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# A VECM Approach to the Financial Development, International Trade and Economic Growth in China After Economic Reform

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**Abstract**
This paper investigates the relationship between the financial development, international trade and economic growth for the People's Republic of China. Annual time series data are used from 1982 to 2014. The study employs the Johansen cointegration and the vector error correction models (VECM) to examine the causal relationship among the variables. The stationary properties of the variables and the order of integration are tested using the Phillips-Perron (PP) test. All the variables are found to be cointegrated meaning that there existence a long-run association. Johansen cointegration results show that there exist one cointegrating vector among economic growth, financial development and international trade in China. The results of VECM confirm the long-run relation to the variables. Financial development is the drivers of economic growth in short and long-run in China.
**Keywords:** Economic Growth, Financial Development, Trade, Cointegration, VECM

## 1. Introduction

The financial sector and openness of the economy are two important determinants of development economics. The financial sector depends on services to households or consumers, business and government sectors, which have a contributory role for economic growth (Rahman *et al*. 2015). When financial markets are underdeveloped then technologies are flexible (Saint-Paul, 1992). The producer who takes flexible technologies, they have no enormous risk, and there is little chance to develop their financial markets. When they developed their financial market, technology would be more efficient and positive impact on productivity. So every economy developed their financial markets, to spreading risk through financial diversification between the economic agents, would be achieve the higher level of development than the economy, which financial markets are not very developed (Habibullah & Eng, 2006). According to the prominent researchers in this field Goldsmith (1969), McKinnon (1973), Shaw (1973), Fry (1988), Jung (1986), Gupta (1984), King and Levine (1993a, 1993b), Chang (2002), Habibullah and Eng (2006), and Rahman *et al*. (2015) are among those who have provided evidence that financial development is a prerequisite for economic growth.

International trade allows a country to expand its economic growth. A country has the capacity to increase its production to increase export growth, but the factor of production is scarcity of these goods domestically so international trade gives him opportunity to import factors. Export is meet the exchange gap and increase the import. For industrialization import is a good phenomenon that increases economic growth.

International trade is promoting economic growth by allowing countries to develop its technology, explore the potential benefits of increasing returns to scale by increasing the effective market size, the goods which have comparative advantage must be specialize, and create incentives for governments to adopt more disciplined types of macroeconomic management and reform market-type institutional. In the meantime, increasing productivity and economic growth are expanding trade and integration by allowing countries to develop its infrastructures that are helpful to trade, have more resources to overcome the information search costs associated with trade or demand relatively more traded goods (Edwards, 1993 & 1998; Lee, 1995; Harrison, 1996; Frankel & Romer, 1999; Irwin & Tervio, 2002; Vamvakidis, 2002; and Kim *et al*. 2012).

Over the period of 1982 to 2014, the Chinese economy grows at around 10% annually. This is a good condition for a country to expand its export and foreign direct investment.Exports and foreign direct investment have execution this swift economic growth. The Chinese economy has been appointed success story of the export-led growth strategy, after Japan and the four Asian tigers: Hong Kong, Korea, Singapore, and Taiwan. In 1978 China has taken open door policies and experienced a tremendous growth of gross domestic product (GDP) which rose from 364.5 billion RMB Yuan in 1978 to 51,932.2 billion in 2012. The effects of the opening were not a long time coming and China emerged as the most dynamic trading nation in the world. They amounted to 75% of its GDP today. China's share of world's exports in 1978 was only 0.6%, which absolute value of 7.6 billion US$, made it thirty-second largest exporting countries worldwide. But 2013 China had become the first largest exporting nation in the world with a nominal value of US$2.2 trillion (WDI, 2015 and Morrison, 2015).

The banking system in China is transferred to market economy in the late 1980's and early 1990's. The peoples Bank, which as a central bank transfer to commercial banks to give more independence. Banking reform

 

is one important example to demonstrate the rule that institutions cannot be changed by legislation alone. Stock markets in Shanghai and Shenzhen are established in the early 1990s (Chow, 2004).

This study examines the relationship among the financial development, international trade and economic growth in the People's Republic of China during 1982 to 2014 using Johansen cointegration and vector error correction model (VECM). Chinas economic history gives an interesting territory to study for several reasons. First, China's economic growth has been remarkable. Over three decades of economic reform 1978 to 2015, the annual growth of GDP averaged 9.75%. Second, China has become the world largest exporting country with the highest volume of foreign exchange reserve estimated at US$ 431.382 billion at the end of 2014. Third, China started its open door policy in 1978, thus it has sufficient data are available for researchers to examine the effect of economic reform on the economic growth. This study targets at filling the gap in the arena devoted solely to examine the relationship among the variables such as financial development, international trade and economic growth in China.

The rest of this study is organized as follows. Section 2 presents the literature review while, methods of the study and model specification are described in section 3. This section also includes other tests such as unit root test, Johansen cointegration test, and VECM model. In section 4, the empirical results and discussions are shown. Finally, summarizes the study and concluding remarks present in section 5.

## 2. Literature Review

The relationship between financial development, international trade or openness of the economy and economic growth are important factors of analysis in economic literature. Trade openness and financial development have a relation to a substantial body of empirical research. The empirical literature is investigated in two different ways: first one separately examine the magnitude of financial development and international trade on economic growth. The second one, examine the relationship between the financial development and international trade.

Kim *et al*. (2012) investigate the interactions among economic growth, financial development, and trade openness through synchronous equation systems. These three variables are interacting each other. Banks and stock market have also impacted on economic growth. Economic growth has positive effect of financial development of trade in richer countries and negative effect of trade on financial development in poorer countries.

Chang (2002) employs multivariate VAR models for China over the period 1987Q1 to 1999Q4. GDP, financial development, and the degree of openness these three variables are cointegrated with one vector, this conclusion is indicated by Cointegration test. The results from Granger causality tests based on multivariate error-correction models (ECM) suggest independence between financial development and economic growth. This hypothesis testing result do not support demand-following or supply-leading to China. Shan and Jianhong (2006) examine the impact of financial development on economic growth in China employing the VAR model. They show that financial development comes as the second force (after the contribution to labor input) in economic growth in China.

Kar *et al*. (2013) examine the direction of causality among trade liberalization, financial development, and economic growth in Turkey using monthly data for the period January, 1989-November, 2007. Turkish economy has a strong causal relation between financial development, trade openness, and economic growth, this are ensuring by linear and nonlinear approach. These results partially imply that economic growth depends upon trade liberalization through external finance in Turkey which has been experiencing capital account liberalization since 1989.

In the developed economies, Luintel and Khan (1999) observe the finance-growth nexus in a multivariate VAR model and found a bi-directional causality between financial development and economic growth in the sample countries. In the case of India, Bhattachrya and Sivasubramanian (2003) examine the causal relationship between financial development and economic growth during 1970-71 to 1998-1999, employing unit root tests and cointegration analysis. Their results show that there exists cointegration between the two series.

Table 1 presents a summary of the literature review of selected studies regarding the finance-growth and international trade openness-growth debate. It is clear from the table that the conclusions regarding the finance-growth and trade openness-growth debate is mixed and inconclusive.

 

Table 1: Summary of Selected Studies on the Financial Development and Economic Growth Hypothesis

| Authors | Sample | Methods | Main Findings |
|---|---|---|---|
| Gokmenoglu et al. (2015) | Pakistan, 1967-2013 | Time Series Data, Cointegration & Granger Causality | The analysis confirm for a long run relationship among international trade, financial development and economic growth. |
| Menyah et al. (2014) | 21 African Countries, 1965-2008 | Panel Causality | The results imply that recent attempts at financial development and trade liberalization do not seem to have made a significant impact on growth. |
| Altantulkhuur (2014) | Mongolia, 1995-2012 | Granger causality under VAR Approach | Significant causal relationship from financial development to economic growth in a case of Mongolia. |
| Asghar & Hussain (2014) | 15 Developing Countries, 1978-2012 | Panel Cointegration | Their findings show that there are strong evidences of the long-run relationship between financial development and economic growth in developing countries. |
| Al-Yousif (2002) | 30 Developing Countries, 1970-1999 | Time Series & Panel Causality | The empirical results strongly support the existence of bi-directional causality between financial development and economic growth. |
| Lensink (2001) | Developing & Developed Countries, 1970-1998 | Cross-country growth regression | The impact of policy uncertainty on economic growth depends on the development of the financial sector. |
| Shan & Jianhong (2006) | China, 1978-2001 | VAR Approach | They find that financial development comes as the second force in leading economic growth in China. |
| Memon et al. (2011) | SAARC Countries, 1980-2009 | Regression | Financial development through the channel of financial liberalization affects economic growth significantly in SAARC countries. |
| Kiran et al. (2009) | 10 Emerging Countries, 1968-2007 | Panel Unit Root Tests & Pedroni's Cointegration Technique | Financial development has a positive and statistically significant impact on economic growth. |
| Levine et al. (2000) | 77 Countries, 1960-1995 | Panel Cointegration Technique | Strong positive relationship between financial development and output growth can be partly explained by the impact of the exogenous components like financial development on economic growth. |
| Choong et al. (2005) | Malaysia 1978-2000 | Granger Causality within VECM Model | Result reveals that stock market development Granger-causes economic growth. |
| Chang & Caudill (2005). | Taiwan 1962-1998 | Granger Causality based on VECM Model | Unidirectional causality running from financial development (measured as the ratio of M2 to GDP) to economic growth. |
| Habibullah & Eng (2006) | 13 Asian Developing Countries, 1990-1998 | Panel Data, GMM Technique | Their studies show that financial development promotes growth. |
| Dritsakis & Adamopoulos (2004) | Greece 1960-2000 | Granger Causality under VAR Model | Granger causality tests based on error correction models show that there is a causal relationship between financial development and economic growth. |

| | Total capital stock | Income of main business | Total assets |
|---|---|---|---|
| Pudong Development Bank | 39.2 | 214.7 | 5730.7 |
| Bank of China | 459.4 | 3345.7 | 59876.9 |

Source: Authors' Compilation

 

## 3. Data and Methods of the Study

Data have used in this study are time series annual figure covering the period 1982-2014. The study measures the financial development is the ratio of $M_2$, a broader definition of money, to nominal GDP, which is widely regarded as a monetization variable (Sims, 1972; Shaw, 1973; McKinnon, 1973; Vogel and Buser, Jung, 1986; Cole *et al*. 1995; Chang, 2005; Asghar and Hussain, 2014). The monetization variable is planned to show the real size of the financial sector of a growing economy (Jung, 1986). Real economic growth in this study is measured by growth of gross domestic product (GDP) in annual percentage. Trade openness (Trade) is summation of real exports and real imports (percentage of GDP). All data are used in this study are taken from World Development Indicators (World Bank, 2016) and International Monetary Fund (2016).

### *3.1 Model Specification*

The dependent variable in this study is the annual growth rate of GDP and the two explanatory variables are financial development ($FD$) and international trade (Trade). The specification of the empirical models in this study takes the following form in equation 1:

$$Economic\ Growth = f(Financial\ Development, International\ Trade) \quad (1)$$

The econometric form of the equation can be written thus:

$$Y_t = \alpha_0 + \beta_1 FD_t + \beta_2 Trade_t + \mu_t \quad (2)$$

Where, $Y_t$ denotes growth rate of gross domestic product (GDP) (annual percentage), $FD_t$ presents financial development which is used as a proxy of broad money supply ($M_2$), $Trade_t$ shows international trade openness (percentage of GDP) is a summation of real exports and imports of the country, $\mu$ = error term of the model, and t = 1, 2, 3… 33 (time period is from 1982-2014), $\alpha$ = Constant and $\beta_1$, $\beta_2$ = coefficients to be estimated.

### *3.2 Hypothesis of the Study*

Most of the studies have used money supply ($M_2$ or $M_3$) as % of GDP to present the financial development (Sims, 1972; Shaw, 1973; McKinnon, 1973; Vogel and Buser, Jung, 1986; Cole *et al*. 1995; Chang, 2005; Asghar and Hussain, 2014). Trade volume increases with the help of increasing production and economic growth, increasing trade allows a country to develop its infrastructure, and the developing infrastructure helps to conducive trade and minimizes the information cost (Edwards, 1993 & 1998; Lee, 1995; Harrison, 1996; Frankel & Romer, 1999; Irwin & Tervio, 2002; Vamvakidis, 2002; and Kim *et al*. 2012).

The hypothesis of the study is:

1. Financial development promotes the economic growth
2. Trade is positively related to economic growth

### *3.3 Unit Root Test*

The Phillips-Perron (PP) unit root test is employed to identify whether the series is suffering for unit root problem or not. By using the PP test, the level of integration can be identified (Phillips & Perron, 1988). The PP test is a robust unit root test in the sense that it is a nonparametric test, which takes into account the serial correlation in stochastic disturbance terms.

### *3.4 Johansen Cointegration Test*

To identify a long-run relationship among the variables, the Johansen (1988) cointegration test is readily used. Two or more random variables are said to be cointegrated if each of the series is non-stationary, but a linear combination of these random variables is stationary (Engle and Granger, 1987). Johansen and Juselius (1990) procedures employ two different tests to examine the number of cointegrating vectors: the trace tests and the maximum eigenvalue tests. Trace statistics, investigate the null hypothesis of *r* cointegrating relations against the alternative of *n* cointegrating relations, where n is a variable in the system for $r = 0, 1, 2, \ldots, n-1$. This equation is computed according to the following method:

$$\mathrm{LR_{tr}(r/n)} = -\mathrm{T}\sum_{\mathrm{i=r+1}}^{\mathrm{n}} \mathrm{Ln}(1-\lambda) \quad (3)$$

The maximum eigenvalue statistics tests the null hypothesis of $r$ cointegrating relations against the alternative of $r+1$ cointegrating relations for $r = 0, 1, 2, \ldots, n-1$. This test statistics are computed as:

$$\mathrm{LR_{Max}}\left(\frac{\mathrm{r}}{\mathrm{n+1}}\right) = -\mathrm{T}\,\mathrm{Ln}(1-\lambda) \quad (4)$$

where $\lambda$ is the maximum eigenvalue and $T$ is the sample size.

### *3.5 Vector Error Correction Model*

If cointegration has detected among the variables, meaning that there exists a long-run equilibrium relationship among them. Therefore, the VECM test has been incorporated to examine the short-run properties of the cointegrated series. The regression equation form for VECM is as follows:

$$Y_t = \alpha_1 + \theta_1 ECT_{t-1} + \sum_{i=0}^{p} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{p} \delta_i \Delta X_{t-i} + \sum_{i=0}^{p} \vartheta_i \Delta Z_{t-i} \quad (5)$$

 

$$X_t = \alpha_2 + \theta_2 ECT_{t-1} + \sum_{i=0}^{p} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{p} \delta_i \Delta X_{t-i} + \sum_{i=0}^{p} \vartheta_i \Delta Z_{t-i} \quad (6)$$

Where, $ECT_{t-1}$ is the error correction term which reflects the deviation from the long-run equilibrium path.

## 4. Empirical Results and Discussion

In case of time series analysis, it is found that most of the variables are nonstationary, i.e., its mean and variance are not constant over time and the value of the covariance between the two time periods does not depend only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. The Phillips-Perron test is used in this paper to detect whether the three variables, considered in the model, are stationary or not. Table 2 reports the unit root test results. According to this result, all the variables are no stationary in their larval forms. On the contrary, they are stationary in the first difference series of all the cases. The results provide the basis for the test of a long-run relationship among the variables.

Table 2: Phillips-Perron (PP) Test for Unit Root

| Variables | Constant and No Trend | | Constant and Trend | | No Constant & No Trend | |
|---|---|---|---|---|---|---|
| | At Level | At 1st Differenced | At Level | At 1st Differenced | At Level | At 1st Differenced |
| Y | -2.867326 | -6.556390* | -2.974326 | -6.317716* | -0.559336 | -6.208809* |
| FD | -0.095336 | -6.711761* | -3.168886 | -6.546351* | 3.866690 | -4.014579* |
| Trade | -1.790281 | -4.438539* | -1.382957 | -4.669254* | 0.231525 | -4.394504* |

Source: Author's Envies output, Note: * means 1 percent significance level

The results of the Johansen cointegration tests are influenced by the considered lag length. Here, Akaike Information Criterion_(AIC) has been incorporated to determine the optimum lag length. According to the AIC, the optimum lag length is 3. Therefore, the study precedes further tests with lags 3.

The Johansen cointegration can be formally tested with the trace and the maximum Eigenvalue statistics. The results are presented in Table 3. The results show that the null hypothesis of no cointegration, i.e., r = 0, is rejected. This is because both Trace Statistic and Max Statistic are larger than the critical value at least at the 1% significance level. Therefore it has been found that there is a long-run relationship among the considered variables.

Table 3: Results of the Johansen Cointegration Tests

| Unrestricted Cointegration Rank Test (Trace) | | | | |
|---|---|---|---|---|
| Hypothesized | | Trace | 0.05 | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None * | 0.721765 | 49.08016 | 29.79707 | 0.0001 |
| At most 1 | 0.340837 | 13.26004 | 15.49471 | 0.1056 |
| At most 2 | 0.055206 | 1.590079 | 3.841466 | 0.2073 |
| Unrestricted Cointegration Rank Test (Maximum Eigenvalue) | | | | |
| Hypothesized | | Max-Eigen | 0.05 | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None * | 0.721765 | 35.82012 | 21.13162 | 0.0002 |
| At most 1 | 0.340837 | 11.66996 | 14.26460 | 0.1237 |
| At most 2 | 0.055206 | 1.590079 | 3.841466 | 0.2073 |
| Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level | | | | |
| * denotes rejection of the hypothesis at the 0.05 level | | | | |
| **MacKinnon-Haug-Michelis (1999) p-values | | | | |

The existence of cointegration between variables is an indication of long-run equilibrium relationship. However, there is a possibility of disequilibrium in the short-run. Now we can use the error term in the cointegrating relation, to estimate the short-run behavior of the variables. The vector error correction models (VECM) are applied to investigate the direction of causality. The short-run equation under the error correction framework is computed to include an adjustment mechanism from the short-run equilibrium to the long-run equilibrium. The result of VECM is presented in Table 4.$\beta_1$is the short-run adjustment parameter. It is negative and also statistically significant at 1% significance level. The value -0.93 implies that 93 per cent of the deviation from the long-run equilibrium level can be corrected annually. The model has no serial correlation, no heteroskedasticity problem and normally distributed which are presented in the *Appendix Table 1* and *Appendix Figure 1* respectively. The model is also stable by checking the CUSUM and CUSUMSQ tests which are shown in the *Appendix Figure 2 and 3*respectively.

 

Table 4: Error Correction Model (ECT) for Long-run Causality

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| $\beta_1$ of $ECT_{-1}$ | -0.927573 | 0.183547 | -5.053609 | 0.0001 |
| $\beta_2$ of Economic $Growth_{(-1)}$ | 0.359582 | 0.174705 | 2.058225 | 0.0543 |
| $\beta_3$ of Economic $Growth_{(-2)}$ | -0.020574 | 0.141001 | -0.145910 | 0.8856 |
| $\beta_4$ of Economic $Growth_{(-3)}$ | 0.260278 | 0.140668 | 1.850301 | 0.0808 |
| $\beta_5$ of Financial $Development_{(-1)}$ | 0.263400 | 0.056795 | 4.637760 | 0.0002 |
| $\beta_6$ of Financial $Development_{(-2)}$ | 0.190523 | 0.081708 | 2.331750 | 0.0315 |
| $\beta_7$ of Financial $Development_{(-3)}$ | 0.092271 | 0.068098 | 1.354960 | 0.1922 |
| $\beta_8$ of $Trade_{(-1)}$ | -0.051499 | 0.081483 | -0.632024 | 0.5353 |
| $\beta_9$ of $Trade_{(-2)}$ | 0.128135 | 0.079359 | 1.614636 | 0.1238 |
| $\beta_{10}$ of $Trade_{(-3)}$ | 0.119325 | 0.083315 | 1.432216 | 0.1692 |
| $\beta_{11}$ of Constant | -3.033426 | 0.855745 | -3.544776 | 0.0023 |
| R-squared | 0.819274 | Mean dependent var | | -0.216720 |
| Adjusted R-squared | 0.718870 | S.D. dependent var | | 2.507091 |
| S.E. of regression | 1.329301 | Akaike info criterion | | 3.688881 |
| Sum squared resid | 31.80676 | Schwarz criterion | | 4.207510 |
| Log likelihood | -42.48877 | Hannan-Quinn criter. | | 3.851309 |
| F-statistic | 8.159817 | Durbin-Watson stat | | 2.081395 |
| Prob(F-statistic) | 0.000072 | | | |

To check the short-run causality, we shall be using the Chi-square value of Wald statistics from financial development to economic growth. Here the coefficients $\beta_5$, $\beta_6$ and $\beta_7$ are financial development. If all the coefficients of financial development (*FD*) $\beta_5$ to $\beta_7$ jointly influence the GDP growth rate (*Y*) then we can say that there is a short-run causality from financial development to economic growth. The corresponding Chi-square probability is 00.15% which is less than 1%. So null hypothesis can be rejected rather can accept the alternative hypothesis. It means that all the coefficients of financial development jointly they are not zero. So the coefficients of financial development having three lags jointly cause economic growth in the short-run, which is presented in *Appendix Table 3*. In the case of international trade (*Trade*) to economic growth, and the corresponding coefficients are $\beta_8$to$\beta_{10}$. The corresponding Chi-square probability is 20.79% which is more than 5%. So the null hypothesis cannot reject rather can accept the null hypothesis. It means that all the coefficients of international trade jointly they are zero. So all the trade openness having three lags jointly cannot cause GDP growth rate in the short-run, which is presented in *Appendix Table 4*. But from the *Appendix Table 5*, the study may conclude that jointly financial development and international trade and their corresponding coefficients $\beta_5$to $\beta_{10}$ are not zero. So there is a strong causality among the variables in the short-run jointly.

## 5. Conclusion

The main objective of this study is to investigate the causal relationship among financial development, international trade and economic growth in China. The period of 1982-2014 are employed for annual time-series. In the present study, Johansen cointegration and error correction models (VECM) are employed to examine the long-run and short-run relationship between the financial developments and international trade on the economic growth for China. The stationary properties of the variables and the order of integration are tested using the Phillips-Perron (PP) test. All the variables are found to be cointegrated meaning that there existence a long-run association. Johansen cointegration results show that there exist one cointegrating vector among economic growth, financial development and international trade. The results of VECM confirm the long-run relationship between the variables. That means financial development causes economic growth in the long-run or there exists a long-run causality. Financial development is the drivers of economic growth in short and long-run in China. The diagnostic tests carried out for all variables are all satisfied, that is, no serial correlation and no heteroscedasticity and the residuals are normally distributed, implying that the estimates are reliable and therefore can be relied upon. The model is also stable by checking CUSUM and CUSUMSQ test. This result is consistent with some studies such as Al-Yousif (2002) in 30 developing countries, Gokmenoglu et al. (2015) in Pakistan, Bhattachrya and Sivasubramanian (2003) in India, and Memon *et al*. (2011) in SAARC countries.

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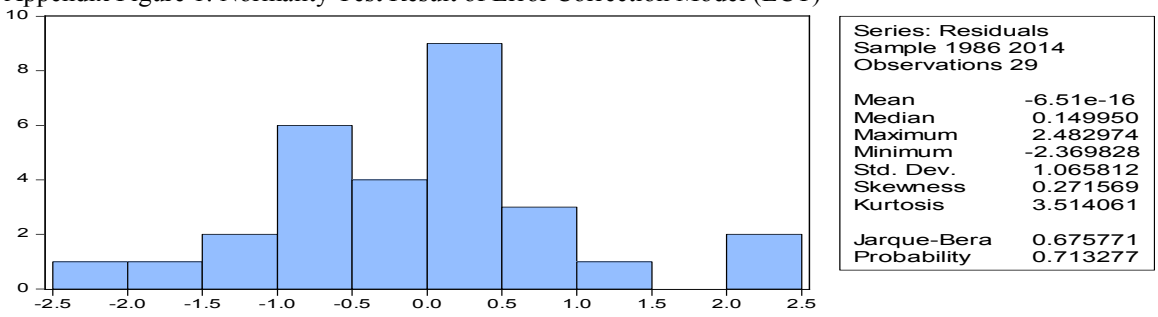
Appendix

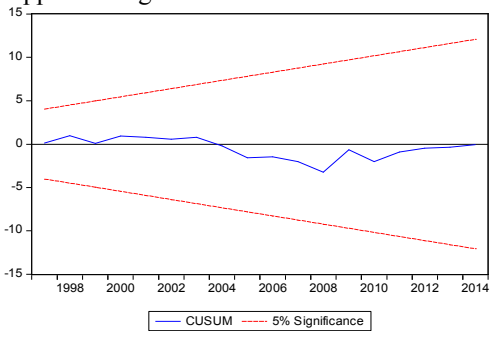
Appendix Figure 1: Normality Test Result of Error Correction Model (ECT)



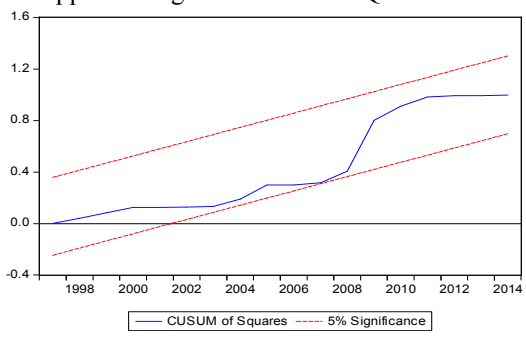

Appendix Table 1: Serial Correlation & Heteroskedasticity Test of Error Correction Model

| | | | |
|---|---|---|---|
| Breusch-Godfrey Serial Correlation LM Test: | | | |
| F-statistic | 0.197235 | Prob. F(2,16) | 0.8230 |
| Obs*R-squared | 0.697775 | Prob. Chi-Square(2) | 0.7055 |
| Heteroskedasticity Test: Breusch-Pagan-Godfrey | | | |
| F-statistic | 1.266978 | Prob. F(12,16) | 0.3234 |
| Obs*R-squared | 14.12999 | Prob. Chi-Square(12) | 0.2925 |
| Scaled explained SS | 6.842843 | Prob. Chi-Square(12) | 0.8678 |

Appendix Figure 2: CUSUM of ECT




Appendix Figure 3: CUSUMSQ of ECT



Appendix Table 2: Short-run Causality from FD to Y

| Wald Test: | | | |
|---|---|---|---|
| Equation: Untitled | | | |
| Test Statistic | Value | df | Probability |
| F-statistic | 7.806985 | (3, 18) | 0.0015 |
| Chi-square | 23.42096 | 3 | 0.0000 |
| Null Hypothesis: $\beta_5=\beta_6=\beta_7=0$ | | | |
| Null Hypothesis Summary: | | | |
| Normalized Restriction (= 0) | | Value | Std. Err. |
| $\beta_5$ | | 0.263400 | 0.056795 |
| $\beta_6$ | | 0.190523 | 0.081708 |
| $\beta_7$ | | 0.092271 | 0.068098 |
| Restrictions are linear in coefficients. | | | |

Appendix Table 3: Short-run Causality from Trade to Y

| Wald Test: | | | |
|---|---|---|---|
| Equation: Untitled | | | |
| Test Statistic | Value | df | Probability |
| F-statistic | 1.674835 | (3, 18) | 0.2079 |
| Chi-square | 5.024505 | 3 | 0.1700 |
| Null Hypothesis: $\beta_8=\beta_9=\beta_{10}=0$ | | | |
| Null Hypothesis Summary: | | | |
| Normalized Restriction (= 0) | | Value | Std. Err. |
| $\beta_8$ | | -0.051499 | 0.081483 |
| $\beta_9$ | | 0.128135 | 0.079359 |
| $\beta_{10}$ | | 0.119325 | 0.083315 |
| Restrictions are linear in coefficients. | | | |

Appendix Table 4: Strong Granger Causality from jointly FD & Trade to Y

| Wald Test: | | | |
|---|---|---|---|
| Equation: Untitled | | | |
| Test Statistic | Value | df | Probability |
| F-statistic | 4.178155 | (6, 18) | 0.0084 |
| Chi-square | 25.06893 | 6 | 0.0003 |
| Null Hypothesis: $\beta_5=\beta_6=\beta_7=\beta_8=\beta_9=\beta_{10}=0$ | | | |
| Null Hypothesis Summary: | | | |
| Normalized Restriction (= 0) | | Value | Std. Err. |
| $\beta_5$ | | 0.263400 | 0.056795 |
| $\beta_6$ | | 0.190523 | 0.081708 |
| $\beta_7$ | | 0.092271 | 0.068098 |
| $\beta_8$ | | -0.051499 | 0.081483 |
| $\beta_9$ | | 0.128135 | 0.079359 |
| $\beta_{10}$ | | 0.119325 | 0.083315 |
| Restrictions are linear in coefficients. | | | |