Exchange Rate Risk and the Trade Pattern of Agri-food:

Evidence from China and Canada

by

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Abstract

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The purpose of this study is to determine whether real exchange rate between China and Canada has a significant effect on the agri-food sector of China value. Co-integration analysis is the key method used in analysis this issue. This paper examines a sample of 100 from January 2005 to April 2013. The research shows there are relationship among export, import and real exchange rate when tested statistically. It is proved that with the moving of the exchange rate, the volume of export and import will move a lot in the same direction with each other but opposite direction with the exchange rate in the long run. On the contrary, when the exchange rate moves in the short run, the export and import will moves a little in the same direction.

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CHAPTER 1

INTRODUCTION

Agriculture is a vital industry in China and supported by over 300 million farmers. China has the largest farm output all over the world, mainly producing rice, wheat, potatoes, sorghum, peanuts, tea, millet, barley, cotton, oilseed, pork, and fish. China has a long farming history and its agriculture development can be due to 7500 BC and played a key role in the worldwide agriculture developing. Jared Diamond (1999) estimated that the earliest attested domestication of rice took place in China by 7500 BC.

China is an important partner of agri-food trade of Canada. However, unlike the United States and Mexico, China does not have a Free Trade Agreement (FTA) with Canada. Therefore, China does not enjoy the benefits of FTA as mentioned by the World Bank in 2012. Not allowed to free entering or leaving, the international trade market for China-Canada will not approach the condition of regional perfect completion. In addition, they cannot move the disadvantages by market enlargement (World Bank, 2012).

Exchange rate is the rate at which one currency can be exchanged for another. It is the most important price index in a country’s international economic activity and plays a significant role in pricing international trade activities.

Due to the growing volume of China's exports and imports, the effects of exchange rate fluctuations on agriculture are obvious. This issue was first put forward by Schuh (1974). Schuh asserted that exchange rates have big influence on the prices received from output and prices paid for inputs. Kost (1976) and Chambers and Just (1982) also found some evidence on the impacts of exchange rate volatility on U.S's exports and domestic commodities.

1.1 Background

In the early 1970s, there was a belief that the floating exchange rate system was a proper method to prevent exchange rate misalignments. With the increase in the volatility of nominal exchange rates, the notion of floating exchange rate has not adequately been reflected in the economic fundamentals that link countries, especially, in the short-run (Frankel, 1991). Bazdrech (2002) asserted that the deviation of nominal exchange rates was persistent and substantial; however, the issue of misalignment was hard to assuage and the obvious increases in rise and fall, sometimes also lead to extra problems. Moreover, it is believed that nominal exchange rate deviation should be substantial and persistent on the view of monetary fundamentals (Bazdrech, 2002). Since the Economic Reform in China took place in the late 1970s, the volume and value of trade have grown dramatically through exports and imports.

It is recognized that China's Reform and Open up is the turning point of the China's economy. After that, the exports and imports between China and Canada have raised on kinds, quantities and value. The data from China's National Bureau of Statistics (CNBS) showed that the total amount of China-Canada exports and imports in 2004 is almost five times larger than that of 1994 and has risen from 3,245,720,000 U.S dollars (USD) to 15,514,170,000 USD. Along with it, China’s agriculture products exports have increased steadily.

However, with the raising volume of imports and exports, the exchange rate of Chinese Yuan (CNY) is falling. The data from Wharton Research Data Service (WRDS) pointed out that the highest exchange rate between Chinese Yuan and Canadian Dollar (CNY/CAD) was 1.5377/1 in 1982. From 1982, the exchange rate of CNY has devaluated almost 0.5 CNY annually until reached a high peak of 6.3272/1 in 1994. After that, the exchange rate fluctuates from 5/1 to 7/1 until now and met the top of 7.1050/1 in 2007. The devaluation of the CNY is regarded as a double-edged sword. For one side, it brings benefits on exportation. But on the other, customers will suffer huge loss on importation.

1.2 Objectives of the Study

This study is designed to achieve the following objectives, among others:

1. To set up an analytical framework to analyze the impacts of volatility in exchange rate risk and its fluctuation on the China-Canada agri-food trade paying based on the commodity specific institutional features.

2. To identify the exchange rate movements in both long-run and short-run and how the changes effect the China-Canada agri-food trade. Use Co-integration Analysis to examine the long-term impacts of exchange rate fluctuation on trade and Error Correction Model (ECM) to examine the short-term fluctuation.

3. To find whether the real exchange rate risk would have affected the volume of the China-Canada agri-food trade patterns adversely with some certain volatility measures.

1.3 Research Hypotheses

To accomplish the above objectives, the following hypothesis was set in null form and was tested in this study:

1. The variations of exchange rate risk between China and Canada have an insignificant impact on the China-Canada agri-food trade patterns in the long run.

2. The variations of exchange rate risk between China and Canada have an insignificant effect on the China-Canada agri-food trade patterns in the short-run.

3. The variations of exchange rate risk between China and Canada have an insignificant effect on the volume of the China-Canada agri-food trade patterns in the long-run.

4. The variations of exchange rate risk between China and Canada have an insignificant effect on the volume of the China-Canada agri-food trade patterns in the short-run.

5. The coefficients of foreign exchange rate risk and foreign price is equal (i.e., it is not appropriate to use exchange rate as a separate variable in the trade model).

CHAPTER 2

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

Elastic analysis is the most influential theory of correlation theoretical study between exchange rate movement and international trade balance payments. "Marshall - Lerner condition", and "J curve effect" are the two most popular theoretical perspectives. Their common theoretical contribution is clarified whether the internal mechanism of the country's trade balance payments would be improved under the condition of currency depreciation. "Marshall - Lerner condition" means that under the condition of elasticity of a country's import and export commodities supply tends to infinity, if the sum of price elasticity of exports and imports (in absolute value) must be greater than 1, then the international trade balance payments can be improved through the country's foreign currency devaluation (Davidson, 2009). J curve effect emphasizes there is "time lag" when currencies devaluation improves the country's trade balance of payments and points out that at the beginning of the devaluation, the country's trade balance situation will not be improved, on the contrary, it will become worsen instead. Only after a time period---- "time lag", the country's import and export scale changes would tend to change and move the trade balance of payments to be better. Then the goal of currency will reach (Hacker and Hatemi, 2004).

2.2 Marshall - Lerner condition

The Marshall–Lerner condition (after Alfred Marshall and Abba P. Lerner), has been proved that the balance of international trade would not been improved immediately when the value of the currency decreases, which has regarded as a technical (Davidson, 2009). In directly views, if the domestic currency depreciates, which means that comparing with the cost of domestic goods, the cost of foreign goods go up relatively. So the customers will consume more domestic commodities instead of import goods. Meanwhile, on the contrary, the consumers on the other side will buy more of imports because the price of the commodities is relative low for them. That is why a positive quantity effect on the balance of trade. But there will be a negative cost effect to offset the balance of trade payments, as customers domestic will spend more money on buying some necessary foreign goods. Davidson (2009) said whether the net effect on the trade balance is positive or negative depends on whether or not the quantity effect outweighs the cost effect; if the quantity effect is greater, then Marshall–Lerner condition is met. Essentially, the Marshall–Lerner condition is an extension of Marshall's theory of the price elasticity of demand to foreign trade (Davidson, 2009).

In form, to some extent, if the sum of absolute value of price elasticity of exports and imports must be greater than1, there will be a positive impact on trade balance when currency devaluates. The trade balance of net effect will be decided by price elasticity. “If goods exported are elastic to price, their quantity demanded will increase proportionately more than the decrease in price, and total export revenue will increase. Similarly, if goods imported are elastic, total import expenditure will decrease” commented by Davidson. Then the trade balance payments will be updated on both sides (Davidson, 2009).

However, in fact, in short period, it has been discovered that merchandise trade turns to be inelastic, because expenditure model and trading compact need time to adjust (Bahmani-Oskoee and Ratha, 2004). So it is hard to reach the Marshall–Lerner condition and the trade balance may deteriorate at first. New prices and trade balance will be adjusted to a better position in the long run, which is named as J-curve effect (Davidson, 2009).

2.3 J-curve Effect Theory

J-curve, in economics, is the concept explains a tendency of the trade balance under a certain set of assumptions when the currency depreciates or devaluates. The notion of currency devaluation refers to more expensive importation supposing there are quickly changes on the quantity of importation and exportation. Therefore, the deficit will be larger and the surplus will be smaller. Later, on the other aspect, lower prices to foreign consumers mean more competition and the export volume will raise partly, comparing with the lower purchasing desire of costlier imports for domestic buyers. Finally, as supposed as above, the trade balance may improve on what it was before the devaluation and vice versus. The only difference is that the J-curve tends to be inverted (Hacker and Hatemi-J, 2004).

After the currency depreciation or devaluation, as the pre-existing trade contracts need to follow, there will not be large changes on importation and exportation. In addition, in the short term, demand of costlier imports appears as price inelastic since consumers cannot find the proper substitute in time (Hacker and Hatemi-J, 2004).

However, during a longer period, currency depreciation may have an expectation on improving the current account balance. Domestic buyers might transform their purchasing to domestic merchandises instead of costly importation if substitute exists. Similarly, lots of foreign buyers may tend to exported products from other countries, which are relatively less expensive in the foreign currency, not the goods or services in their own country (Hacker and Hatemi-J, 2004).

“Empirical investigations of the J-curve have sometimes focused on the effect of exchange rate changes on the trade ratio, i.e. exports divided by imports, rather than the trade balance, exports minus imports. Unlike the trade balance, the trade ratio can be logged regardless of whether a trade deficit or trade surplus exists” Hacker and Hatemi-J showed in 2004.

2.4 Literature Review on Exchange Rate Movements Influence the Trade Balance

For the study of exchange rate movements influence the trade balance, there are many related research scholars at home and abroad, which formed a certain theory as well. Such early study of dynamic adjustment process has accumulated a large number of literatures all over the world and most of the researches mainly focus on whether it meets the Marshall - Lerner condition or not, but cannot reach a same conclusion.

2.4.1 Support for Marshall - Lerner Condition

Himarios's research in 1989 studied the historical data of 1953-1973 and 1975-1984, involving 27 countries and 60 devaluation episodes. His research support the traditional view and proved the devaluation, in some extent, would affect the actual structure and the actual variable in economy and then improved the international trade balance payments (Himarios, 1989).

In 1985, Bahmani-Oskooee studied the statistical relationship between devaluation and the trade balance of four less developed countries---- Greece, India, Korea, and Thailand from 1973 to 1980. He explored all possible cases of exchange rate on Almon lag structures. Empirical results support the validity of the J-curve phenomenon. However, in relatively weak financial system, the closed economy, long-term and serious trade deficit or a higher import rigid demand will also make the change in the exchange rate of the J curve effect weakened or deformed (Bahmani-Oskooee, 1985).

Rawlins (2010) examined the relationship between the trade balance and the real exchange rate in two regions of the western hemisphere: Central America and the Caribbean. It contains the data from 12 countries in that the areas and focused on the US, Britain, France and Japan. The study examined the whether there existed a long steady relationship on income levels and the trade balance if two sides of the currencies devalued using OLS and the Fisher-Johansen Panel Co-integration technique. The strong conclusion showed the trade balance of a nation can be improved by changing the real exchange rate (Rawlins, 2010).

Bahmani-Oskooee and Alse reexamined the statistics from 19 developed countries and 22 less-developed countries and detect the relationship from trade balance to real effective exchange rate, in which the co-integration approach was applied to evaluate quarterly from 1971 to 1990 in the long run. In fact, only 6 countries out of 20 can be applied ones indicated that co-integration existed between trade balance and the real effective exchange rate. They were proved nonco-integrated in most cases, displaying there are not some effective improving on trade balance if currency devaluates in the long run. However, in the successful countries, co-integration was proved, error-correction model was assessed and proof supporting the J Curve effect was provided (Bahmani-Oskooee, M., & Alse, J, 1994).

2.4.2 Objective Opinions of Marshall - Lerner Condition

The present research looks for co-integration to test a possible long-run dynamic relationship between the trade-weighted real exchange rate of US dollar and US real trade balance again. The length of the observation time period is from June 1973 to June 1993. It was proved that the trade-weighted real exchange value of dollar and the US real trade balance are non-stationary respectively in level of the unit root test. So there is no systematic long-run association between the two variables even if the ADF test using the flexible exchange rate (Rahman and Mustafa, 1996).

Miller in 2005 said that the changes of policy lead to increased trade surplus will change the real exchange rate, and then increase the difference between savings and investment, and then to improve the current account balance (Miller, 2005).

2.4.3 Main Views on the Influence of Exchange Rate Volatility on Trade Balance from Chinese Scholars

1. Exchange rate depreciation cannot improve the trade balance and exchange rate volatility had no significant effect on trade balance. Ren Zhaozhang and Ning Zhongzhong (2004) use the annual data on China's foreign trade balance and the real exchange rate from 1978 to 2002 to analyze their relationship and found that not only the coefficient of determination is low, but also no long-term equilibrium relationship based on the co-integration test and Granger causality test. The effect of devaluation or appreciation on China's trade balance and China's trade influencing the U.S. trade balance is very limited. So the exchange rate policy is not China's effective current account adjustment measure for the balance payments position (Ren and Ning, 2004).

2. Export flexibility is extremely close to the critical value, so the influence of it on China's trade balance is not very obvious. Chen Biaoru (1992) used the import and

export price indices and trade index from Ministry of Foreign Trade Statistics 1980-1989 to regress and gave the following results: the price elasticity of demand for imports is 0.3007 and the export price elasticity of demand is 0.7241. Sum of the price elasticity of export and import demand is 1.0248, indicating that the effect of devaluation or appreciation on improving the trade balance is negligible. When the whole economic growth rises, trade balance will be improved. According to Goldman Sachs' stduy in 2003, China's exchange rate elasticity of exports is about 0.2. It means that if the trade-weighted real effective exchange rate decreased by 1%, the quantity of China exports is expected to grow by 0.2%. Actually, the floating rate almost has no effect on the current Chinese export growth (Chen Biaoru, 1992).

3. Exchange rate depreciation can improve the trade balance. Lu Xiangqian and Dai Guoqiang (2005) used data of 1994-2003 to have empirical test. Under the long-term relationship between CNY against volatility of major world currencies weighted real exchange rate, the export exchange rate flexibility is 1.881 and import exchange rate flexibility is -1.959, which implied that the sum of the absolute value of the two is more than 3.8. Therefore, fluctuation of CNY real exchange rate has significant effects on China's export and import, confirming the Marshall - Lerner condition (Lu Xiangqian and Dai Guoqiang, 2005).

2.5 Conclusion and Innovation

From the research showing above, it is proved that all of the studies focusing on the relationship between the exchange rate and trade balance are not new enough and the frequency of the countries chosen are sometimes too high, like the United States and Japan. Additionally, the data Chinese scholar choosing is almost annual data, which makes the observations limited. That is the reason some tests are lack of persuasion.

Consequently, in this paper, monthly data is chosen from 2005, the year China had Exchange Rate System Reform, to 2013. Also, choose Canada as a new comparison. As both senior agri-food exporters, China and Canada trade more and more often and exchange rate change is more and more significant. It is necessary to find whether exchange rate will affect the trade balance.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Since almost economic statistics are counted by time, such as day, week, month and year. So all the data used should be time series. Time series analysis method was first put forward by Box and Jenkins in 1976 and now widely used in all fields of social science, especially in economic sphere. The factor of this modeling is regardless the function of other variables, based on the variation of the variable itself and the extrapolation to describe the sequence of events changing (Box and Jenkins, 1976).

For all the tests of economic statistics, the first thing to do is to test whether the variable is non-stationary or not. If the variable is non-stationary, it shows directly there is unit root in sequence. It is common to use ADF test to it. If the test results cannot refute the sequence unit root hypothesis, traditional regression analysis cannot be used directly on the non-stationary sequences. Instead should tend to co-integration test, test the co-integration of non-stationary sequence of order one and then build the Error Correction Model (VCM). Co-integration theory and Error Correction Model, not only solved the problem of stationary time series, but also taking into account how the long-term equilibrium relationship system effects the short-term fluctuations. As a result, the conclusion is more solid empirical basis.

3.2 The Model

Under the condition of not considering the influence of other variables, studies the relationship between China's agricultural exports (X) and the CNY to the Canadian dollars' real exchange rate (R). In order to eliminate heteroscedasticity in the modeling, the mathematical model in this paper adopts the exponential form to build econometric models as follows:

$$\ln Xt = c + \alpha \ln Rt + u \qquad (1)$$

lnXt is the current our country exports of agricultural products; lnRt is the current CNY real exchange rate against the CAD; α is China's agricultural exports of real exchange rate elasticity; u is random disturbance.

3.3 Test Statistics

3.3.1 Stationary Test (Unit Roots)

Since the problem of spurious regression, it is necessary to examine whether the variable is non-stationary or not. In this paper, Augmented Dickey-Fuller (ADF) Unit Roots Test has been used. Set ADF test:

$$Dy_t = \hat{\rho} y_{t-1} + \sum_{i=1}^{k} \hat{\gamma}_t Dy_{t-i} + \hat{v}_t \qquad (2)$$

$H_{0:}$ ρ=0(y_t is non-stationary), $H_{1:}$ ρ<0(y_t is stationary)

3.3.2 Co-integration Test

Engle and Granger put forward the co-integration theory and its approach in 1987, offering a new way to solve the problem of non-stationary series. While some economic variables are non-stationary series, there may be stationary relationship on linear combinations. This stationary linear combination is called co-integration equation and can be interpreted as the long-term stability between variables equilibrium relationship (Engle and Granger, 1987).

For the test, first to establish the regression equation and then test the Unit Root Test for level of residual.

$$y_t = \beta_1 x_t + u_t \qquad (3)$$

y_t is the current our country exports of agricultural products; x_t is the current CNY nominal exchange rate against the CAD

3.3.3 Error Correction Model (ECM)

Owing to Granger Theorem, if there are several co-integration exist among non-stationary variables, there must be ECM existing. ECM has two forms, one is formed of one equation and the other is formed with multiple equations. The multiple equation of error correction model is set up from the foundation of Vector Autoregression Model (VAR) and is called Vector Error Correction Model (VECM). The advantage of ECM is that there are two parameters in the model, describing the long term and short term relationship of variables in one equation. Therefore, it can explain the economic issues on both static and dynamic characteristics.

For the ECM, if y_t , x_t ~I(1) and co-integration exists,

$$Dy_t = \beta_0 Dx_t + \beta_1 ECM_{t-1} + u_t \qquad (4)$$

$ECM_t = y_t - k_0 - k_1 x_t$ is the non-stationary error; $y_t = k_0 + k_1 x_t$ shows that there are long term relationship exists between y_t and x_t ; $\beta_1 ECM_{t-1}$ is the error correction.

3.3.4 Granger Causality Test

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y.

3.4 Data Sources

In this paper, considering the different fluctuation level of China’s exchange rate (which mentioned in background) and China’s foreign exchange reform in 2005, from which China began to try some floating rate policy instead announced fixed rate. So choose the monthly data from January 2005 to April 2013, a total of 100 samples. Focusing on the international trade between China and Canada, all the exchange rate in this paper is real exchange rate and come from WRDS. The statistics on export and import are from the Canadian International Merchandise Trade Database in Statistics Canada.

CHAPTER 4

RESULTS

4.1 Stationary Test Results

To test the stationarity of time series, Unit Root Test is a serious way. There are lots of ways to test the Unit Root, in this paper, just choose the ADF test.

In general, test the ADF has three steps:

1. Test the original time series; do not choose the order difference level and whether the equation has intercept or trend and intercept.
2. Test the first order difference of original time series with choosing whether the equation has intercept.
3. Test the two order difference of original time series with choosing whether the equation has trend and intercept.

In addition, test the stationarity and co-integration, should choose the right order of the variable. So in this paper, decide the lag of variable based on the minimum value of the AIC principle.

4.1.1 Test for Unit Root in Level

The table below shows the results of the total agri-food statistics for export, import and real exchange rate. For the null hypothesis of the variable having a unit root, statistics below display that all the null hypothesis cannot be rejected when they are tested in level ----all the variables have unit root and are non-stationary.

Table 4.1 Unit Root Test Results

Variable in Level	Estimated Coefficient	Lag Length (Months)	Augmented Dickey-Fuller test statistic	
			t-Statistic	Prob.*
China-Canada EX	-0.28229	4	1.233981	0.9438
China-Canada IM	-0.30136	1	0.679257	0.8609
Real China-Canada Rate	-0.25339	4	-0.92718	0.3124

4.1.2 Test for Unit Root in First Order Difference

As the test for Unit Root directly in level failed, begin to test the Unit Root in First Order Difference. The statistics below shows that under the test of first order difference, all the null hypothesis should be rejected since the ADF statistics are larger than the critical value at significance level (1%, 5% and 10%). Series of the logarithm of Canada's agri-food exports to China, Canada's agri-food imports from China and the nominal exchange rate of CAD/CNY, all have not unit root and are stationary.

Table 4.2 Unit Root Test Results in First Order Difference

Variable in First Difference	Estimated Coefficient	Lag Length (Months)	Augmented Dickey-Fuller test statistic	
			t-Statistic	Prob.*
China-Canada EX	0.281655	3	-8.15938	0.0000
China-Canada IM	-1.30115	0	-13.2754	0.0001
Real China-Canada Rate	0.242556	1	-10.4936	0.0000

4.1.3 Test First Order Difference for Unit Root in Level

To make sure the sequence is integrate, test the first order difference for Unit Root. As the tables showing below, ADF test statistic value is less than the respective critical value of significance level (1%, 5% and 10%), the null hypothesis can be rejected. Series of the first order difference of the logarithm of Canada's agri-food exports to China, Canada's agri-food imports from China and the nominal exchange rate of CAD/CNY, all have not unit root and are stationary. So it is proved that lnex, lnim, lnrate~I(1).

Table 4.3 Test First Order Difference for Unit Root in Level

First Order Difference for Unit Root in Level	Estimated Coefficient	Lag Length (Months)	Augmented Dickey-Fuller test statistic	
			t-Statistic	Prob.*
China-Canada DEX	-1.34165	0	-13.9763	0.0000
China-Canada DIM	-1.29685	0	-13.2889	0.0000
Real China-Canada DRate	0.257314	3	-7.76676	0.0000

4.2 Co-integration Test

4.2.1 Set Regression Equation

Since lnex, lnim, lnrate~I(1), set the regression equation:

$$\text{lnex} = \beta\,\text{lnrate} + u_t\,, \qquad \text{lnim} = \beta\,\text{lnrate} + u_t$$

Table 4.4 Regression Equation of Export and Rate

Dependent Variable: EX
Method: Least Squares
Date: 08/15/13 Time: 02:56
Sample: 2005M01 2013M04
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RATE	36.67801	1.758141	20.86182	0.0000

R-squared	-147.848930	Mean dependent var	18.87067
Adjusted R-squared	-147.848930	S.D. dependent var	0.669618
S.E. of regression	8.169580	Akaike info criterion	7.048662
Sum squared resid	6607.461	Schwarz criterion	7.074713
Log likelihood	-351.4331	Hannan-Quinn criter.	7.059205
Durbin-Watson stat	0.460180		

Table 4.5 Regression Equation of Import and Rate

Dependent Variable: IM
Method: Least Squares
Date: 08/15/13 Time: 03:01
Sample: 2005M01 2013M04
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RATE	37.67801	1.758141	21.43060	0.0000

R-squared	-265.403744	Mean dependent var	19.29645
Adjusted R-squared	-265.403744	S.D. dependent var	0.500529
S.E. of regression	8.169580	Akaike info criterion	7.048662
Sum squared resid	6607.461	Schwarz criterion	7.074713
Log likelihood	-351.4331	Hannan-Quinn criter.	7.059205
Durbin-Watson stat	0.460180		

From the charts above, both of the t-Statistic is greater than the critical value, which means that the coefficients can be accepted. Get:

lnex=36.67801lnrate+u_t , linim=37.67801lnrate+u_t ,

and the residual series reex and reim. The equations tell that the relationship between export and real exchange rate is positive. When real exchange rate rises 1%, the volume of the export will rise 36.678%. So does the import. When real exchange rate rises 1%, the volume of the import will rise 36.678%.

4.2.2 Test Residual for Root Test in Level

If the residual series reex and reim are stationary, it means there are co-integration among lnex, lnim and lnrate. As usual, choose ADF test to make sure whether it is stationary or not. As the tables showing below, the null hypothesis is that residual series has unit root and ADF test statistic value is less than the respective critical value of significance level (1%, 5% and 10%). So the null hypothesis can be rejected and reex and reim are stationary. So it is proved that reex, reim ~I(0) and between Jan 2005 and April 2013, lnex and lnrate co-integrate. So do lnim and lnrate.

Table 4.6 Test Residual for Root Test in Level

Test Residual for Root Test in Level	Estimated Coefficient	Lag Length (Months)	Augmented Dickey-Fuller test statistic	
			t-Statistic	Prob.*
REEX	-0.14122	1	-2.09622	0.0352
REIM	-0.14122	1	-2.09622	0.0352

4.3 Error Correction Model (ECM)

4.3.1 Set Regression Equation

Since lnex, lnim, lnrate~I(1), set the regression equation:

$$\text{lnex} = k_0 + k_1 \,\text{lnrate} + u_t , \qquad \text{lnim} = k_0 + k_1 \,\text{lnrate} + u_t$$

Table 4.7 Regression of Export and Rate

Dependent Variable: EX
Method: Least Squares
Date: 08/15/13 Time: 03:08
Sample: 2005M01 2013M04
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.28771	0.061950	327.4853	0.0000
RATE	-3.328103	0.133320	-24.96327	0.0000

R-squared	0.864109	Mean dependent var	18.87067
Adjusted R-squared	0.862722	S.D. dependent var	0.669618
S.E. of regression	0.248100	Akaike info criterion	0.069830
Sum squared resid	6.032267	Schwarz criterion	0.121933
Log likelihood	-1.491485	Hannan-Quinn criter.	0.090917
F-statistic	623.1647	Durbin-Watson stat	0.757712
Prob(F-statistic)	0.000000		

Table 4.8 Regression of Import and Rate

Dependent Variable: IM				
Method: Least Squares				
Date: 08/15/13 Time: 03:35				
Sample: 2005M01 2013M04				
Included observations: 100				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.28771	0.061950	327.4853	0.0000
RATE	-2.328103	0.133320	-17.46252	0.0000
R-squared	0.756787	Mean dependent var		19.29645
Adjusted R-squared	0.754306	S.D. dependent var		0.500529
S.E. of regression	0.248100	Akaike info criterion		0.069830
Sum squared resid	6.032267	Schwarz criterion		0.121933
Log likelihood	-1.491485	Hannan-Quinn criter.		0.090917
F-statistic	304.9395	Durbin-Watson stat		0.757712
Prob(F-statistic)	0.000000			

From the charts above, both of the t-Statistic is greater than the critical value, which means that the coefficients can be accepted. Get:

$$\text{lnex}=20.28771-3.328103\text{lnrate}+u_t, \qquad \text{lnim}=20.28771-2.328103\text{lnrate}+u_t$$

Then get the residual series reex1 and reim1. The equations tell that the relationship between export and real exchange rate is negative. When real exchange rate rises 1%, the volume of the export will fall 3.328%. So does the import. When real exchange rate rises 1%, the volume of the import will fall 3.328%.

4.3.2 Test Residual for Root Test in Level

Same as 4.2.2, test the Unit Root of the residual to make sure it is stationary. As the tables showing below, ADF test statistic value is less than the respective critical value of significance level (1%, 5% and 10%), the null hypothesis can be rejected and reex1 and reim1 are stationary. So it is proved that reex1, reim1 ~I(0) and between Jan 2005 and April 2013, lnex and lnrate co-integrate. So do lnim and lnrate.

Table 4.9 Test Residual for Root Test in Level

Test Residual for Root Test in Level	Estimated Coefficient	Lag Length (Months)	Augmented Dickey-Fuller test statistic	
			t-Statistic	Prob.*
REEX1	-0.38811	0	-4.91473	0.0000
REIM1	-0.38811	0	-4.91473	0.0000

4.3.3 Set ECM

Set:

$$\Delta\,\text{lnex} = \beta_0 + \alpha\, reex1_{t-1} + \beta_1 \Delta\,\text{lnrate} + \varepsilon_t$$

$$\Delta\,\text{lnim} = \beta_0 + \alpha\, reim1_{t-1} + \beta_1 \Delta\,\text{lnrate} + \varepsilon_t$$

Get:

$$\Delta\,\text{lnex} = 0.007138 + 0.210557\, reex1_{t-1} - 2.413948 \Delta\,\text{lnrate} + \varepsilon_t$$

$$\Delta\,\text{lnim} = 0.007138 + 0.210557\, reim1_{t-1} - 1.413948 \Delta\,\text{lnrate} + \varepsilon_t$$

Table 4.10 Error Correction of Export and Rate

Dependent Variable: DEX
Method: Least Squares
Date: 08/15/13 Time: 03:14
Sample (adjusted): 2005M02 2013M04
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007138	0.015277	0.467244	0.6414
REEX1	0.210557	0.065880	3.196081	0.0019
DRATE	-2.413948	0.113300	-21.30576	0.0000

R-squared	0.829774	Mean dependent var	0.014679
Adjusted R-squared	0.826228	S.D. dependent var	0.364488
S.E. of regression	0.151940	Akaike info criterion	-0.900823
Sum squared resid	2.216245	Schwarz criterion	-0.822183
Log likelihood	47.59071	Hannan-Quinn criter.	-0.869005
F-statistic	233.9788	Durbin-Watson stat	2.286279
Prob(F-statistic)	0.000000		

Table 4.11 Error Correction of Import and Rate

Dependent Variable: DIM
Method: Least Squares
Date: 08/15/13 Time: 03:39
Sample (adjusted): 2005M02 2013M04
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007138	0.015277	0.467244	0.6414
REIM1	0.210557	0.065880	3.196081	0.0019
DRATE	-1.413948	0.113300	-12.47966	0.0000

R-squared	0.619618	Mean dependent var	0.011859
Adjusted R-squared	0.611693	S.D. dependent var	0.243829
S.E. of regression	0.151940	Akaike info criterion	-0.900823
Sum squared resid	2.216245	Schwarz criterion	-0.822183
Log likelihood	47.59071	Hannan-Quinn criter.	-0.869005
F-statistic	78.18890	Durbin-Watson stat	2.286279
Prob(F-statistic)	0.000000		

In the long run, the change of real exchange rate has a negative effect on the export. When real exchange rate rises 1%, the volume of export will decrease 2.414%. But in the short run, the change of real exchange rate has a positive effect on the export. When real exchange rate rises 1%, in the next month, the volume of export will rise 0.211%. So does the import.

4.4 Granger Causality Test

From the study above, it is found there is co-integrated relationship between the CNY/CAD real exchange rate and the agri-food import or export. However, if there is actual causality relationship between the two. So Causality Test is needed in further step. Test lnex, lnim and lnrate for Causality Test.

Lags: 1	causality test for lnex and lnrate		
Null Hypothesis:	Obs	F-Statistic	Prob.
RATE does not Granger Cause EX	99	4.84102	0.0302
EX does not Granger Cause RATE		9.35990	0.0029

From the table above, it is found that the real exchange rate is not the reason for the change of agri-food export. In addition, the agri-food export is not the reason for the change of real exchange rate. There is no causal relationship between the two.

Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
RATE does not Granger Cause IM	99	1.44238	0.2327
IM does not Granger Cause RATE		9.35990	0.0029

From the table above, it is found that the real exchange rate is not the reason for the change of agri-food import. In addition, the agri-food import is not the reason for the change of real exchange rate. There is no causal relationship between the two.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

The purpose of this chapter is to overview all the research above and to find the advantage and disadvantage of this study, even some good suggestions.

From the results in the Chapter 4, though the Granger Causality Test shows there are not significant causality relationship among export, import and real exchange rate, it has been proved that there are really relationship between export and real exchange rate and import and real exchange rate respectively. When the exchange rate moves, the volume of export and import will move a lot in the same direction with each other but opposite direction with the exchange rate in the long run. On the contrary, if the exchange rate moves in the short run, the export and import will moves a little in the same direction.

5.2 Contributions of this Research

It is the first time to study the relationship of agri-food trade between China and Canada. The study chooses a good time period from the beginning of exchange rate reform in China. Co-integration analysis displays the effects among export, import and exchange rate in long term and Error Correction Model displays the effects in short term, which certifies the empirical contribution of the study.

5. 3 Limitations and Suggestion for Future Research

Firstly, limitation of this study is the limited observations. The monthly data chosen are just 100 and it may make the regression not properly correct. Sometimes, limited sample space could lead to wrong direction. It is better to find a proper way to increase the sample space.

Secondly, in this paper, research has just focused on the export, import and exchange rate. In addition, some other macroeconomic parameters have not been considered. International trade will be affected by lots of macroeconomic indexes, such as unemployment rate, CPI and inflation rate. In the future study, some macroeconomic indexes can be put together to do the test.

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APPENDICES 1-13

Appendices 1 Test for Unit Root in Level for China-Canada Export

Null Hypothesis: EX has a unit root
Exogenous: None
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.233981	0.9438
Test critical values:	1% level	-2.589531	
	5% level	-1.944248	
	10% level	-1.614510	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EX)
Method: Least Squares
Date: 08/14/13 Time: 15:10
Sample (adjusted): 2005M06 2013M04
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EX(-1)	0.002222	0.001800	1.233981	0.2204
D(EX(-1))	-0.497967	0.101939	-4.884941	0.0000
D(EX(-2))	-0.355855	0.109220	-3.258159	0.0016
D(EX(-3))	-0.295298	0.109164	-2.705089	0.0082
D(EX(-4))	-0.282292	0.101545	-2.779986	0.0066

R-squared	0.241754	Mean dependent var	0.016658
Adjusted R-squared	0.208055	S.D. dependent var	0.367202
S.E. of regression	0.326778	Akaike info criterion	0.652124
Sum squared resid	9.610546	Schwarz criterion	0.786539
Log likelihood	-25.97591	Hannan-Quinn criter.	0.706438
Durbin-Watson stat	2.061339		

Appendices 2 Test for Unit Root in Level for China-Canada Import

Null Hypothesis: IM has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.679257	0.8609
Test critical values:	1% level	-2.588772	
	5% level	-1.944140	
	10% level	-1.614575	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IM)
Method: Least Squares
Date: 08/14/13 Time: 15:20
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IM(-1)	0.000837	0.001233	0.679257	0.4986
D(IM(-1))	-0.301364	0.098087	-3.072422	0.0028

R-squared	0.088971	Mean dependent var	0.012724
Adjusted R-squared	0.079481	S.D. dependent var	0.244930
S.E. of regression	0.234995	Akaike info criterion	-0.038309
Sum squared resid	5.301371	Schwarz criterion	0.014446
Log likelihood	3.877127	Hannan-Quinn criter.	-0.016971
Durbin-Watson stat	2.073759		

Appendices 3 Test for Unit Root in Level for China-Canada Exchange Rate

Null Hypothesis: RATE has a unit root
Exogenous: None
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.927182	0.3124
Test critical values:	1% level	-2.589531	
	5% level	-1.944248	
	10% level	-1.614510	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RATE)
Method: Least Squares
Date: 08/14/13 Time: 15:24
Sample (adjusted): 2005M06 2013M04
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RATE(-1)	-0.025822	0.027850	-0.927182	0.3563
D(RATE(-1))	-0.536429	0.102659	-5.225330	0.0000
D(RATE(-2))	-0.338246	0.114464	-2.955047	0.0040
D(RATE(-3))	-0.213447	0.113620	-1.878604	0.0635
D(RATE(-4))	-0.253388	0.100594	-2.518919	0.0135

R-squared	0.281375	Mean dependent var	-0.003264
Adjusted R-squared	0.249437	S.D. dependent var	0.144210
S.E. of regression	0.124937	Akaike info criterion	-1.270823
Sum squared resid	1.404826	Schwarz criterion	-1.136409
Log likelihood	65.36411	Hannan-Quinn criter.	-1.216510
Durbin-Watson stat	2.051762		

Appendices 4 Test for Unit Root in First Order Difference for China-Canada Export

Null Hypothesis: D(EX) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.159384	0.0000
Test critical values:	1% level	-3.500669	
	5% level	-2.892200	
	10% level	-2.583192	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EX,2)
Method: Least Squares
Date: 08/14/13 Time: 15:13
Sample (adjusted): 2005M06 2013M04
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EX(-1))	-2.426841	0.297429	-8.159384	0.0000
D(EX(-1),2)	0.930525	0.244043	3.812950	0.0003
D(EX(-2),2)	0.575996	0.177027	3.253713	0.0016
D(EX(-3),2)	0.281655	0.101443	2.776476	0.0067
C	0.042525	0.033929	1.253339	0.2133

R-squared	0.715177	Mean dependent var	-0.003912
Adjusted R-squared	0.702518	S.D. dependent var	0.598974
S.E. of regression	0.326692	Akaike info criterion	0.651598
Sum squared resid	9.605493	Schwarz criterion	0.786013
Log likelihood	-25.95093	Hannan-Quinn criter.	0.705912
F-statistic	56.49634	Durbin-Watson stat	2.061102
Prob(F-statistic)	0.000000		

Appendices 5 Test for Unit Root in First Order Difference for China-Canada Import

Null Hypothesis: D(IM) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.27540	0.0001
Test critical values:	1% level	-3.498439	
	5% level	-2.891234	
	10% level	-2.582678	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IM,2)
Method: Least Squares
Date: 08/14/13 Time: 15:21
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IM(-1))	-1.301154	0.098012	-13.27540	0.0000
C	0.017168	0.023775	0.722102	0.4720

R-squared	0.647365	Mean dependent var	-0.002032
Adjusted R-squared	0.643692	S.D. dependent var	0.393560
S.E. of regression	0.234922	Akaike info criterion	-0.038931
Sum squared resid	5.298073	Schwarz criterion	0.013823
Log likelihood	3.907617	Hannan-Quinn criter.	-0.017593
F-statistic	176.2364	Durbin-Watson stat	2.073744
Prob(F-statistic)	0.000000		

Appendices 6 Test for Unit Root in First Order Difference for China-Canada Exchange Rate

Null Hypothesis: D(RATE) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.49363	0.0000
Test critical values:	1% level	-3.499167	
	5% level	-2.891550	
	10% level	-2.582846	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RATE,2)
Method: Least Squares
Date: 08/14/13 Time: 15:25
Sample (adjusted): 2005M04 2013M04
Included observations: 97 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RATE(-1))	-1.751958	0.166954	-10.49363	0.0000
D(RATE(-1),2)	0.242556	0.099570	2.436031	0.0167
C	-0.003650	0.013032	-0.280104	0.7800

R-squared	0.723966	Mean dependent var	0.002459
Adjusted R-squared	0.718092	S.D. dependent var	0.241504
S.E. of regression	0.128226	Akaike info criterion	-1.239598
Sum squared resid	1.545551	Schwarz criterion	-1.159968
Log likelihood	63.12050	Hannan-Quinn criter.	-1.207399
F-statistic	123.2686	Durbin-Watson stat	2.031101
Prob(F-statistic)	0.000000		

Appendices 7 Test First Order Difference for Unit Root in for China-Canada Export

Null Hypothesis: DEX has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.97631	0.0000
Test critical values:	1% level	-2.588772	
	5% level	-1.944140	
	10% level	-1.614575	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEX)
Method: Least Squares
Date: 08/14/13 Time: 17:17
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEX(-1)	-1.341649	0.095995	-13.97631	0.0000

R-squared	0.668180	Mean dependent var	-0.003429
Adjusted R-squared	0.668180	S.D. dependent var	0.598608
S.E. of regression	0.344821	Akaike info criterion	0.718570
Sum squared resid	11.53346	Schwarz criterion	0.744947
Log likelihood	-34.20994	Hannan-Quinn criter.	0.729239
Durbin-Watson stat	2.118219		

Appendices 8 Test First Order Difference for Unit Root in for China-Canada Import

Null Hypothesis: DIM has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.28885	0.0000
Test critical values:	1% level	-2.588772	
	5% level	-1.944140	
	10% level	-1.614575	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DIM)
Method: Least Squares
Date: 08/14/13 Time: 17:21
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIM(-1)	-1.296848	0.097589	-13.28885	0.0000

R-squared	0.645450	Mean dependent var	-0.002032
Adjusted R-squared	0.645450	S.D. dependent var	0.393560
S.E. of regression	0.234342	Akaike info criterion	-0.053922
Sum squared resid	5.326850	Schwarz criterion	-0.027545
Log likelihood	3.642190	Hannan-Quinn criter.	-0.043253
Durbin-Watson stat	2.069572		

Appendices 9 Test First Order Difference for Unit Root in for China-Canada Exchange Rate

Null Hypothesis: DRATE has a unit root
Exogenous: None
Lag Length: 3 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.766755	0.0000
Test critical values:	1% level	-2.589531	
	5% level	-1.944248	
	10% level	-1.614510	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DRATE)
Method: Least Squares
Date: 08/14/13 Time: 17:23
Sample (adjusted): 2005M06 2013M04
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DRATE(-1)	-2.381466	0.306623	-7.766755	0.0000
D(DRATE(-1))	0.828429	0.255922	3.237033	0.0017
D(DRATE(-2))	0.478245	0.183101	2.611920	0.0105
D(DRATE(-3))	0.257314	0.100427	2.562201	0.0120

R-squared	0.743328	Mean dependent var	0.000201
Adjusted R-squared	0.734867	S.D. dependent var	0.242450
S.E. of regression	0.124840	Akaike info criterion	-1.282370
Sum squared resid	1.418244	Schwarz criterion	-1.174838
Log likelihood	64.91255	Hannan-Quinn criter.	-1.238919
Durbin-Watson stat	2.051578		

Appendices 10 Test Residual of Regression for Unit Root in Level for Export and Rate

Null Hypothesis: REEX has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.096217	0.0352
Test critical values:	1% level	-2.588772	
	5% level	-1.944140	
	10% level	-1.614575	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REEX)
Method: Least Squares
Date: 08/15/13 Time: 03:00
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REEX(-1)	-0.141221	0.067369	-2.096217	0.0387
D(REEX(-1))	-0.328241	0.098519	-3.331763	0.0012

R-squared	0.199350	Mean dependent var	0.105483
Adjusted R-squared	0.191010	S.D. dependent var	5.596111
S.E. of regression	5.033359	Akaike info criterion	6.090249
Sum squared resid	2432.131	Schwarz criterion	6.143004
Log likelihood	-296.4222	Hannan-Quinn criter.	6.111587
Durbin-Watson stat	2.115602		

Appendices 11 Test Residual of Regression for Unit Root in Level for Import and Rate

Null Hypothesis: REIM has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.096217	0.0352
Test critical values:	1% level	-2.588772	
	5% level	-1.944140	
	10% level	-1.614575	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REIM)
Method: Least Squares
Date: 08/15/13 Time: 03:03
Sample (adjusted): 2005M03 2013M04
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REIM(-1)	-0.141221	0.067369	-2.096217	0.0387
D(REIM(-1))	-0.328241	0.098519	-3.331763	0.0012

R-squared	0.199350	Mean dependent var	0.105483
Adjusted R-squared	0.191010	S.D. dependent var	5.596111
S.E. of regression	5.033359	Akaike info criterion	6.090249
Sum squared resid	2432.131	Schwarz criterion	6.143004
Log likelihood	-296.4222	Hannan-Quinn criter.	6.111587
Durbin-Watson stat	2.115602		

Appendices 12 Test Residual of ECM Regression for Unit Root in Level for Export and Rate

Null Hypothesis: REEX1 has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.914729	0.0000
Test critical values:	1% level	-2.588530	
	5% level	-1.944105	
	10% level	-1.614596	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REEX1)
Method: Least Squares
Date: 08/15/13 Time: 03:15
Sample (adjusted): 2005M02 2013M04
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REEX1(-1)	-0.388112	0.078969	-4.914729	0.0000

R-squared	0.197250	Mean dependent var	0.005294
Adjusted R-squared	0.197250	S.D. dependent var	0.215897
S.E. of regression	0.193436	Akaike info criterion	-0.437690
Sum squared resid	3.666915	Schwarz criterion	-0.411477
Log likelihood	22.66566	Hannan-Quinn criter.	-0.427084
Durbin-Watson stat	2.278927		

Appendices 13 Test Residual of ECM Regression for Unit Root in Level for Import and Rate

Null Hypothesis: REIM1 has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.914729	0.0000
Test critical values:	1% level	-2.588530	
	5% level	-1.944105	
	10% level	-1.614596	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REIM1)
Method: Least Squares
Date: 08/15/13 Time: 03:37
Sample (adjusted): 2005M02 2013M04
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REIM1(-1)	-0.388112	0.078969	-4.914729	0.0000

R-squared	0.197250	Mean dependent var	0.005294
Adjusted R-squared	0.197250	S.D. dependent var	0.215897
S.E. of regression	0.193436	Akaike info criterion	-0.437690
Sum squared resid	3.666915	Schwarz criterion	-0.411477
Log likelihood	22.66566	Hannan-Quinn criter.	-0.427084
Durbin-Watson stat	2.278927		