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# REAL EFFECTIVE EXCHANGE RATE AND UNEMPLOYMENT RATE: THE DIFFERENCE BETWEEN RE-EXPORTING AND NON-RE-EXPORTING COUNTRIES

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REAL EFFECTIVE EXCHANGE RATE AND UNEMPLOYMENT RATE:  
THE DIFFERENCE BETWEEN RE-EXPORTING  
AND NON-RE-EXPORTING  
COUNTRIES

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Presented to  
the Graduate School of  
Clemson University

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts  
Economics

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by  
Xiaolong He  
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## ABSTRACT

In this paper, I examine the relationship between unemployment rate and real effective exchange rate in several countries from 1994 to 2009. The analysis shows that most of countries have a negative relationship between those two factors, which implies increase of exchange rate can improve employment rate in an economy. However, re-exporting countries like the Netherlands, Singapore and Hong Kong has a less negative relationship than other countries. I hypothesize that those results are caused by the different elasticity of demand for imports.

## DEDICATION

I would like to dedicate this thesis to my family, for their support and encouragement.

## ACKNOWLEDGMENTS

First of all, I would like to thank my adviser Michal Jerzmanoski. He always answers my questions patiently and carefully. He taught me how to build an economic model and how to use it.

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## CHAPTER ONE

### INTRODUCTION

What effects do movements in the real exchange rate have on unemployment rate is uncertain. The US politicians often improve their positions by attacking exchange rate. The common idea that they usually use is Chinese workers replace American workers because of the depreciation policy of China government so that Chinese labor force become cheaper. However, Charles Evans, the chief of Chicago Federal Reserve, was interviewed by the journalists of China Economics Weekly said " It is very hard to draw the conclusion that unemployment rate will decrease a lot when there is an appreciation of Chinese currency."<sup>1</sup> In addition, Robert C. Feenstra also points out the labor productivity of American workers get improved when low-productivity goods are distributed to developing countries with outsourcing. The unemployment rate will come back to natural unemployment rate in the long run after the temporary shock like exchange rate. (Feenstra, 2009) Therefore, the relationship between exchange rate and unemployment rate is not clear.

In this article, I would like focusing on studying the relationship between unemployment rate and real effective exchange rate, by adding some major factors that are important on country's economic progress such as inflation rate, interest rate, GDP growth rate. At the same time, a panel data is used from 1994 to 2010 and 25 countries is

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<sup>1</sup> Jialong Tan and Xuelian Song who is journalist of China Economics Weekly report that the exchange rate does not have relationship with unemployment rate of USA in 2010.

included. The conclusion is that real effective exchange rate has a negative influence on unemployment rate from the general data.

Afterwards, I test if there are different relationships between real effective exchange rate on unemployment rate for re-exporting and non-re-exporting countries. According to theory of international trade, devaluation of currency of home country increases exports of home goods. However, devaluation of currency of home country has an unsure relationship on imports of home goods. The unsure relationship is decided by the elasticity for imports. Therefore, Net exports (Imports- exports) are unsure if there is a change in real exchange rate.

I think the elasticity for imports is different for re-exporting countries and non-re-exporting countries, holding other factors fixed. For instance, Entrepot economics such as Hong Kong and Singapore are an important feature of global exchange. (Findlay and Wellisz, 1993; Sung, 1997) These trading centers specialize in matching buyers and sellers in different markets. In particular, they intermediate a substantial fraction of trade between Asia and the rest of the world. In 1998, the ratio of total trade to GDP was 259% in Hong Kong and 256% in Singapore. Hong Kong, a typical re-exporting country, imports goods from China and then distributes them to a final distribution. In 1996, re-exports of Chinese goods equaled 52% of Hong Kong GDP. (Feenstra Hanson, 2000) Re-exports play a very important role for economy of Hong Kong. Therefore, different from normal trades, entrepot activities have a strong demand for imports from origin, which makes real effective exchange rate has different effect on unemployment rate for re-export countries.

I assume other factors in two kinds of countries are same like resources and technology. Same technology level can ensure the benefit from processing is same. Same amount of resources can ensure same demand for imports to meet domestic uses. In a simple example, a re-exporting country seems like an intermediary company. The company specialize importing goods from some companies and then selling those goods to other companies. The value of money the company holds is very critical because it decides how many goods the company can import to make markups. On the contrary, there is no extra profit for non-re-exporting countries to import besides satisfying domestic consumptions and process, because non-re-exporting countries cannot make more profits through re-exports. Since resources and technology are same for two kinds of countries, the demands for imports to meet domestic uses are same. But re-exporting countries can gain more benefits through re-exports. Hence, I believe re-exporting countries have a stronger demand for imports than non-re-exports by holding other factors same.

The result from general data is that there is an obvious difference of real effective exchange rate on unemployment. The coefficient for re-exporting countries is less negative than non-re-exporting countries.

This article is composed by several chapters. The first chapter is this introduction. In the second chapter, I give a brief literature review. In the third chapter, I describe the definition and implication of key words. In the next chapter, I discuss formal theories and how they influence the relationship between exchange rate and unemployment rate. The analysis is presented in chapter 5, which applies to explain how exchange rate affects

unemployment rate in different ways for re-exporting countries and non-re-exporting countries. The empirical specifications are in section 6, and the results from that are showed in section 7. Conclusions are drawn in the last section 8.

## CHAPTER TWO

### LITERATURE REVIEW

There are a lot of literature focuses on this topic of the relationship between real effective exchange rate and unemployment rate and among other variables. Chimnani, Hina, Bhutto, Niaz, Butt, Falauddin, Shaikh Sheeraz and Devi, Warcha pointed out exchange rate has positive impact on unemployment rate in ten Asian countries (2012). Filztekin found a positive relationship of exchange rate and unemployment rate. (2004) Chang and Shen for Taiwan, South Korea and Singapore and Burgess (2011) and Knetter for G-7 countries (2008) found a positive relationship between exchange rate and unemployment rate.

On the other hand, in recent decades, re-exports has been increasing in some countries because of world openness in trade. By now, more than 50% Dutch manufacturing exports are re-exports. In Germany, re-exports account for more 15% of total exports, in Singapore for more than 50%, and in Hong Kong around 95 %.( Mellens, Noordman, Verbruggen, 2007) Feenstra also underlined the importance of re-exports in some countries. Hong Kong plays a role that distributes a large fraction of China's exports including customs, insurance, and freight charges since 1997. Re-exports of Chinese goods are much more expensive when they leave Hong Kong than when they enter. (Feensta, Hanson, 2000)

## CHAPTER THREE

### DEFINITION OF KEY WORDS

#### **2.1 What is real effective exchange rate?**

Effective Exchange Rate is an index that shows the relative strength of a currency relative to a basket of other currencies. The definition is “weighted average value of a country's currency relative to all major currencies being traded within an index or pool of currencies. The value is determined by the importance a home country places on all other currencies traded within the pool, as measured by the balance of trade, taking account of price indicates.”<sup>2</sup> Real effective exchange rate is the nominal effective exchange rate<sup>3</sup> divided by a price deflator or index of costs. The difference between real and nominal effective exchange rate is the real effective exchange rate considering the price deflator. On the other hand, the difference between real effective exchange rate and real exchange rate is that real effective exchange rate is a weighted average of exchange rate of home country versus overseas countries' currencies, considering the weight for each foreign country equal to its share in trade. In short, the real effective rate considers the multilateral trade. While, the real exchange rate is only focusing on bilateral relationship. I introduce this vector in my article to replace real exchange rate, since I think real effective exchange rate is more authoritative to study the effect of exchange rate on trade. For instance, a country named A has trade relationships with B & C. And the trade share with B is 90% the trade share with C is only 10%. In this case, Country B currency

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<sup>2</sup> This definition is from Investopedia and National Institution of Statistics and Economics Studies

<sup>3</sup> Weighted average of several foreign currencies.

definitely will have a bigger effect on trade than country C with the same change of currency and the effective exchange rate can reflect the true results directly. On the contrary, if we only focus on the real exchange rate, we may not get the true result caused by the change of currency. In the trade of world, Hong Kong could be a good reason to explain how important of real effective exchange rate and why I use real effective exchange rate to replace real exchange rate. Hong Kong holds a special place regard to re-exports because of its special in relation to China. (Noordman and Verbruggen, 2007) In 1996, re-exports of Chinese goods equaled 52% of Hong Kong GDP. (Hsieh and Woo, 1999) Eyeballing Table 1.1 column (2), we see Chinese re-exports through Hong Kong is a big share of total Chinese exports. In this arrangement, traders in Hong Kong import goods from China and then distribute them to a destination. (Feenstra and Hanson, 2000) It is believed that Hong Kong is very dependent on China on trade. Meanwhile, there is no doubt that Hong Kong uses Renminbi to import goods, which is Chinese currency. In this situation, it is nonsense to study influences on unemployment rate from other countries currency if those countries own too little trade share with Hong Kong. Even though there is an obvious change of the value of those currencies related to Hong Kong dollars, the trade volume between Kong and those countries will not change a lot, because of the little share of them. As a result, I use real effective exchange rate to replace real exchange rate because it consider comprehensively trade relationships with whole countries rather than just one country.

## **2.2 What are re-exports?**

Re-exports are goods which are imported, undergo little or no processing, and are then exported again, matching the buyers the sellers in different markets. (Feenstra and Hanson 2000) On the other hand, the definition from IMF is “Exports of foreign goods in the same state as previously imported”. Statistic Netherlands (CBS) gives a more concrete definition “re-exports as goods which have been imported into the Netherlands and leave the country again after no (or virtually no) further processing. At the same time, they include goods among domestically-produced exports if these goods undergo some processing and consequently are given a new six-digit product code.” However, there is still no international agreement about the definition on the definition of the re-exports. Some people think that “If computers are imported and exported again with only user manuals in the language of the destination country added to the boxes, this is intuitively clearly a case of re-exports.” (Mellens, Noordman and Verbruggen, 2007) Because of this unclear and different definition from different countries, our data on re-exports may be not so accurate.

### **2.3 What countries are re-exports countries in the world?**

Re-exporting country is a country has a large share of re-exports in total exports of goods. Scholars point out large re-exporting countries include Belgium, Germany, United States, Netherlands, Singapore and so on that have more than 10 percent of their exports are re-exports.(Gehlhar, Narayanan and Walmsley, 2008) Here, I use those countries to stand for re-exporting countries in the paper.

### **2.4 What characteristics of those typical re-exporting countries?**

Although Belgium, Germany, USA, Singapore, Hong Kong, the Netherlands are re-exporting countries. However, trade plays a much more important in Singapore, Hong Kong, Belgium compared with USA and Germany. Singapore, Hong Kong, Belgium and the Netherlands that are typical re-exporting countries have an extreme big trade volume that is over than 100% except German and USA. (Table 1.2) Trade volume is the “sum of exports and imports of goods and services as a share of gross domestic product.”<sup>4</sup> We may claim that this big trade volume means that trade plays a very important role in those countries. In addition, most of re-exports countries are high income countries. Singapore has the top GDP per capita in the world as well as the other re-exports countries have.

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<sup>4</sup> This definition is from World Bank.

## CHAPTER FOUR

### THEORIES

#### **3.1 AD-AS Model**

According to open Keynesian theory ( $Y=C+I+G+NX$ ) (Keynes, 1936), net exports affect aggregate demand positively. But increased aggregate demand does not mean higher employment rate.

#### **Short run**

##### **a. Classic AD-AS Model**

No matter in classic AD-AS Model or Keynesian Model, AD (Aggregate Demand) curve is a downward curve. However, AS (Aggregate Supply) curves are different each other. In classic AD-AS Model, (Glanville and Alan, 2011), the assumptions are real wage can be adjusted all the time. Labor market stays in equilibrium. Employment rate is not affected by price level and it always stays in full-employment situation. And the output also stays in full-outputs situation. Hence, AS curve should be vertical curve which shows price level does not affect output. From the Figure 1.1, we can also find the change of aggregate demand does not change output at all but price level, because of full-employment level in short run according to Class AD-AS model.

##### **b. Keynesian Model**

The aggregate supply curve is different in Keynesian Model. Keynes argues that it is wrong to assume the competitive markets. He believes that employment does not always stay in full-employment because of sticky in wages and price. (Keynes, 1936)

Before the full-employment, the aggregate supply is an upward curve that means more productions will be produced with increase of price level. Hence, the increase of aggregate demand will increase the output and employment rate if economy is in recession, like the point C to point A in Figure 1.2. However, if employment stays in full-employment, increase of aggregate demand does not increase outputs and employment rate, like point A to point B.

### **Long run**

In the long-term, the aggregate supply curve should be a vertical line like it in classic AD-AS model. (Figure 1.3) Wage and cost of productions will also increase when price level increases. There is no reason for firms to hire more workers or produce more. Aggregate demand does not affect employment rate in long-term.

All in all, I believe in Keynesian model that most of employment level does not get into full-employment in the world. Net exports tend to decrease unemployment rate.

### **3.2 Exchange rate and Trade**

Exchange rate has a direct influence on net exports. However, the effect of exchange rate on the net export is uncertain and the elasticity of demand for imports plays a crucial factor. In international finance, for the exports side, when domestic exchange rate becomes higher (domestic currency depreciation), domestic country can export more because their goods become relatively cheaper. Depreciation of home country's currency has two effects for home country. 1. A rise in the home currency prices of a foreign currency. 2. It makes home goods cheaper for foreigners and foreign goods more expensive for domestic residents. (Paul R. Krugman and Maurice Obstfeld, 2011) For

example, in 1986, people can use 3.45 yuans to trade for 1 US dollar.<sup>5</sup> In 1995, the exchange rate was 8.35. The Chinese currency got a huge depreciation. In 1986, if the price of a cloth was 100 yuans, US customers paid  $100/3.45 = 28.98$  dollars to buy one. Holding the price expressed in yuans constant in 1995, US customers just need to pay  $100/8.35 = 11.97$  dollars. The depreciation of yuan makes the Chinese goods look very cheap and more clothes would be exported to US. So, the depreciation of home country currency will increase the volume of exports normally. ( $EX = P * Q$ , EX is the exports, P is the price of exports, one cloth which is 100 yuans in here, Q is the quantity of clothes which are exported. In here, China is the home country. The quantity of clothes which are exported to US goes up because the relative price goes down, while price of clothes keep constant that is 100 yuans, so exports for China will go up. )

For the side of imports, because the exchange rate goes up, the price of imports rise,<sup>6</sup> (domestic currency depreciation) but the quantity also decreases. Those two factors which one is bigger are unsure and it depends on the elasticity of the product. ( $IM = P * Q$ , IM is the imports, P is the price of imports, Q is the quantity of imports. Because the home currency value goes down, home country has to spend more domestic money on imports, at the time, the quantity will go down because of the higher relative price. So, P goes up and Q goes down, it is unsure for the result of imports. The key factor is the elasticity for imports.) For instance, oil is very inelastic. Although world oil prices

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<sup>5</sup> Yuan is the unit of Renminbi.

<sup>6</sup> When the exchange rate goes up (depreciation of home currency), home importers have to spend more home money to trade for foreign money to purchase same amount of goods compare to the original. For instance, US firms use 5 dollars (40 yuans) to import a shirt from China. However, when the US dollars depreciate, the shirt is still 40 yuans, but US firms have to spend more money to buy it like 6 or 7 dollars.

increase because of world currency depreciation, the demand for oil is still very large for the whole world. So, other countries in the world still import a lot of oil. Import volume may be larger than the original situation. On the contrary, if the product is very elastic for the importing country, the importing country will be very sensitive to price of the product. The imports may shrink than the original situation. All in all, we cannot know whether a country imports (Price after the change\* Quantity after the change) is bigger or smaller than its original point (Price before the change\*Quantity before the change) because of unknown elasticity of the product for this country.

Exports tend to increase and the variation of imports is not certain with depreciation of home currency. Therefore, the effect of exchange rate on net export ( $NX=EX-IM$ ) is not sure for a country. In practice imports usually stays about constant but exports will go up with the devalued currency normally (I do find the resource, but this idea is from international finance). It means net exports go up with the devalued currency.

Overall, because of the two reasons, that are net exports has a negative relationship with unemployment rate and exchange rate has an unsure effect on net exports, the exchange rate has an unsure effect on unemployment rate. If an increase of exchange rate can increase more exports than imports and make net exports keep bigger, unemployment rate will decrease. If devalued currency can increase the net exports, devalued currency can decrease the unemployment rate.

## CHAPTER FIVE

### ANALYSIS

Singapore and Hong Kong are typical extended re-exporting countries. The advantage is their geography that they are natural ports. But their resources are very scarce. Although Singapore is much industrialized now, they still rely on imported goods. The Singaporean economy depends heavily on exports and refining imported goods, especially in manufacturing, which constituted 27.2% of GDP in 2010. Like Feenstra said in his paper, Hong Kong imports from China, and then distributes them to the world. (Feenstra and Hanson, 2000) This is the mechanism of re-exports. Singaporean also has to import first, and then directly export these products later. The elasticity for imports should be very inelastic. When Singapore currency depreciate (exchange rate increase), Singapore still imports a lot of products but with a higher price. The amount of imports will increase; On the other hand, when Singapore tries to re-export these products, they have to increase the price because of the increasing import costs. It may make the advantage on exports caused by the depreciation of currency become less. In fact, there are a lot of trade-related services producing industries in Singapore, like trade insurance. Therefore, currency depreciation for typical extended re-exporting countries will not bring so much benefit for unemployment rate as it should do. In addition, Singapore also has scarce resources which make import cost become bigger when currency of Singapore depreciates for domestic uses not for re-exports, and then unemployment rate will not be improved so much.

Hence, if domestic currency exchange rate increases (depreciation), the imports of domestic for a country that has an inelastic demand for imports would be increased a lot like Singapore, that is re-exporting and poor-resources country. Unemployment rate cannot get improved by as much as non-reporting countries. However, in the same conditions, exchange rate often improve unemployment rate for countries that have an elastic demand for imports

In order to study the relationship between real effective exchange rate and unemployment rate, the most effective and precise variable is elasticity of imports. However, data about this variable is hard to get because it needs to calculate how quantity of imports is affected by price of imports. In order to address the lack of data, I introduce a dummy variable called re-exporting countries that distinguish re-exporting countries and non-re-exporting countries. As I mentioned in introduction, re-exporting countries will have a stronger demand for imports than non-re-exporting holding other factors fixed. Re-exporting countries can make more money than other countries through imports, which makes re-exporting countries have a more inelastic demand for imports, holding other factors are same.

It is very hard to find two groups of countries that have same factors. The results from direct comparison from re-exporting and non-re-exporting countries are not clear because of the different factors like different resources and technology two countries have. Because of the existence of retained imports,<sup>7</sup> some non-re-exporting countries

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<sup>7</sup> Imports of goods and services are composed by two parts. The first part is re-exports of goods and service which a country imports in order to export. The second part is called retained imports. “Retained imports of goods refer to those imported goods which are

could also have a strong demand for imports, because non-re-exporting countries can process imports and increase domestically produced exports like Japan. Hence, the different influence on unemployment rate can be small from real effective exchange rate between re-exporting countries and others when I selected a lot of all varieties of countries into data.

Consequently, I have such hypotheses.

1. Real effective Exchange rate has a negative influence on unemployment rate considering the whole data.
2. Real effective Exchange rate in re-exporting countries has a less negative effect on unemployment rate compared with non-re-exporting countries, but the difference would not be pretty large. The reasons are re-exporting countries include USA that are rich in resources and non-re-exporting countries include Japan and so on that are scared in resources but are not re-exporting countries.

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retained for use in Hong Kong rather than being re-exported to other places. The value of retained imports of goods is derived by subtracting the estimated import value of re-exports of goods from the value of imports of goods. (Continued) The former is obtained by removing an estimated re-export margin from the value of re-exports of goods. The Census and Statistics Department regularly conducts a survey of re-export trade, based on which the rates of re-export margin for different categories of goods are estimated for deriving retained import statistics. Retained import statistics are subject to revision when the latest estimates on rates of re-export margin become available. ” ( Census and Statistics Department of Hong Kong )

## CHAPTER SIX

### DATA AND MODELS

#### 4.1. Data Sources

The trade data I use for thesis are from several sources: Inflation rate, Interest rate, GDP growth rate, Trade volume, Net export from database of World Bank. The Real effective real exchange rate is provided by Bank for International Settlements. The unemployment rate data is from International Monetary Fund - 2011 World Economic Outlook. All the data span 1995 to 2009.

#### 4.2 Models

Model 1

$$dU_{it} = \beta_0 + \beta_1 \log REX_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 NX_{it} + \beta_5 INR_{it} + \sum \alpha_i Country + \sum \gamma_t Year_t + \varepsilon_{it}$$

Model 2

$$dU_{it} = \beta_0 + \beta_1 \log REX_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 NX_{it} + \sum \alpha_i Country + \sum \gamma_t Year_t + \varepsilon_{it}$$

Model 3

$$dU_{it} = \beta_0 + \beta_1 \log REX_{it} + \beta_2 RE^* \log REX_{it} + \sum \alpha_i Country + \sum \gamma_t Year_t + \varepsilon_{it}$$

The second equation is different than the first since INR (real interest rate) is removed in there. Explanations are in the methodologies.

The Dependent variable is unemployment rate. Other variables are independent variables.

INF stands for inflation rate (annual %). Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of

acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. (World Bank) The inflation rate is 0% in the 1960 which is the base year.

INR is the real interest rate (%), which is the lending interest rate adjusted for inflation as measured by the GDP deflator.

GDPR is the real GDP growth (annual %). Annual percentage growth rate of GDP at market prices is based on constant local currency at 2000. Some scholars may use constant U.S. Dollars 2000 as the based price. In fact, according the definition of the growth rate of real GDP, there is no difference on result by applies those two methods.

$$\begin{aligned}
 GDPR_{lc} &= (RGDP_n - RGDP_{n-1}) / RGDP_{n-1} \\
 &= (Q_n * P_{lc} - Q_{n-1} * P_{lc}) / Q_{n-1} * P_{lc} = Q_n - Q_{n-1} / Q_{n-1} \\
 GDPR_{dc} &= (RGDP_n - RGDP_{n-1}) / RGDP_{n-1} \\
 &= (Q_n * P_{dc} - Q_{n-1} * P_{dc}) / Q_{n-1} * P_{dc} = Q_n - Q_{n-1} / Q_{n-1}
 \end{aligned}$$

$GDPR_{lc} = GDPR_{dc}$ . So, The GDPR is affected by the quantity rather than the price index.

REX is real effective exchange rate index (2005 = 100) Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

RE is a dummy variable re-exports to distinguish re-exporting countries and others. USA, Germany, Hong Kong, Singapore and the Netherlands are re-exporting countries. And others are non-re-exporting countries.

### 4.3 Methodologies

The first equation is used to see the relationship between the unemployment and real effective exchange rate by adding other macroeconomics major factors. According to the model in the paper “The Effect of Exchange Rate on Unemployment Rate in Asian Countries”, I choose those major factors in my model. (Chimnani, Bhutto, Butt, Shaikh and Devi, 2012) Unlike their methodology, I use the fixed effects regression which holds constant average effects of each country. I can control for the average difference across countries in any observable or unobservable predictors, which incline the influence of omitted variable bias if I believe that unobservable variables are not time-variant.

However, there is a vital rule for of fixed effects that the variable I am interested in which have to have a little variation within a group. For instance, the exchange rate in Hong Kong should vary within the 16 years. Otherwise, I have to give up fixed effects estimation. In my data, this kind of problem does not exist.

The second equation is almost as same as the first one but it does not include real interest rate. I do not want to shrink my data because of real interest rate that is not the key factor I want to study in this paper. During the process that I collect data, some information about real interest rate cannot be found.(even the nominal interest rate, like Germany interest rate from 2002 to 2009) Therefore, I choose to regress variables excluding real interest rate in model 2 to get the results from more observations.

The first model contains all major variables but with fewer observations, the second model lacks interest rate but has more observations. Combining both is to gain comprehensive results.

After I confirm unemployment rate has an obvious relationship with real effective exchange rate, I try to see the different relationship in re-exporting countries and non-exporting countries. No matter in Model 1 or Model 2, the effect of each independent variable is assumed to be same across the groups which show an average within-group effect. However, I believe there are different slopes across all groups because the country is a re-exporting country or not. Hence, I use chow test to check the state of pooled and separate function. The conclusion is that I should run separate regressions for the two types of countries. (See Appendix)

## CHAPTER SEVEN

### RESULTS

Table 1.3 and Table 1.4 are used to see the relationship between real effective exchange rate and unemployment. Table 1.3 which uses Model 1 to points out that the results of exchange rate on unemployment rate along with other variables by using 16 high income countries<sup>8</sup> from 1994 to 2009. A different regression is represented by each column and each row stands for a coefficient and standard error. Individual coefficient are statistically significant at \*5%, \*\*1% and \*\*\*10%. Numbers in parentheses stand for standard error.

Column (01) in table 1.3 shows the directly negative influence of real effective exchange rate on unemployment rate. Real effective exchange rate increase by 1%, unemployment rate will go down by 0.02967% which is significant at 5% significance level. Column (02) shows that real effective exchange rate has a greater negative effect on employment rate by adding inflation rate with the 0.1% significance level. The inflation rate is chose by me because inflation has a relationship with unemployment rate in the short run according to Philips Curve. (Blanchard, Olivier , 2000)  $R^2$  increases from 64.4% to 69.4%. In column (03), GDP growth rate is added in the regression, since the growth of GDP tends to have a relationship with unemployment rate. Real effective exchange rate still has a negative effect on unemployment rate at 0.1% significant level.  $R^2$  jumps from 69.4% to 70.1%. By adding the last variable interest rate, real effective

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<sup>8</sup> The Netherlands, Singapore, Norway, Slovenia, UK, US, Australia, Belgium, Canada, Denmark, Hong Kong, Iceland, North Korea, Japan, Czech Republic, Switzerland.

exchange rate still makes negative influence on unemployment rate. The  $R^2$  is 70.6% in the end, which means 70.6% of the variation of unemployment rate is explained by the model. The paper selected real interest because interest rate will affect firms' investment decisions. When interest rate goes up, the cost of loan will be bigger for industries, and then unemployment rate will rise. These results are consistent with my expectation that exchange rate has a negative relationship with unemployment rate in the world normally.

Table 1.4 that is regressed from Model 2 which is as almost same as Table 1.3, but interest rate is removed in here. By deleting this variable, I make the number of observations increase from 256 to 400 and the number of countries is 25.<sup>9</sup> Consequently, the results are as same as Table 1.3 that real effective exchange rate has a negative influence on unemployment rate at different significant levels.

Table 1.5 is from Model 3. This regression contains an interaction re-exports times log real effective exchange rate. The coefficient of this variable is 1.899 which means log real effective exchange rate has a larger negative influence on unemployment rate for re-exporting countries compared with non-re-exporting countries.

Table 1.6 and E are used to examine the relationship between real effective exchange rate and unemployment rate for re-exporting countries and non-re-exporting countries. The observations of Table 1.6 and Table 1.7 are from Table 1.3. (16 countries

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<sup>9</sup> The Netherlands, Singapore, Norway, Slovenia, UK, US, Australia, Belgium, Canada, Denmark, Hong Kong, Iceland, North Korea, Japan, Czech Republic, Switzerland, Germany, Austria, Cyprus, Greece, Ireland, Luxembourg, Portugal, Sweden, New Zealand.

and span from 1994 to 2009) Table 1.6 only contains non-re exporting countries<sup>10</sup> and Table 1.7 contains re-exporting countries.<sup>11</sup> In Table 1.6, the coefficients of log real exchange rate are -3.078, -4.265\*\*, -4.229\*\*, -4.156\*\* respectively.

However, in Table 1.7, the coefficients of log real effective exchange rate are -0.103, -1.925, -2.994\*, -3.051\* respectively. I have to emphasize that these results are not significant. The small size of sample may make the results. Real effective exchange rate tends to have a less negative effect on unemployment rate for re-exporting countries than non-re-exporting countries, although results are not very significant for re-exporting countries. It is believed that the results are not statistical significance. However, those results are consistent with my expectation that re-exporting countries will be influenced more than non-exporting countries and the difference is quite big (-4.156 vs -3.051) when adding all variables. This big difference implies that increase 1% of real effective exchange rate, unemployment rate will decrease more 0.01105% for non-re-exporting countries than re-exporting countries. Unemployment rate in non-re-exporting countries get more improvement than re-exporting countries, which is economic significance.

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<sup>10</sup> Norway, Slovenia, UK, Australia, Canada, Denmark, , Iceland, North Korea, Japan, Czech Republic, Switzerland.

<sup>11</sup> The Netherlands, Singapore, US, Belgium, Hong Kong.

## CHAPTER EIGHT

### CONCLUSIONS AND FUTURE DISCUSSIONS

#### 6.1 Conclusions

In this paper, I explore the relationship between exchange rate and unemployment rate. Real effective exchange rate that is used to replace exchange rate and other major macroeconomic variables are added in the model as independent variables. The results present that higher real effective exchange rate will lower the unemployment rate. After examining this relationship, I divide the whole group into two clusters by introducing re-exports in the model which is a dummy variable so as to see the different influences on unemployment rate for two clusters. The conclusion is that real effective exchange rate has a less negative effect on unemployment rate in re-exporting countries compared with non-re-exporting countries, this difference is big but the results from non-re-exporting countries are not statistically significant. The results are not very statistically significant but economically significant.

#### 6.2. Further Discussions

I want to use share of imports (%GDP) as a variable to replace elasticity of demand for imports. Indeed, in my opinion, the share of imports (%GDP) maybe correlated positively with the elasticity of demand for imports in a country.<sup>12</sup> However, this selecting method is not precise and scientific. In fact, imports share (%GDP) cannot explain the elasticity. For instance, we regard a country as a person. He just needs to

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<sup>12</sup> If imports take a big share of a country's GDP, it may show this country really needs imports in some degree.

spend little money to buy foods because the relatively cheap price and fixed little demand for foods. Hence, the share of consuming foods of income (%income) is not very high. However, foods are definitely inelastic demand for him because he has to purchase fixed little foods although price of foods becomes expensive. Therefore, the low share of foods (%income) cannot show the strong elasticity of demand for foods. Similarity, the low share of imports cannot show the strong elasticity of demands for imports. If we are intended for a more authorized result, we need to know how the price of imports affect the quantity to which is the method to get the elasticity.

## APPENDICES

## APPENDIX A

### Tables

| Year | Total<br>China Exports<br>(billions US\$) | Re-Export<br>Share of Total<br>China Exports | Outward Processing Share of China |                         |                  | Foreign-Invested Enterprise Share of China |                         |                  |
|------|---|--|-----------------------------------|-------------------------|------------------|--|-------------------------|------------------|
|      | (1)                                       | (2)  | Direct<br>Exports                 | Exports to<br>Hong Kong | Total<br>Exports | Direct<br>Exports                          | Exports to<br>Hong Kong | Total<br>Exports |
|      | (1)                                       | (2)  | (3)                               | (4)                     | (5)              | (6)  | (7)                     | (8)              |
| 88   | 38.7                                      | 43.1   | 12.8                              | 49.7                    | 32.1             | 1.2  | 8.5                     | 4.7              |
| 89   | 46.3                                      | 51.5   | 19.7                              | 56.9                    | 40.3             | 3.1  | 13.4                    | 8.3              |
| 90   | 55.4                                      | 55.2   | 21.9                              | 58.5                    | 43.4             | 4.2  | 16.7                    | 10.9             |
| 91   | 67.8                                      | 59.1   | 24.9                              | 61.5                    | 47.1             | 6.5  | 19.1                    | 13.5             |
| 92   | 84.7                                      | 60.1   | 24.8                              | 63.1                    | 47.9             | 8.6  | 20.8                    | 15.2             |
| 93   | 98.0                                      | 61.3   | 24.4                              | 67.2                    | 49.4             | 17.8                                       | 35.1                    | 27.1             |
| 94   | 120.2                                     | 57.7   | 27.4                              | 62.1                    | 47.7             | 19.8                                       | 35.2                    | 28.5             |
| 95   | 151.6                                     | 53.3   | 32.7                              | 65.8                    | 50.1             | 21.9                                       | 40.6                    | 31.3             |
| 96   | 161.0                                     | 49.8   | 38.1                              | 76.0                    | 54.3             | 31.3                                       | 49.8                    | 39.0             |
| 97   | 181.3                                     | 46.9   | 39.6                              | 69.9                    | 52.7             | 33.3                                       | 47.1                    | 39.1             |
| 98   | 177.7                                     | 45.4   | 40.7                              | 73.8                    | 54.7             | 36.4                                       | 49.7                    | 41.9             |

*Notes:* Column (1) shows total China exports (direct exports plus re-exports through Hong Kong) in billions of current U.S. dollars; column (2) shows Chinese re-exports through Hong Kong as a share of total Chinese exports; columns (3)-(5) shows the share of exports related to outward processing in direct Chinese exports to countries other than Hong Kong, Chinese exports to Hong, and total Chinese exports; and columns (6)-(8) show the share of exports by foreign-invested enterprises in direct Chinese exports, Chinese exports to Hong Kong, and total Chinese exports.

Table 1.1: Direct Exports and Re-exports of Chinese Goods, 1988-1998.

| The Netherlands |              | Singapore |              | Belgium |              | Hong Kong |              | Germany |              | USA  |              |
|-----------------|--------------|-----------|--------------|---------|--------------|-----------|--------------|---------|--------------|------|--------------|
| year            | Trade Volume | year      | Trade Volume | year    | Trade Volume | year      | Trade Volume | year    | Trade Volume | year | Trade Volume |
| 1994            | 107.94       | 1994      | 318.18       | 1994    | 123.36       | 1994      | 266.73       | 1994    | 45.34        | 1994 | 21.94        |
| 1995            | 113.05       | 1995      | 349.26       | 1995    | 126.78       | 1995      | 290.35       | 1995    | 46.89        | 1995 | 23.36        |
| 1996            | 113.98       | 1996      | 340.33       | 1996    | 128.11       | 1996      | 274.21       | 1996    | 48.65        | 1996 | 23.63        |
| 1997            | 120.96       | 1997      | 328.41       | 1997    | 135.82       | 1997      | 262.02       | 1997    | 53.51        | 1997 | 24.35        |
| 1998            | 120.45       | 1998      | 316.36       | 1998    | 135.60       | 1998      | 248.00       | 1998    | 55.79        | 1998 | 23.68        |
| 1999            | 121.87       | 1999      | 343.08       | 1999    | 135.75       | 1999      | 248.88       | 1999    | 57.93        | 1999 | 24.09        |
| 2000            | 134.62       | 2000      | 371.82       | 2000    | 153.36       | 2000      | 279.12       | 2000    | 66.46        | 2000 | 25.95        |
| 2001            | 128.77       | 2001      | 360.09       | 2001    | 152.06       | 2001      | 269.55       | 2001    | 67.60        | 2001 | 23.71        |
| 2002            | 121.79       | 2002      | 360.06       | 2002    | 147.65       | 2002      | 286.57       | 2002    | 66.84        | 2002 | 22.98        |
| 2003            | 119.73       | 2003      | 386.97       | 2003    | 142.46       | 2003      | 327.17       | 2003    | 67.52        | 2003 | 23.32        |
| 2004            | 125.41       | 2004      | 412.87       | 2004    | 146.96       | 2004      | 364.60       | 2004    | 72.05        | 2004 | 25.25        |
| 2005            | 130.72       | 2005      | 429.94       | 2005    | 153.42       | 2005      | 377.09       | 2005    | 77.42        | 2005 | 26.53        |
| 2006            | 137.93       | 2006      | 437.39       | 2006    | 157.72       | 2006      | 392.44       | 2006    | 85.41        | 2006 | 27.87        |
| 2007            | 140.17       | 2007      | 404.70       | 2007    | 161.25       | 2007      | 396.77       | 2007    | 87.33        | 2007 | 28.91        |
| 2008            | 144.24       | 2008      | 460.47       | 2008    | 169.01       | 2008      | 407.38       | 2008    | 90.01        | 2008 | 30.97        |
| 2009            | 130.14       | 2009      | 421.57       | 2009    | 142.84       | 2009      | 374.32       | 2009    | 79.85        | 2009 | 25.64        |

Table 1.2: Trade volume (Net Exports+Imports) for re-exporting countries, The Netherlands, Singapore, Belgium, Hong Kong, Germany and USA from 1994 to 2009.

|  | Unemployment<br>Rate | Unemployment<br>Rate | Unemployment<br>Rate | Unemployment<br>Rate |
|--|----------------------|----------------------|----------------------|----------------------|
| Log Real<br>Effective<br>Exchange Rate | -2.967*              | -4.593***            | -4.446***            | -4.366**             |
|  | (-1.201)             | (-1.095)             | (1.069)              | (1.074)              |
| Inflation Rate                         |                      | -0.244**             | -0.268***            | -0.229***            |
|  |                      | (0.0784)             | (0.0765)             | (-0.0674)            |
| GDP Growth<br>Rate                     |                      |                      | 0.067                | 0.063                |
|  |                      |                      | (0.0571)             | (0.0429)             |
| Interest Rate                          |                      |                      |                      | -0.0164              |
|  |                      |                      |                      | (0.00672)            |
| _cons                                  | 20.42***             | 28.54***             | 27.70***             | 27.46***             |
|  | (5.344)              | (4.792)              | (4.711)              | (4.724)              |
| F                                      | 34.5                 | 37.4                 | 38.76                | 35.48                |
| N                                      | 256                  | 256                  | 256                  | 256                  |
| adj. R-sq                              | 0.644                | 0.694                | 0.701                | 0.706                |
| =** p<0.05                             | ** p<0.01            | *** p<0.001"         |                      |                      |

Table 1.3. Estimation Results for 16 Countries.

| Variable | Obs | Mean     | Std. Dev. | Min       | Max      |
|----------|-----|----------|-----------|-----------|----------|
| UEM      | 256 | 5.190625 | 2.126217  | 1.014     | 10.885   |
| INF      | 256 | 2.605781 | 2.748723  | -4.022988 | 20.99354 |
| GDP      | 256 | 7.467356 | 18.15273  | -8.007858 | 97.08562 |
| INR      | 256 | 5.852347 | 11.06719  | -5.81162  | 105.6275 |
| logREX   | 256 | 4.61064  | .1783341  | 3.974168  | 5.065308 |
| year     | 256 | 2001.5   | 4.618802  | 1994      | 2009     |

Table 1.4: Summary for 16 countries.

|                                  | Unemployment Rate | Unemployment Rate | Unemployment Rate |
|----------------------------------|-------------------|-------------------|-------------------|
| Log Real Effective Exchange Rate | -2.577*           | -4.646***         | -4.453***         |
|                                  | (1.094)           | (1.009)           | (0.971)           |
| Inflation Rate                   |                   | -0.316***         | -0.329***         |
|                                  |                   | (0.0783)          | (0.0751)          |
| GDP Growth Rate                  |                   |                   | 0.0473            |
|                                  |                   |                   | (0.0551)          |
| _cons                            | 18.71***          | 29.06***          | 28.06***          |
|                                  | (4.869)           | (4.46)            | (4.337)           |
| F                                | 42.96             | 50.8              | 52.09             |
| N                                | 400               | 400               | 400               |
| adj. R-sq                        | 0.661             | 0.711             | 0.713             |
| * p<0.05                         | ** p<0.01         | *** p<0.001"      |                   |

Table 1.5: Estimation Results for 25 Countries but do not add interest rate.

| Variable | Obs | Mean     | Std. Dev. | Min       | Max      |
|----------|-----|----------|-----------|-----------|----------|
| UEM      | 400 | 5.629193 | 2.408783  | 1.014     | 14.7     |
| INF      | 400 | 2.548966 | 2.420336  | -4.479938 | 20.99354 |
| GDPR     | 400 | 5.842941 | 14.77274  | -8.007858 | 97.08562 |
| logREX   | 400 | 4.604981 | .1519792  | 3.974168  | 5.065308 |
| year     | 400 | 2001.5   | 4.615545  | 1994      | 2009     |

Table 1.6: Summary for 25 countries.

|   | Unemployment Rate |
|---|-------------------|
| Log Real Effective Exchange Rate                | -2.964*           |
|   | (1.327)           |
| Re-exports*<br>Log Real Effective Exchange Rate | 1.899             |
|   | (2.096)           |
| _cons   | 20.39***          |
|   | (5.877)           |
| F   | 42.75             |
| N   | 400               |
| adj. R-sq                                       | 0.660             |

Table 1.7: Estimation Results for 16 Countries (regress log real effective exchange rate and Re-export\* log real effective exchange rate).

| Variable  | Obs        | Mean            | Std. Dev.       | Min             | Max             |
|-----------|------------|-----------------|-----------------|-----------------|-----------------|
| UEM       | <b>400</b> | <b>5.629193</b> | <b>2.408783</b> | <b>1.014</b>    | <b>14.7</b>     |
| logREX    | <b>400</b> | <b>4.604981</b> | <b>.1519792</b> | <b>3.974168</b> | <b>5.065308</b> |
| RE_logREX | <b>400</b> | <b>1.119563</b> | <b>1.995536</b> | <b>0</b>        | <b>5.065308</b> |

Table 1.8: Summary for 16 countries.

|                                  | Unemployment Rate | Unemployment Rate | Unemployment Rate | Unemployment Rate |
|----------------------------------|-------------------|-------------------|-------------------|-------------------|
| Log Real Effective Exchange Rate | -3.078            | -4.265**          | -4.229**          | -4.156**          |
|                                  | (1.647)           | (1.456)           | (1.422)           | (1.424)           |
| Inflation Rate                   |                   | -0.162*           | -0.211*           | -0.206**          |
|                                  |                   | (0.08)            | (0.0845)          | (0.0862)          |
| GDP Growth Rate                  |                   |                   | 0.0932            | 0.0848            |
|                                  |                   |                   | (0.0594)          | (0.060)           |
| Interest Rate                    |                   |                   |                   | -0.0181***        |
|                                  |                   |                   |                   | (0.00535)         |
| _cons                            | 21.30**           | 27.12***          | 26.79***          | 26.58***          |
|                                  | (7.324)           | (6.393)           | (6.266)           | (6.270)           |
| F                                | 27.42             | 26.24             | 26.97             | 25.29             |
| N                                | 176               | 176               | 176               | 176               |
| adj. R-sq                        | 0.616             | 0.639             | 0.657             | 0.667             |
| ** p<0.05                        | ** p<0.01         | *** p<0.001"      |                   |                   |

Table 1.9: Estimation Results for 11 Non-re-exporting Countries

| Variable | Obs | Mean     | Std. Dev. | Min       | Max      |
|----------|-----|----------|-----------|-----------|----------|
| UEM      | 176 | 5.234994 | 2.076077  | 1.014     | 10.885   |
| INF      | 176 | 2.907475 | 2.94168   | -1.346719 | 20.99354 |
| INR      | 176 | 6.218999 | 13.18236  | -5.81162  | 105.6275 |
| GDPR     | 176 | 9.399684 | 21.53132  | -8.007858 | 97.08562 |
| logREX   | 176 | 4.586469 | .1943261  | 3.974168  | 5.037694 |

Table 2.0: Summary for 11 countries

|  | Unemployment<br>Rate | Unemployment<br>Rate | Unemployment<br>Rate | Unemployment<br>Rate |
|--|----------------------|----------------------|----------------------|----------------------|
| Log Real<br>Effective<br>Exchange Rate | -0.103               | -1.925               | -2.994*              | -3.051*              |
|  | (1.616)              | (1.283)              | (1.37)               | (1.348)              |
| Inflation Rate                         |                      | -0.471***            | -0.490***            | -0.452***            |
|  |                      | (0.0605)             | (0.0552)             | (0.0785)             |
| GDP Growth<br>Rate                     |                      |                      | -0.131*              | -0.117               |
|  |                      |                      | (0.0573)             | (0.0591)             |
| Interest Rate                          |                      |                      |                      | 0.0515               |
|  |                      |                      |                      | (0.0641)             |
| _cons                                  | 8.837                | 19.05**              | 24.57***             | 24.34***             |
|  | (7.501)              | (5.966)              | (6.502)              | (6.492)              |
| F                                      | 19.16                | 30.82                | 36.89                | 32.58                |
| N                                      | 80                   | 80                   | 80                   | 80                   |
| adj. R-sq                              | 0.679                | 0.848                | 0.859                | 0.859                |
| =** p<0.05                             | ** p<0.01            | *** p<0.001"         |                      |                      |

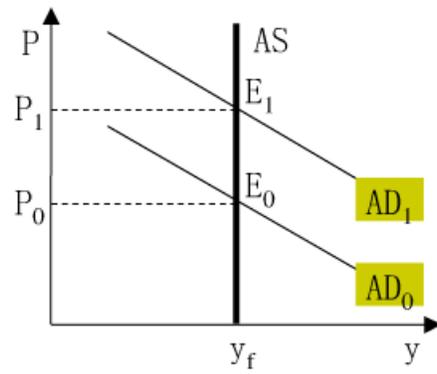
Table 2.1: Estimation Results for 5 Re-exporting Countries

| Variable | Obs | Mean     | Std. Dev. | Min       | Max      |
|----------|-----|----------|-----------|-----------|----------|
| UEM      | 80  | 5.093012 | 2.242931  | 1.425     | 9.8      |
| INF      | 80  | 1.942055 | 2.137742  | -4.022988 | 9.068924 |
| INR      | 80  | 5.045712 | 3.074656  | -.7855397 | 14.10345 |
| GDPR     | 80  | 3.216235 | 3.173222  | -5.882614 | 10.57506 |
| logREX   | 80  | 4.663817 | .1218147  | 4.496749  | 5.065308 |

Table 2.2: Summary for 5 countries

## APPENDIX B

### Figures



Figures 1.1

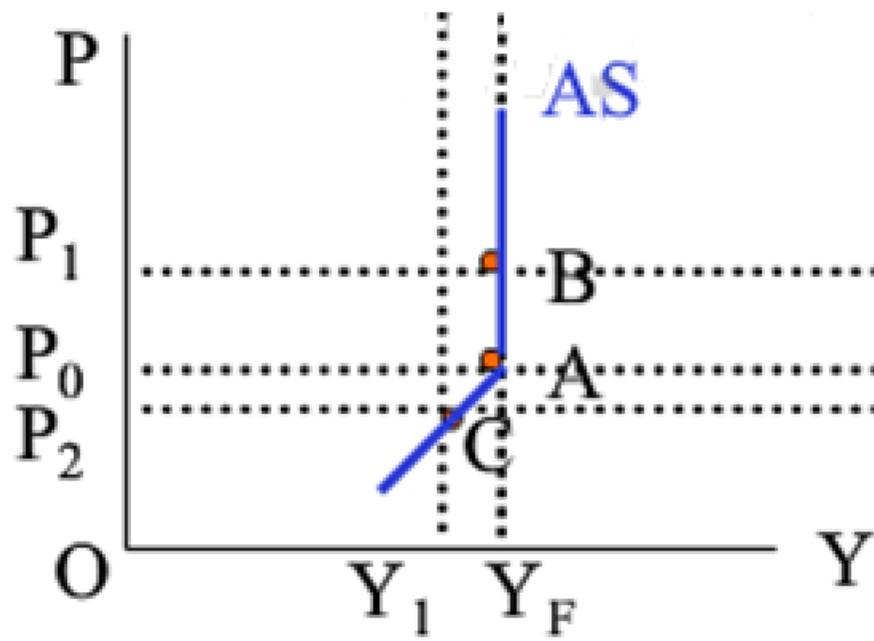


Figure 1.2

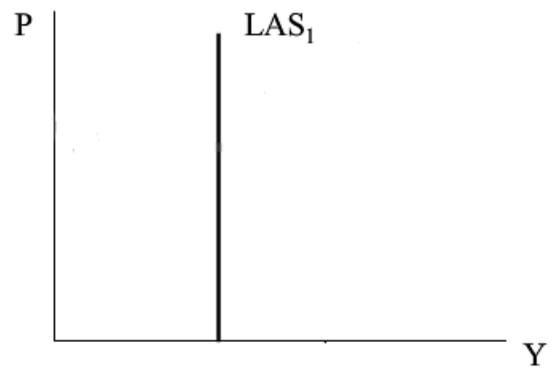


Figure 1.3

## Appendix C

### Computation of Chow Test Statistics

Chow Test Statistics are used in the thesis in order to see re-exports is a reliable dummy variable to divide the whole data. There are two methods to calculate the Chow Test Statistics. The one I used is that regress each of the models and calculate by hand.

The formula for Chow Test is

$$\frac{\text{ess}_c - (\text{ess}_1 + \text{ess}_2)}{k} \div \frac{\text{ess}_1 + \text{ess}_2}{N_1 + N_2 - 2 \cdot k}$$

I run the pooled regression and two separate regressions, and then got three results Table A1, Table A2 and Table A3 by using the 16 countries data.

By eyeballing those three tables, I know  $\text{ess}_c$  is 877.87 which is the error sum of squares of the pooled regression.  $\text{Ess}_1$  is 480.26 which is the error sum of squares of separate regression 1 as well as  $\text{ess}_2$  is 229.22.  $K$  is 20 that is the number of estimated parameters.  $N_1$  and  $N_2$  are 176 and 80 which are the number of observations in groups.

After the calculation, the numerator is 8.42 and the denominator is 3.28. The final result is 2.57. Therefore, the F statistic is 2.57. The critical F-value is 1.97 at 1%

significant level. (Table A4) We conclude that the pooled function is an inadequate specification and we should run separate regressions for the two types of countries.<sup>13</sup>

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<sup>13</sup> William Gould and Christopher Dougherty present how to use Chow Test.

| Source   | SS         | df  | MS         |
|----------|------------|-----|------------|
| Model    | 274.933869 | 19  | 14.4702036 |
| Residual | 877.870065 | 236 | 3.71978841 |
| Total    | 1152.80393 | 255 | 4.52079974 |

Number of obs = 256  
F( 19, 236) = 3.89  
Prob > F = 0.0000  
R-squared = 0.2385  
Adj R-squared = 0.1772  
Root MSE = 1.9287

Table A1: Estimation Results for 16 Countries

| Source   | SS         | df  | MS         |
|----------|------------|-----|------------|
| Model    | 274.004593 | 19  | 14.4212944 |
| Residual | 480.262263 | 156 | 3.07860425 |
| Total    | 754.266856 | 175 | 4.31009632 |

Number of obs = 176  
F( 19, 156) = 4.68  
Prob > F = 0.0000  
R-squared = 0.3633  
Adj R-squared = 0.2857  
Root MSE = 1.7546

Table A2: Estimation Results for 11 Non-re-exporting Countries

| Source   | SS         | df | MS         |
|----------|------------|----|------------|
| Model    | 168.205393 | 19 | 8.85291541 |
| Residual | 229.222949 | 60 | 3.82038249 |
| Total    | 397.428342 | 79 | 5.03073851 |

Number of obs = 80  
F( 19, 60) = 2.32  
Prob > F = 0.0071  
R-squared = 0.4232  
Adj R-squared = 0.2406  
Root MSE = 1.9546

Table A3: Estimation Results for 5 Re-exporting Countries

Degrees of freedom 1:  ?

Degrees of freedom 2:  ?

Probability level:  ?

Critical F-value: 1.96555755

Table A4: Critical Value of F (21,213)

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