than 1. That means the

US and Japan can reduce current accounts surplus if the US and Japan appreciates their currencies. Also, they can reduce deficit if the two countries depreciates their currencies.

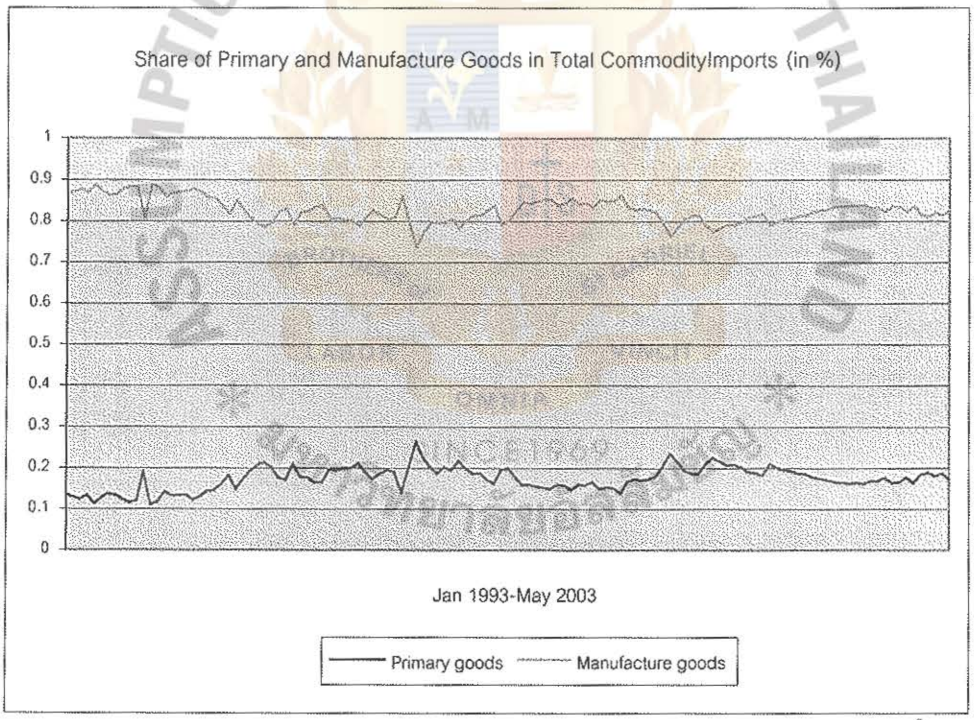
6.3 Recommendation

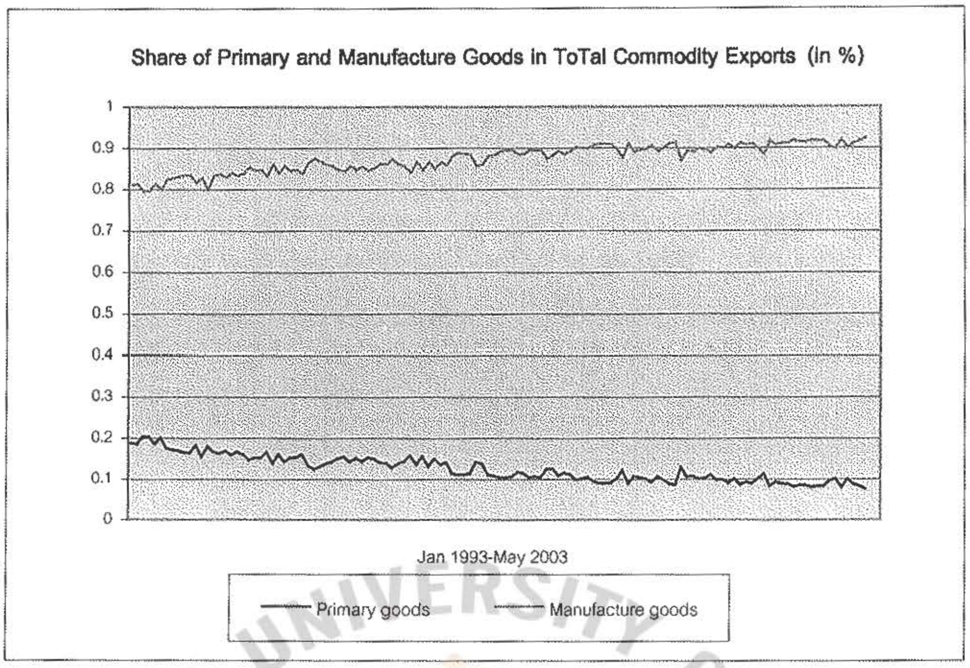
Table 6.2 Summary of recommendation

Finding	Recommendation
The income elasticity of demand for Japan imports from China 4.316. The income elasticity of demand for Japan exports to China is 0.519. The income elasticity of demand for US imports from China 3.854. The income elasticity of demand for US imports from China is 0.796. The income elasticity of demand for US imports from Japan is 1.048.	1.The Japanese goods has less competitiveness than other competitors in the US and Chinese market and the U.S goods has less competitiveness than other competitors in the Chinese market are due to there is a reorganization of production on a worldwide basis. The U.S and Japanese government should recognize this trend. 2. Japan must reform its financial market so that it can enhance Japanese goods' competitiveness in the U.S and Chinese markets.
The price elasticity of demand for Japan imports from US is –0.709. The price elasticity of demand for Japan exports to US is 0.354. The sum of two price elasticities absolute value is larger than 1.	When Japan or the U.S regulates its trade deficit, they must consider that the relative price effect of devaluation should dominate the three effects: 1. The reverse absorption effect. 2. The pass-through effect. 3. The inflation effect. Otherwise, the overall effects of devaluation on the trade balance become uncertain.

The large differentials of income elasticities between the three countries implicate there is a reorganization of production on a worldwide basis. The U.S and Japan should focus on this trend, but not urge China to appreciate its currency Yuan. In traditional approach, countries specialize in final goods in which they have a comparative advantage and they export these. However, China's trade policy which has granted tariff exemptions to imports used for processing and re-export, has proved very successful in creating export-oriented industries.Figure6.1gives the share of Chinese primary and manufacture goods in total commodity imports. Figure 6.2 gives the evolution of China's trade by customs regime.

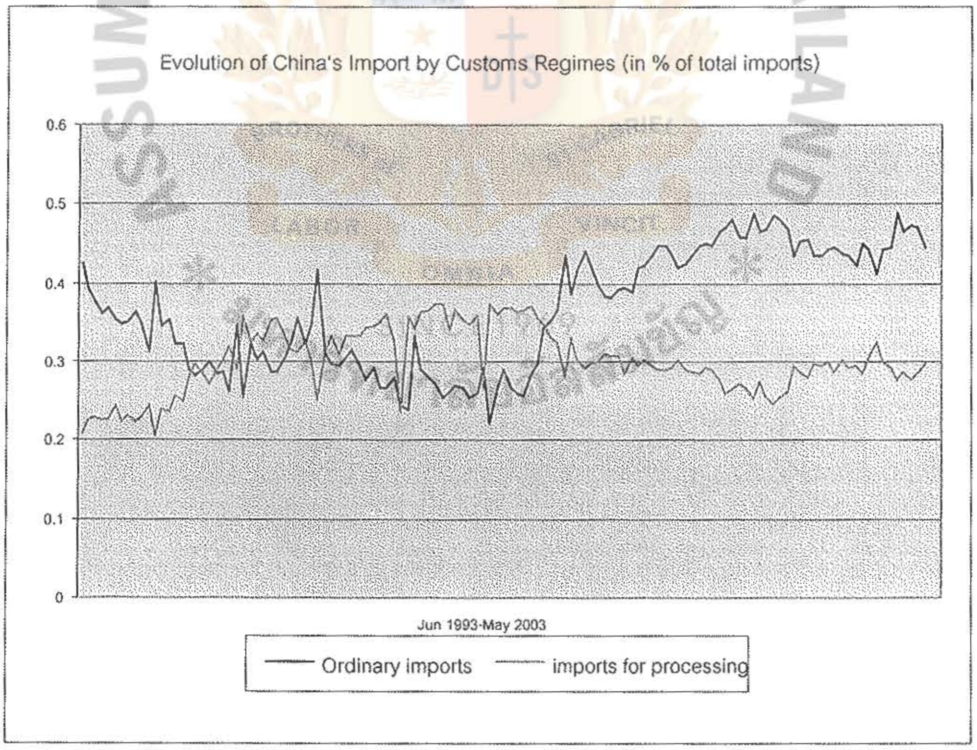
Figure 6.1 the share of Chinese primary and manufacture goods in total commodity imports and exports

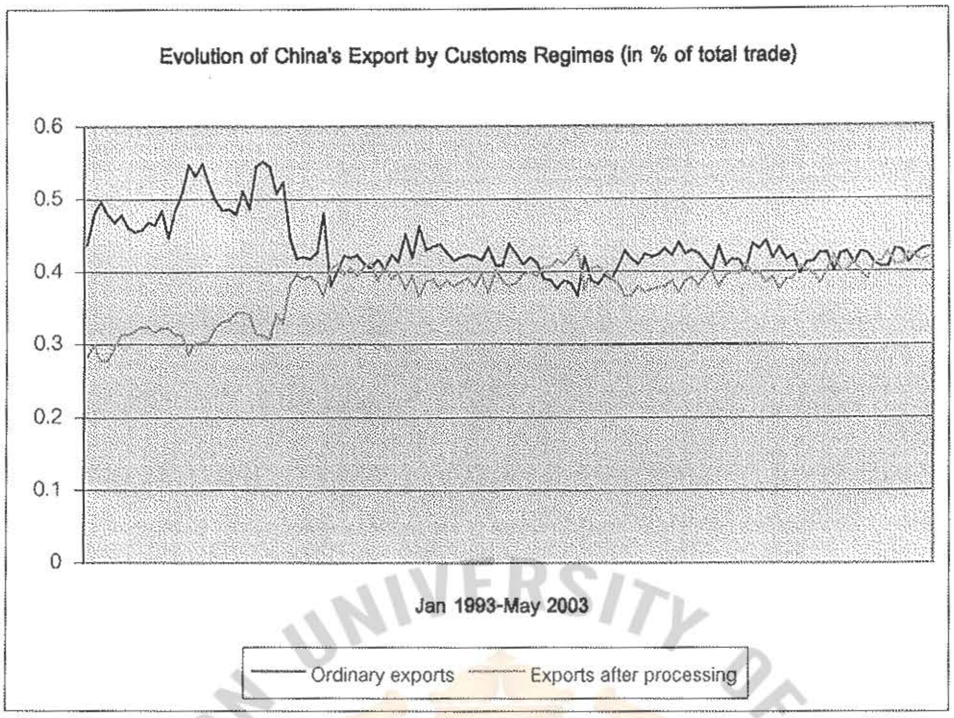




***Source*:** Computed data compiled from Census and Economic Information Center database.

Figure 6.2 the evolution of China's import and export by customs regime





Source: Computed data compiled from Census and Economic Information Center database.

Figure 6.1 and 6.2 implicate China's trade structure has been changing. Also, the change can be employed to explain why there is large differential in income elasticities between China and other two countries. Production process has become internationally fragmented, as firms located in different countries take part in the production of a commodity but at different stages of the value-added chain. The various stages of production correspond to different production functions, and a country tends to specialize in the individual segments of production in which it has a comparative advantage. There is no discussion for Yuan undervalued in this study. However, if China keeps the stability of its currency Yuan, Chinese government should allow Japan and US capital enter Chinese capital market.

The Japanese goods has less competitiveness than other competitors in the US and Chinese market is due to the unsuccessful restructure of Japanese economy when there is a reorganization of production on a worldwide basis. Beginning in 1994, the Japanese government pursued broad economic deregulation, a specific package of deregulation measures for financial markets, and administrative reform. The private sector has also carried out some restructuring in the face of substantial excess capacity in some industries. The economic stagnation of the 1990s was largely macroeconomic in origin, stemming from the rise and collapse of real estate and stock prices. However, the macroeconomic origin of the problems obscures the fact that structural problems and flaws in the existing system contributed to the creation of the asset bubble. Furthermore, the failure to reform throughout most of the 1990s complicated and delayed the recovery of the economy. Therefore, robust economic recovery depends on further systemic reform and not just macroeconomic fixes. So, Japan must reform its financial market so that it can increase Japanese goods' competitiveness in the U.S and Chinese markets.

The Marshall-Lerner elasticities condition holds between the U.S and Japan provides that the devaluation immediately makes domestic products cheaper than foreign product. But in a highly open industrial economy, several other effects may partially or completely offset the favorable "relative price effect". Japan and the US government should focus on the following effects.

The first is the reverse absorption effect: Devaluation tends to stimulate part of domestic spending, particularly investment by tradable industries, and worsens the trade balance. Conversely, appreciation dampens domestic investment, causes recession, and perpetuates a trade surplus.

Second, there is the pass-through effect. If the home currency is kept substantially undervalued (overvalued) in view of the law of one price, imported inflation (deflation) will arise through commodity arbitrage, which dilutes and eventually eliminates the initial international price gap. In the long run, the price advantage of domestic industries will disappear, and the real exchange rate will be unaffected by manipulation of the nominal exchange rate.

Third, inflation will also result from expansionary domestic monetary policy. To engineer and sustain devaluation over many years, it is necessary to maintain an expansionary monetary policy relative to major trading partners. With such policy bias, sooner or later absorption will be stimulated, and domestic price will edge up and consequently the trade deficit will increase.

When Japan or the U.S regulates its trade deficit, they must consider that the relative price effect of devaluation should dominate the three effects. Otherwise, the overall effects of devaluation on the trade balance become uncertain.

Bibliography

Abdelhak Senhadji and Claudio Montenegro (1998), "Time series analysis of export demand equations: a cross-country analysis." *Journal of Economic Literature* Classification Numbers: F14,F41,E21,C22.

Andrew B.Adel, Ben S.Bernanke,(2002), "*Macroeconomics, fourth edition.*" ,New York

Dennis R.Appleyard (1995), "*International Economics, second edition.*", London

Golub,(1994), "The United States-Japan Current Account Imbalance: A Review" *IMF Working Paper* PPAA/94/8

Grahame Thompson, (1998), " *Economic Dynamism in the Asia-Pacific*" page 261

Joseph E. Gagnon, (2003), "Long-run supply effects and the elasticities approach to trade" *Journal of Economic Literature* Classification F1, F4

Krugman (1991) "Geography and Trade, MIT Press", Chapter 1-2 *Journal of Economic Literature* Classification F6, F8

Menzie D. Chinn(2003): " Doomed to deficits? Aggregate U.S. trade flows re-examined" *NBER Working Paper* 9521

Meredith (1993)"Revisiting Japan's External Adjustment Since 1985" *IMF Working Paper* WP/93/52-EA

Peter Hooper, Karen, Johnson and Jaime Marquez (1998) " Trade Elasticities for G-7 countries" *Report of Divisision of international Finance*, Board of Governors of the Federal Reserve System Washington.

Ronald I.Mckinnon. (1997) "*US Dollar and Japanese Yen*" , Tokyo

Valerie cerra and Anuradha Dayal-Gulati (1999) " China's Trade Flows: Changing Price Sensitivities and the Reform Process" *IMF working paper* WP/99/1

Vincent DROPSY(2000) " China's accession to the WTO, real exchange rate changes and their impact on U.S. trade with greater China" *Department of Economics, LH 702* California State University.

Wen Hai(1998) "中美贸易逆差及两国产业结构变化" *工作论文*。No.45 中国经济研究中心，北京大学。

William Cline (1995) "the Reduced-Form Model", *Predicting External Imbalance for the United States and Japan.*

Yongxiang Bu (2001) " China's equilibrium real exchange: a counterfactual analysis" *Working Paper in Economics and Econometrics* No.390. Australian National University.

Zhongxia Jin (2003) "中国汇率与利率、国际收支平衡的动态联系。" *工作论文* No.132 中国经济研究中心，北京大学。

Website

IMF Finance, May 21,2003 " where does IMF get its money" *International Monetary Fund* Website: www.imf.org

Environment, May 1,2003."Environmental and recycling efforts spur business competition" *Ministry of Economy, Trade and Industry, Japan* Website: www.meti.go.jp

NCPA publication, August 14,2003 "Social Security Reform Around the World: Lessons from Other Countries" *National Center For Policy Analysis.* Website: www.ncpa.org

Publications, August 22, 2003, "Core Business Statistics Series, Comparative Statistics" US census Bureau: Foreign Trade Statistics, Website: www.census.gov

News, October 21, 2003. "APEC summit in Thailand, Chinese government with policy Yuan" Wall Street Journal, Website: http://online.wsj.com

Report, April 23, 2003. "China ranked fifth in the international trade" World Trade Organization, Website: www.wto.org

Zhang Li (2002) "U.S-Japan-China Relations: Reducing Frictions and Improving Cooperation" *Center for Strategic and International Studies, Pacific Forum.* Website: www.csis.org

Appendix

Equation (1)

Descriptive Statistics

	Mean	Std. Deviation	N
LNUSEXCH	3.5188	.24680	37
LNREGDCH	8.3138	.36827	37
LNREUSYU	-2.1229	.01339	37

Correlations

		LNUSEXCH	LNREGDCH	LNREUSYU
Pearson Correlation	LNUSEXCH	1.000	.775	.635
	LNREGDCH	.775	1.000	.814
	LNREUSYU	.635	.814	1.000
Sig. (1-tailed)	LNUSEXCH	.	.000	.000
	LNREGDCH	.000	.	.000
	LNREUSYU	.000	.000	.
N	LNUSEXCH	37	37	37
	LNREGDCH	37	37	37
	LNREUSYU	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREGDCH	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNUSEXCH

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.775(a)	.600	.589	.15823	.600	52.584	1	35	.000	1.512

a Predictors: (Constant), LNREGDCH
b Dependent Variable: LNUSEXCH

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.317	1	1.317	52.584	.000(a)
	Residual	.876	35	.025		
	Total	2.193	36			

a Predictors: (Constant), LNREGDCH
b Dependent Variable: LNUSEXCH

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.798	.596		-1.340	.189	-2.008	.411					
	LNREGDCH	.519	.072	.775	7.252	.000	.374	.665	.775	.775	.775	1.000	1.000

a Dependent Variable: LNUSEXCH

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREUSYU	.014(a)	.075	.941	.013	.338	2.958	.338

a Predictors in the Model: (Constant), LNREGDCH
b Dependent Variable: LNUSEXCH

Coefficient Correlations(a)

Model			LNREGDCH
1	Correlations	LNREGDCH	1.000
	Covariances	LNREGDCH	.005

a Dependent Variable: LNUSEXCH

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	LNREGDCH
1	1	1.999	1.000	.00	.00
	2	.001	45.795	1.00	1.00

a Dependent Variable: LNUSEXCH

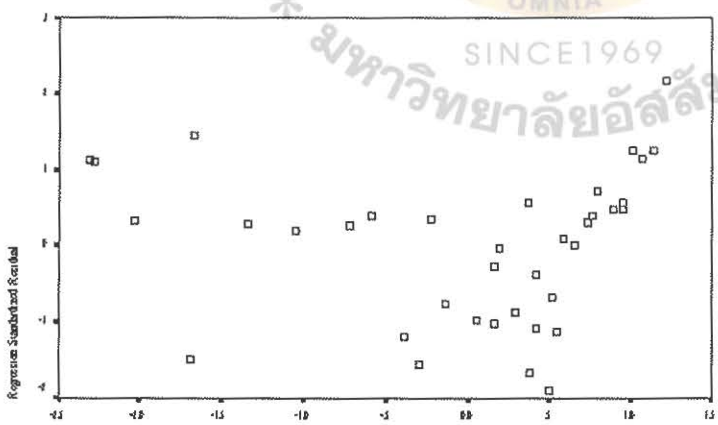
Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.0776	3.7520	3.5188	.19123	37
Residual	-.3009	.3417	.0000	.15602	37
Std. Predicted Value	-2.307	1.220	.000	1.000	37
Std. Residual	-1.901	2.160	.000	.986	37

a Dependent Variable: LNUSEXCH

Scatterplot

Dependent Variable: LNUSEXCH



Regression Standardized Predicted Value

Equation (2)

Descriptive Statistics

	Mean	Std. Deviation	N
LNUSIMCH	5.1310	.35251	37
LNREGDUS	9.0433	.09028	37
LNREYUUS	2.1229	.01339	37

Correlations

		LNUSIMCH	LNREGDUS	LNREYUUS
Pearson Correlation	LNUSIMCH	1.000	.987	-.714
	LNREGDUS	.987	1.000	-.713
	LNREYUUS	-.714	-.713	1.000
Sig. (1-tailed)	LNUSIMCH	.	.000	.000
	LNREGDUS	.000	.	.000
	LNREYUUS	.000	.000	.
N	LNUSIMCH	37	37	37
	LNREGDUS	37	37	37
	LNREYUUS	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREGDUS	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNUSIMCH

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.987(a)	.974	.973	.05744	.974	1320.931	1	35	.000	1.767

a Predictors: (Constant), LNREGDUS
b Dependent Variable: LNUSIMCH

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.358	1	4.358	1320.931	.000(a)
	Residual	.115	35	.003		
	Total	4.473	36			

a Predictors: (Constant), LNREGDUS
b Dependent Variable: LNUSIMCH

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-29.720	.959		-30.992	.000	-31.667	-27.774					
	LNREGDUS	3.854	.106	.987	36.345	.000	3.639	4.069	.987	.987	.987	1.000	1.000

a Dependent Variable: LNUSIMCH

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREYUUS	-.021(a)	-.527	.602	-.090	.491	2.036	.491

a Predictors in the Model: (Constant), LNREGDUS
b Dependent Variable: LNUSIMCH

Coefficient Correlations(a)

Model			LNREGDUS
1	Correlations	LNREGDUS	1.000
	Covariances	LNREGDUS	.011

a Dependent Variable: LNUSIMCH

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	LNREGDUS
1	1	2.000	1.000	.00	.00
	2	4.848E-05	203.106	1.00	1.00

a Dependent Variable: LNUSIMCH

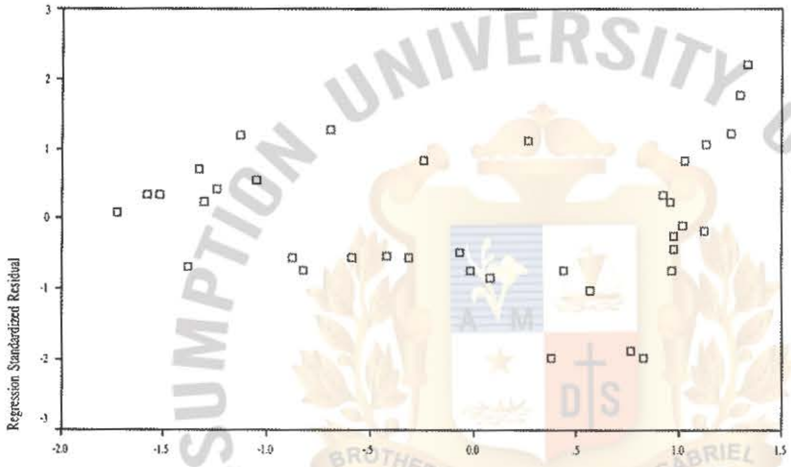
Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.2330	4.4313	3.4730	.71814	37
Residual	-1.1139	1.2379	.0000	.55555	37
Std. Predicted Value	-1.727	1.334	.000	1.000	37
Std. Residual	-1.977	2.197	.000	.986	37

a Dependent Variable: LNUSIMCH

Scatterplot

Dependent Variable: LNUSIMCH



Regression Standardized Predicted Value

Equation (3)

Descriptive Statistics

	Mean	Std. Deviation	N
LNCHEXJA	2.5399	.35044	37
LNREGDJA	11.7738	.05273	37
LNREYUYE	-8.1451	.71063	37

Correlations

		LNCHEXJA	LNREGDJA	LNREYUYE
Pearson Correlation	LNCHEXJA	1.000	.650	-.525
	LNREGDJA	.650	1.000	-.743
	LNREYUYE	-.525	-.743	1.000
Sig. (1-tailed)	LNCHEXJA	.	.000	.000
	LNREGDJA	.000	.	.000
	LNREYUYE	.000	.000	.
N	LNCHEXJA	37	37	37
	LNREGDJA	37	37	37
	LNREYUYE	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREGDJA	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNCHEXJA

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.650(a)	.422	.405	.27023	.422	25.541	1	35	.000	1.687

a Predictors: (Constant), LNREGDJA
b Dependent Variable: LNCHEXJA

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.865	1	1.865	25.541	.000(a)
	Residual	2.556	35	.073		
	Total	4.421	36			

a Predictors: (Constant), LNREGDJA
b Dependent Variable: LNCHEXJA

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-48.281	10.056		-4.801	.000	-68.696	-27.866					
	LNREGDJA	4.316	.854	.650	5.054	.000	2.583	6.050	.650	.650	.650	1.000	1.000

a Dependent Variable: LNCHEXJA

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREYUYE	-.095(a)	-.488	.629	-.083	.448	2.234	.448

a Predictors in the Model: (Constant), LNREGDJA
b Dependent Variable: LNCHEXJA

Coefficient Correlations(a)

Model			LNREGDJA
1	Correlations	LNREGDJA	1.000
	Covariances	LNREGDJA	.729

a Dependent Variable: LNCHEXJA

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	LNREGDJA
1	1	2.000	1.000	.00	.00
	2	9.759E-06	452.712	1.00	1.00

a Dependent Variable: LNCHEXJA

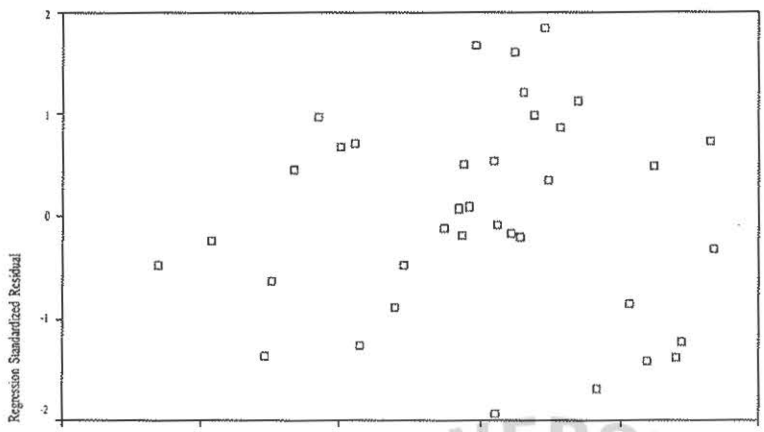
Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.0134	2.9220	2.5399	.22762	37
Residual	-.5235	.4988	.0000	.26645	37
Std. Predicted Value	-2.313	1.679	.000	1.000	37
Std. Residual	-1.937	1.846	.000	.986	37

a Dependent Variable: LNCHEXJA

Scatterplot

Dependent Variable: LNCHEXJA



Equation (4)

Descriptive Statistics

	Mean	Std. Deviation	N
LNCHIMJA	1.9896	.35136	37
LNREGDCH	8.3138	.36827	37
LNREYEYU	2.6094	.11789	37

Correlations

		LNCHIMJA	LNREGDCH	LNREYEYU
Pearson Correlation	LNCHIMJA	1.000	.834	.586
	LNREGDCH	.834	1.000	.726
	LNREYEYU	.586	.726	1.000
Sig. (1-tailed)	LNCHIMJA	.	.000	.000
	LNREGDCH	.000	.	.000
	LNREYEYU	.000	.000	.
N	LNCHIMJA	37	37	37
	LNREGDCH	37	37	37
	LNREYEYU	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREGDCH	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNCHIMJA

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.834(a)	.696	.687	.19648	.696	80.130	1	35	.000	1.667

a Predictors: (Constant), LNREGDCH
b Dependent Variable: LNCHIMJA

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.093	1	3.093	80.130	.000(a)
	Residual	1.351	35	.039		
	Total	4.444	36			

a Predictors: (Constant), LNREGDCH
b Dependent Variable: LNCHIMJA

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-4.628	.740		-6.254	.000	-6.130	-3.126					
	LNREGDCH	.796	.089	.834	8.952	.000	.615	.976	.834	.834	.834	1.000	1.000

a Dependent Variable: LNCHIMJA

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREYEYU	-.042(a)	-.307	.760	-.053	.473	2.116	.473

a Predictors in the Model: (Constant), LNREGDCH
b Dependent Variable: LNCHIMJA

Coefficient Correlations(a)

Model			LNREGDCH
1	Correlations	LNREGDCH	1.000
	Covariances	LNREGDCH	.008

a Dependent Variable: LNCHIMJA

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	LNREGDCH
1	1	1.999	1.000	.00	.00
	2	.001	45.795	1.00	1.00

a Dependent Variable: LNCHIMJA

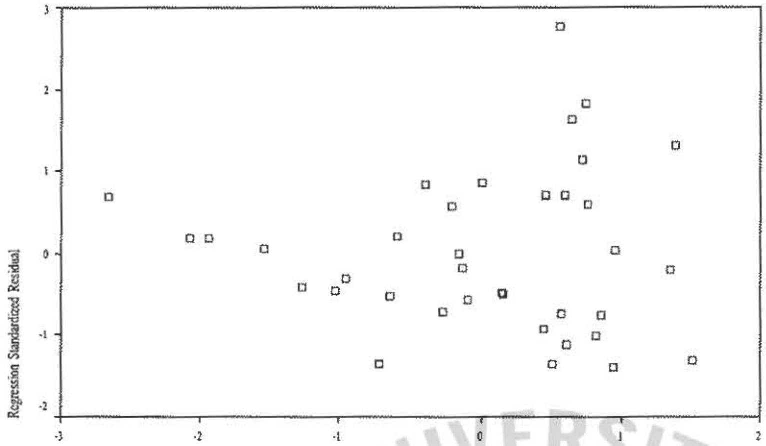
Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.3517	2.3532	1.9896	.24005	37
Residual	-.3683	.7300	.0000	.25657	37
Std. Predicted Value	-2.657	1.515	.000	1.000	37
Std. Residual	-1.395	2.765	.000	.972	37

a Dependent Variable: LNCHIMJA

Scatterplot

Dependent Variable: LNCHIMJA



Equation (5)

Descriptive Statistics

	Mean	Std. Deviation	N
LNJAEXUS	3.5617	.13219	37
LNREUSGD	9.0433	.09028	37
LNREYEUS	4.7327	.11612	37

Correlations

		LNJAEXUS	LNREUSGD	LNREYEUS
Pearson Correlation	LNJAEXUS	1.000	.892	.716
	LNREUSGD	.892	1.000	.566
	LNREYEUS	.716	.566	1.000
Sig. (1-tailed)	LNJAEXUS	.	.000	.000
	LNREUSGD	.000	.	.000
	LNREYEUS	.000	.000	.
N	LNJAEXUS	37	37	37
	LNREUSGD	37	37	37
	LNREYEUS	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREUSGD	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	LNREYEUS	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNJAEXUS

Model Summary(c)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.892(a)	.795	.789	.06066	.795	135.958	1	35	.000	
2	.928(b)	.861	.853	.05069	.066	16.112	1	34	.000	2.446

a Predictors: (Constant), LNREUSGD
b Predictors: (Constant), LNREUSGD, LNREYEUS
c Dependent Variable: LNJAEXUS

ANOVA(c)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.500	1	.500	135.958	.000(a)
	Residual	.129	35	.004		
	Total	.629	36			
2	Regression	.542	2	.271	105.387	.000(b)
	Residual	.087	34	.003		
	Total	.629	36			

a Predictors: (Constant), LNREUSGD
b Predictors: (Constant), LNREUSGD, LNREYEUS
c Dependent Variable: LNJAEXUS

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-8.247	1.013		-8.143	.000	-10.303	-6.191					
	LNREUSGD	1.306	.112	.892	11.660	.000	1.078	1.533	.892	.892	.892	1.000	1.000
2	(Constant)	-7.593	.862		-8.809	.000	-9.344	-5.841					
	LNREUSGD	1.048	.113	.716	9.236	.000	.817	1.279	.892	.846	.590	.680	1.470
	LNREYEUS	.354	.088	.311	4.014	.000	.175	.533	.716	.567	.257	.680	1.470

a Dependent Variable: LNJAEXUS

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREYEUS	.311(a)	4.014	.000	.567	.680	1.470	.680

a Predictors in the Model: (Constant), LNREUSGD
b Dependent Variable: LNJAEXUS

Coefficient Correlations(a)

Model			LNREUSGD	LNREYEUS
1	Correlations	LNREUSGD	1.000	
	Covariances	LNREUSGD	.013	
2	Correlations	LNREUSGD	1.000	-.566
		LNREYEUS	-.566	1.000
	Covariances	LNREUSGD	.013	-.006
		LNREYEUS	-.006	.008

a Dependent Variable: LNJAEXUS

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	LNREUSGD	LNREYEUS
1	1	2.000	1.000	.00	.00	
	2	4.848E-05	203.106	1.00	1.00	
2	1	3.000	1.000	.00	.00	.00
	2	.000	95.987	.08	.02	.79
	3	3.953E-05	275.485	.92	.98	.21

a Dependent Variable: LNJAEXUS

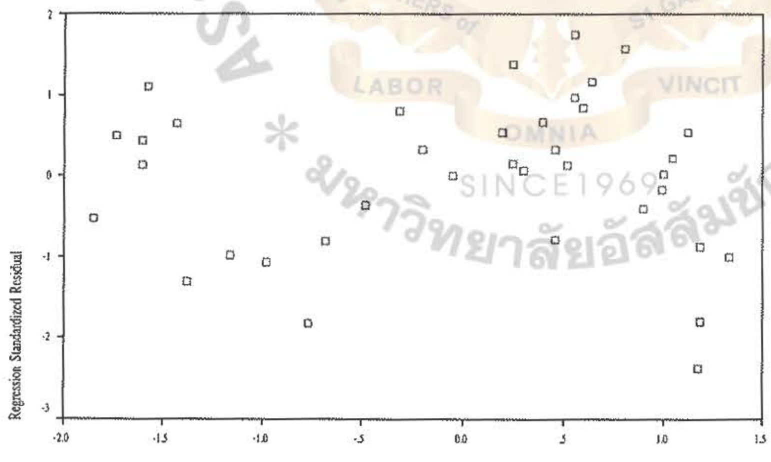
Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.3342	3.7257	3.5617	.12266	37
Residual	-.1200	.0885	.0000	.04927	37
Std. Predicted Value	-1.854	1.337	.000	1.000	37
Std. Residual	-2.367	1.745	.000	.972	37

a Dependent Variable: LNJAEXUS

Scatterplot

Dependent Variable: LNJAEXUS



Regression Standardized Predicted Value

Equation (6)

Descriptive Statistics

	Mean	Std. Deviation	N
LNJAIMUS	2.9841	.11923	37
LNREJAGD	11.7738	.05273	37
LNREUSYE	-4.7327	.11612	37

Correlations

		LNJAIMUS	LNREJAGD	LNREUSYE
Pearson Correlation	LNJAIMUS	1.000	.398	-.691
	LNREJAGD	.398	1.000	-.438
	LNREUSYE	-.691	-.438	1.000
Sig. (1-tailed)	LNJAIMUS	.	.007	.000
	LNREJAGD	.007	.	.003
	LNREUSYE	.000	.003	.
N	LNJAIMUS	37	37	37
	LNREJAGD	37	37	37
	LNREUSYE	37	37	37

Variables Entered/Removed(a)

Model	Variables Entered	Variables Removed	Method
1	LNREUSYE	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: LNJAIMUS

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.691(a)	.477	.462	.08743	.477	31.951	1	35	.000	1.696

a Predictors: (Constant), LNREUSYE
b Dependent Variable: LNJAIMUS

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.244	1	.244	31.951	.000(a)
	Residual	.268	35	.008		
	Total	.512	36			

a Predictors: (Constant), LNREUSYE
b Dependent Variable: LNJAIMUS

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.373	.594		-.628	.534	-1.579	.833					
	LNREUSYE	-.709	.125	-.691	-5.653	.000	-.964	-.455	-.691	-.691	-.691	1.000	1.000

a Dependent Variable: LNJAIMUS

Excluded Variables(b)

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	LNREJAGD	.118(a)	.865	.393	.147	.808	1.237	.808

a Predictors in the Model: (Constant), LNREUSYE
b Dependent Variable: LNJAIMUS

Coefficient Correlations(a)

Model			LNREUSYE
1	Correlations	LNREUSYE	1.000
	Covariances	LNREUSYE	.016

a Dependent Variable: LNJAIMUS

Collinearity Diagnostics(a)

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	LNREUSYE
1	1	2.000	1.000	.00	.00
	2	.000	82.652	1.00	1.00

a Dependent Variable: LNJAIMUS

Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.7756	3.1323	2.9841	.08237	37
Residual	-.1528	.1412	.0000	.08621	37
Std. Predicted Value	-2.532	1.800	.000	1.000	37
Std. Residual	-1.748	1.615	.000	.986	37

a Dependent Variable: LNJAIMUS