THE NEXUS BETWEEN FDI, TRADE OPENNESS, REAL EXCHANGE RATE AND INFRASTRUCTURE QUALITY: INDIA'S POST LIBERALIZATION

GAN JUN HAO
GOH THIAN WEAI
HONG HAO SEANG
HUN MOOI EAM
TEO ZHEN SHYANG

BACHELOR OF ECONOMICS (HONS) FINANCIAL ECONOMICS

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
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BY

GAN JUN HAO
GOH THIAN WEAI
HONG HAO SEANG
HUN MOOI EAM
TEO ZHEN SHYANG

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DEPARTMENT OF ECONOMICS

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DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is 11,360 words.

Name of Student:	Student ID:	Signature:
1. GAN JUN HAO	12ABB00811	_______________
2. GOH THIAN WEAI	12ABB00193	_______________
3. HONG HAO SEANG	12ABB07600	_______________
4. HUN MOOI EAM	12ABB00829	_______________
5. TEO ZHEN SHYANG	12ABB00755	_______________

Date: 27th August 2014

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DEDICATION

This research project is lovingly dedicated to our respective parents and also our friends who have been our constant source of inspiration and energy. They have given us the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
BOP	Balance of Payment
BRICS	Brazil, Russia, India, China, and South Africa
EG	Engle-Granger
EVIEW	Economic View
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
GDP	Gross Domestic Product
INFQ	Infrastructure Quality
IMF	International Monetary Fund
INR	Indian Rupee
IRF	Impulse Response Function
JC	Johansen Cointegration
MNCs	Multinational Companies
PP	Philip-Perron
REXR	Real Exchange Rate
SIC	Schwarz Information Criterion
SSA	Sub-Sahara African
TO	Trade Openness

US	United States
USD	United States Dollar
VAR	Vector Autoregression
VECM	Vector Error Correction Model

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ABSTRACT

This study tends to investigate the nexus between foreign direct investment, real exchange rate, trade openness, and infrastructure quality in India after liberalization. The period studied upon is from the second quarter of 1991 to the fourth quarter of 2013. In the empirical analysis, vector autoregressive (VAR) model is used to estimate the regression. Unit root test, Johansen cointegration test, Granger causality test, variance decomposition, and impulse response functions (IRFs) are also used in this paper. The empirical result shows that trade openness is a major influence and has a positive relationship with the foreign direct investment inflows in India. Besides, real exchange rate was found to have a positive impact on foreign direct investment in India too, though not that much compared to the influence of trade openness. Infrastructure quality, on the other hand, was found to have a negative relationship with and the impact is extremely small in influencing foreign direct investment. Policy implications suggest the Indian government to focus on improving trade openness by liberalizing trade policies, maintain a stable exchange rate to improve investors' confidence.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

Foreign direct investment inflow (FDI) is important and is considered a key element in illustrating a country's international economic integration, and at the same time promotes technology transfer between countries. India, the second most populous country in the world has been experiencing fluctuations in FDI in the past decades even after its economic liberalization in 1991. Thus, it is of upmost importance to study the nexus between India's FDI and some of its important determinants since its economic reformation taking in consideration of exchange rate, trade openness, and infrastructure quality. In this chapter, a theoretical outline will be presented with the inclusion of research background, problem statement, research objectives, research questions, as well as significance of study.

1.1 Research Background

1.1.1 Foreign Direct Investment (FDI)

According to the International Monetary Fund (IMF), foreign direct investment inflows, otherwise known as FDI, refers to investments made outside of the economy of the investor to obtain long-term interest in enterprises. Why is FDI so important to a country? FDI allows companies to increase their production rate, remove trade barriers, at the same time allow joint ventures and acquisitions to happen. FDI is an essential factor which will improve economic growth and enhance the economic structure quality of a country. A research done by Chaitanya (2004) stated that FDI provides more yearned for resources which can help to accelerate capital formation, at the same time smoothen the progress of transfer of technology, knowledge, and skills. India actually has a few benefits to offer its foreign investors such as political stability, an enormous market, huge and increasingly skilled labor, single digit inflation rate, and a steadily growing economy.

1.1.2 Economic Liberalization in India

The economic liberalization in India has paved the way for economic reformations which include deregulation, relaxing government control, allowing of foreign capital inflows, allowing for greater privatization, decreasing tax rates, and loosening economic barriers. Before liberalization, India was in deep trouble and suffered a Balance of Payment (BoP) crisis in 1985. India was not able to pay for important imports and experienced high deficits, rising inflation, and increased borrowings from external sources to finance it and the crisis pushed India to near bankruptcy.

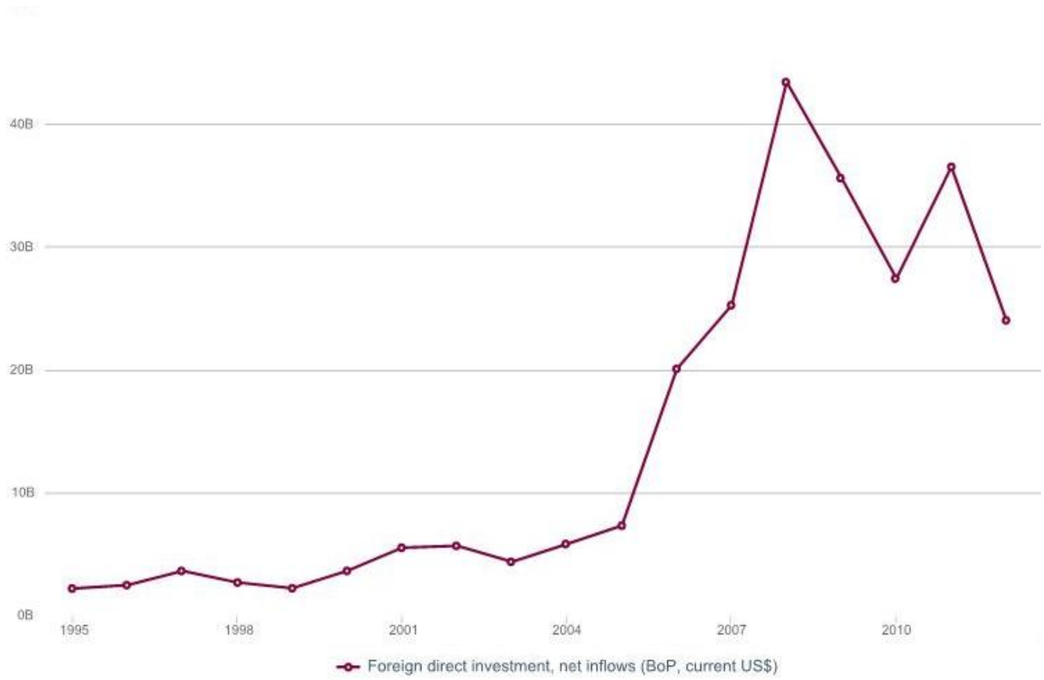
In July 1991, Manmohan Singh, former Prime Minister of India, made a major decision to implement reforms which include devaluation of the rupee, eradication of most quotas and production licenses, and allow certain industries to accept foreign capital. This liberalization has led to an expansion in India's economy and also foreign investment inflows. According to a research done by Bhattacharya and Palaha (1996), the number of foreign collaborations went up from a mere 950 cases in 1991 to 1854 cases in 1994, which almost doubled. Besides, the actual FDI rose more than eight times in a short span of three years.

A more detailed explanation would be this. India was faced with depleting of foreign reserves that necessitated devaluation in 1991 (Kalirajan, Prasad & Drysdale, 2012). India was still using a fixed exchange rate system then. When the exchange rate is under the fixed exchange rate system and a country experience high inflation rate relative to other countries, the country's goods become much more expensive which causes the foreign goods to become cheaper. Thus, India devalued its currency, a move to lower the prices of its good so that foreign countries would purchase goods from India. A year after the currency devaluation, India implemented the dual exchange rate regime. Under this regime, the government allows importers to pay for some imports with foreign exchange valued at free-market rates and other imports could be purchased with foreign exchange purchased at a government-mandated rate.

1.2 Problem Statement

India is a developing country whose future growth is heavily dependent on the participation of world economy.

Figure 1.1: Total FDI inflows of India (BoP, current US$) – 1975 to 2012



Source: World Bank

According to World Bank, India's net FDI were of negative figures before 1977, at negative US$ 36 million and reached a minimum point on 1978, at US$ 18.09 million. The small amount of IFDI lasted till 1994 and reaches its first billion on 1995, a total of US$ 2.14 billion. However, the net FDI decreased slightly from US$ 3.58 billion in 1997 to US$ 2.17 billion in 1999. During 2000s, India's FDI experienced a drastic increase and reached its peak in 2008, achieving a total of US$ 43.4 billion but declined for the next two years to US$ 27.4 billion in 2010. Figures continued to fluctuate for the subsequent years, from US$ 36.5 billion in 2011 to US$ 28 billion in 2013.

Table 1.1: Total FDI inflows in China & India (BoP, current US$

Year	Foreign direct investment, net inflows (BoP, current US$)	
	China	India
2003	49.46 billion	4.32 billion
2004	62.11 billion	5.77 billion
2005	104.11 billion	7.27 billion
2006	124.08 billion	20.03 billion
2007	156.25 billion	25.23 billion
2008	171.54 billion	43.41 billion
2009	131.06 billion	35.58 billion
2010	243.70 billion	27.40 billion
2011	280.07 billion	36.50 billion
2012	253.48 billion	23.40 billion
2013	267.22 billion	28.00 billion

Source: World Bank

Being a member of BRICS countries (Brazil, Russia, India, China, South Africa), India's IFDI remains the lowest among the BRICS region. China holds the highest number of IFDI recorded, with a total of US$ 280 billion in 2011 while Russia and Brazil at US$ 75 billion and US$ 50 billion respectively. The amount of China's FDI has outstripped India by an extremely huge amount, a difference of US$ 243.57 billion in 2011. The average FDI inflow in China over a period of ten years is US$ 167.58 whereas the amount of FDI received by India is significantly lower, a total of US$ 23.36. This indicates that India is lagging behind in comparison to major developing countries such as China, despite sharing certain similarities. Both are endowed with a large population, low labor cost, human capital, and huge geographical region. Apart from that, both countries adopted import substitution industrialization strategy; China from early 1950s to late 1970s, India from early 1950s to 1990s. Both carried out reformations; China from early 1980s, India from early 1990s, towards liberalization of trade policies, tax policies, and so on (Tian & Yu, 2012).

The economic reforms led to a sturdy growth of FDI in both countries but in a different scale over the years (Drysdale, Kalirajan & Prasad, 2012). Reports have been reporting that the attractiveness of India's FDI has decreased and has been surpassed by other emerging economies although it was previously one of the largest and fastest growing economies. China is currently the globe's leading FDI recipient, while India on the other hand, is still struggling with unstable FDI. The interesting question is as to how China is attracting significantly more FDI compared to India despite having similar volume in population size, China with a population of 1.39 billion and India at 1.26 billion. Besides, China's FDI recovered rapidly after the financial crisis in 2008 whereas India's FDI remains below its initial volume.

1.3 Research Objectives

1.3.1 General Objectives

This research paper seeks to identify the relationship between FDI and infrastructure quality, FDI and trade openness, and FDI and real exchange rate in India during 1999 to 2013.

1.3.2 Specific Objectives

1. To study the trends of FDI in India.

2. To examine the nexus between FDI and trade openness, FDI and infrastructure quality, FDI and real exchange rate in India respectively.

1.4 Research Questions

India, a major emerging economy, has been experiencing fluctuant FDI during recent years despite its effort in liberalising the economy over the years whereas China, also an emerging economy, saw its FDI increase at a shocking rate where it surpassed United States as the world's largest FDI recipient in 2011. Why is the gap between the two developing countries so huge despite having similar population size and implementing economic reformation. This research paper aims to answer a few questions. By studying the relationship between real exchange rate, trade openness, and infrastructure quality to FDI, how different is each variable responding in terms of its impact? Besides, are they positively related or negatively related to India's FDI? These are questions that are worthy of further research and discussion.

1.5 Significance of the Study

As discussed above, India did indeed saw an improvement in FDI since the economic liberalization but it is of a fluctuant trend. This research paper can help in identifying which variable is of upmost importance in influencing FDI in India as it includes several essential factors such as trade openness, infrastructure quality, and real exchange rate.

By carrying out this research, it will help in contributing to previous researches and further strengthen the significance of the mentioned independent variables, providing stronger results overall. Furthermore, if any of the variables are found to be insignificant, policymakers in India can prevent wastage of capital and resources at the same time allocate these expenditures into other important areas, as so to improve the inflows of FDI into India, which will result in a more robust economy.

Besides the contribution to policymakers, this research can also be used as a form of reference for future potential investors who are looking to invest in India, as they will understand which determinants are of more important in contribute to India's FDI.

1.6 Chapter Layout

Chapter 1 is an overview of the research study, which explains the research problem and also provides the research objectives and aims to be achieved. Besides, it establishes the research questions that need to be tested.

Chapter 2 consists of literature review, a study of existing published work of other researchers. By reviewing published journal articles by other researchers, it helps in the understanding of the research topic and the development of a sound theoretical framework.

Chapter 3 talks about the methodologies used in the research, which depicts how the research is carried out in regarding its design, data collection techniques, sampling design, measurement scales, and data analysis methods and constructs measurement.

Chapter 4 provides the results and data analysis which is significant in answering the research questions and hypotheses tested.

Chapter 5 is made up of discussion, implications and conclusion of the research. Recommendations are provided in this chapter to future researchers who are interested into carrying out further research.

1.7 Conclusion

This study aims at finding out the nexus between FDI in India in relation to real exchange rate, infrastructure quality, and trade openness from 1999 to 2013. This research not only intends on contributing in strengthening the results of previous researches, but also gives an insight to policymakers. The next chapter discusses regarding literature review, which is a study of existing studies done by previous researchers.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

Previous studies regarding the determinants of FDI are reviewed in this chapter. In this chapter, linkage is provided between the dependent variable, FDI, and independent variables which include real exchange rate, trade openness, and infrastructure quality. Relevant literatures have been reviewed and the findings of previous studies are useful in the development research paper.

2.1 Review of the Literature

2.1.1 Foreign Direct Investment Inflow (FDI)

Foreign direct investment inflow (FDI) is a main contribution of funds formation in developing countries, as well as strengthening connection to world trade and finances its development path. When compared to other types of capital flows, FDI is more advantageous as it is more stable and would not create obligations when there is a financial crisis. This was observed in the study done by Cho (2013). FDI improves the capacity of the host country to act in response when there are available opportunities due to global economic integration. Most countries in the world would not reject FDI, as it is extremely crucial and contains positive effects in generating income from inflows of capital, advanced technology, and so on. Besides, FDI is a dependable indicator in indicating globalization due to the transfer of resources across borders such as technological skill. Firms would also set up production facilities abroad, in order to lower production cost and to protect existing markets.

2.1.2 Real Exchange Rate (REXR)

Theoretically, the influence of exchange rate on FDI is vague and relies on the motivation of foreign investors. Depreciation in the exchange rate of the host country will lower local assets and production cost which in turn generate higher FDI inflows. In contrary, it may reduce motivation for foreign firms to penetrate the local market through local production, due to tariff jumping becoming less useful. Firms are assumed to not invest in countries with weaker currencies as they are related to exchange rate risk. Conversely, an increase in exchange rate, in result of a shortage in exchange supply, may cause FDI inflows to increase. Previous studies carried out that examined the effect of exchange rate on FDI inflows produced mixed results.

A research by Enu, Havi, and Obeng (2013) investigated the determinants of FDI into Ghana during 1980 to 2012 by using vector autoregression (VAR) analysis. Results show that during the last two years, exchange rate is statistically significant in encouraging IFDI. Granger causality test indicates that FDI and exchange rate have bidirectional causality. Another research carried out by Jin and Zang (2013) which investigates the impact of change in exchange rate on FDI in China from 1997 to 2012 by using VAR approach and concluded that a unilateral directional causality relationship exists between real effective exchange rate and FDI, where a change in exchange rate with change FDI significantly. A research carried out by Danmola (2013) studied the effect of exchange rate on FDI in Nigeria from 1980 to 2010 by running several tests such as Augmented Dickey Fuller (ADF), Philip Perron (PP) and Granger causality test to identify short run dynamics and results indicate that not only there exist an unidirectional causality in the relationship between exchange rate volatility and FDI, it has a positive influence on FDI too.

Another research carried out by Chowdhury and Wheeler (2008) which investigates how does real exchange rate volatility affects foreign direct investment in Japan, China, the United Kingdom, and the United States by using vector autoregressive models. The results obtained through variance decompositions and impulse response functions indicate a positive impact from exchange rate volatility to FDI. Besides, a research paper by Khan, Rahman and Sattar (2012) on the effectiveness of exchange rate on FDI by implementing causality analysis found out an existence of a positive and bidirectional relationship among exchange rate and FDI which means an increase in exchange rate will raise the value of foreign currency and decrease the cost of production in host currency. Albert and Stuart (2008) ran a VAR analysis on the determinants of FDI in the case of Sri Lanka and findings indicate that a host country's currency depreciation of the repatriation of profits derived from reinvested earnings are a long run concern and suggest Sri Lankan policymakers to focus on the health of major economic indices, such as exchange rate. In addition, Egwaikhide, Ogun and Ogunleye (2010) examined the relationship between real exchange rate and FDI in selected Sub-Sahara African (SSA) countries and found it inconclusive as different countries seems to have different exchange rate effects on FDI. The effect of real exchange rate movements on FDI in Botswana, Ghana, Central African Republic and South Africa was found to be ambiguously negative whereas in Kenya and Uganda real exchange rate has unambiguous positive effects on FDI.

Despite many studies illustrating causality between exchange rate and FDI, other researchers did not manage to identify a significant relationship between them. A study done by Boahen and Evans (2014) on the impact of exchange rate on FDI in Ghana by using a VAR model found the relationship between exchange rate and IFDI to be statically insignificant. In addition, Emmanue and Luther (2014) did a causality analysis of FDI and exchange rate volatility in Ghana and found exchange rate and FDI to not have a significant relationship. Moreover, Kirchner (2012) found a unidirectional causality between trade openness and FDI in Australia.

2.1.3 Trade Openness (TO)

Openness of trade of a country itself reflects trade liberalization, where the country opens its markets to allow international trade, at the same time reducing trade barriers such as tariffs and quotas. This increases specialization and also division of labour, which results in not only an improvement towards export capability and productivity, but to economic growth as well.

In a study done by Ay, Mangir and Sarac (2012), a bidirectional causality relationship was found between trade openness and FDI in Poland as well as unidirectional causality between trade openness and FDI in Turkey when a comparative analysis between Turkey and Poland on the determinants of FDI was carried out. Besides, Albert and Stuart (2008) ran a vector auto-regression (VAR) analysis to investigate the impact of changes in several macroeconomic variables on Sri Lanka's FDI which include trade openness as well. Results shown a greater degree of openness to trade was favorable as it has a positive influence on FDI in Sri Lanka. Fida, Naqvi and Zakaria (2014) studied the impact of trade openness on FDI in Pakistan during 1972 to 2010 and a significant positive relationship between trade openness and FDI was found. Demirhan and Masca (2008) analysed the determinants of FDI in 38 developing countries from 2000 to 2004 and found that trade openness has a positive and significant relationship with FDI, which means it is able to indicate a country's willingness to take in foreign investment.

However, several researches did not manage to find causal relationship between trade openness and FDI. One of them was a study done by Enu, Havi and Obeng (2013) which applied a VAR analysis on major macroeconomic determinants of FDI in Ghana from 1980 to 2012. No causal relationship between trade openness and FDI was found. Furthermore, Chang (2007) did a study on analyzing relationships among FDI and degree of openness in Taiwan but did not manage to find a causal relationship between the two. Donga, Hayatudeen and Umaru (2013) investigate the effect of trade openness of Nigerian economy by using VAR model and results did not depict an existence of causation between trade openness and FDI. Results from other researchers show otherwise. Rao, Sridharan and Vijayakumar (2010) studied the determinants responsible in affecting FDI inflows on BRICS countries from 1975 to 2007, using panel data analysis. The impact of trade openness on FDI is not confirmed in this study. This result is identical to that of Mateev (2009), where he examined the major determinants of FDI flows in Central and Southeastern European countries and found that trade openness do not seem to have an impact on FDI flows. Likewise, a study conducted by Hassan and Khan (2013) on analyzing the determinants of FDI in Malaysia from 1980 to 2010 found trade openness and FDI to not have a causal relationship between each another.

2.1.4 Infrastructure Quality (INFQ)

Infrastructure is extremely crucial, as poor quality of infrastructure may increase costs for firms and if inversed will attract FDI inflows. By reducing costs, business will be able to obtain and maximize their profit. Thus, infrastructure quality is essential to improve FDI (Liu, 2013). Krugell (2005) stated that the quality of infrastructure is vital in attracting FDI into a country.

Gwenhamo (2009) highlighted that the availability and quality of infrastructure some of which are transportation, communications and energy supply, affects FDI positively because better form of infrastructure decreases transaction and production costs while increasing the country's attractiveness as an investment destination. Besides, higher level of infrastructure quality generally requires a developed system of roads, airports, seaports, supply of electricity and water and also internet and telephone network (Onyeiwu & Shrestha, 2004). A study done by Rusike (2007) on examining the trends and determinants of FDI to South Africa for 1975 to 2005 found an existence of a positive relationship between infrastructure quality and FDI inflow.

According to Bhattacharya (2012), electric, water and gas supply when used as a proxy for infrastructure quality, is positive and statistically significant at 5% significance level which implies that a higher level of infrastructure has positive impact in the short run. Bidirectional causality is observed only in the case of FDI and electricity, gas and water supply. Similarly, a study was conducted to examine the economic impact of FDI in Sri Lanka by taking in GDP and level of infrastructure from 1980 to 2011. Thus, results revealed a significant impact of level of infrastructure on FDI. Based on the results, the findings with respect to causality indicate that the level of infrastructure plays a crucial role in attracting FDI into Sri Lanka. Since level of infrastructure is responsible for attracting FDI, more attention should be paid to development of infrastructure as poor infrastructure would be an impediment to future growth in FDI inflows. Moreover, Esew and Yaroson (2014) explained that the availability of good infrastructure such as roads and energy supply will reduce the cost of doing business for investors and the ability of these investors to maximize the rate of return of their investment. By conducting this study, supply of energy was used as a proxy for infrastructural development.

However, no causal relationship was found between energy supply and FDI in the study. Mustajab (2009) carried out a research to study the process and impact of infrastructure investment in Indonesia and findings revealed that electricity is insignificant in having an impact on FDI. A study by Carike, Elsabe and Henri (2012) on the relationship between Chinese FDI in Africa found quality infrastructure to be an inconclusive determinant of Chinese FDI. Chinese firms seem to either target countries which possess a low infrastructure quality or does not seem to consider infrastructure in a country at all when investing in other countries.

2.2 Conclusion

There are a total of three independent variables used in this study, which consist of real exchange rate, infrastructure quality, and trade openness. Previous studies shows that the chosen independent variables consist of mixed results in terms of determining FDI inflows in many othercuntries. Thus, researchers will collect indicator's observation from a consistent database and plan the research carefully especially methodologies so as to prove the determinants are actually related to each another.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter is regarding the research methodology, which consists of research design, data collection methods, data processing, and data analysis. It is important to choose an appropriate methodology because if the methodology used is inappropriate in the study, results obtained could be misleading. The methodologies discussed in this chapter will be put to further usage in the upcoming chapters but for now, only explanation regarding the nature of the tests will be discussed. The following tests will be discussed in order.

a) Augmented Dickey-Fuller (ADF) and Philip Perron (PP) unit root test

b) Johansen Cointegration test

c) Vector Autoregressive (VAR) model

d) Granger Causality test

e) Variance Decomposition

f) Impulse Response Function (IRF)

3.1 Research Design

In this study, quantitative research was used to meet our research objectives. Quantitative methods are particularly useful when researchers seek to study large-scale patterns of behavior as they can be measured and quantified. According to Muijs (2000), quantitative research is labelled as explaining incidents by collecting numerical data that are explored by using mathematical techniques, in particular statistics. The main purpose of carrying out a research is to explain the phenomenon. This study seeks to identify the nexus between FDI inflow and infrastructure quality, FDI inflow and trade openness, and FDI inflow and real exchange rate in India during 1999 to 2013. Data is collected and analyzed using mathematical methods but in order to do so, data collected have to be in numerical form.

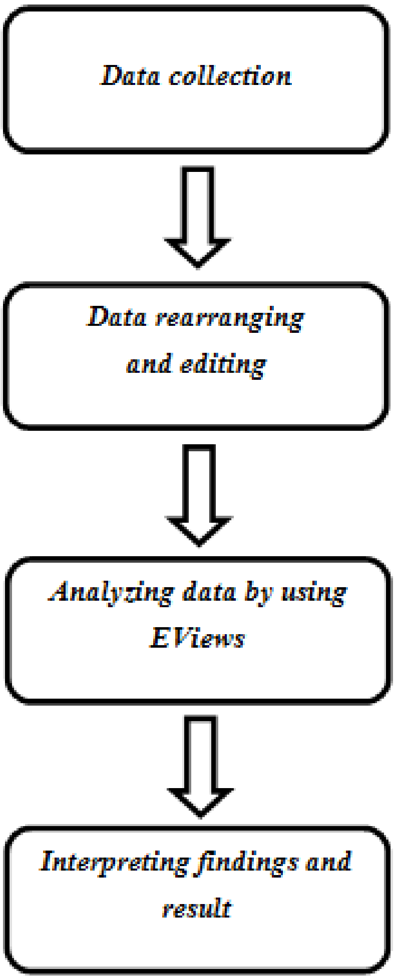
3.2 Data Collection Methods

Secondary data were used to carry out this research. In order to determine the impact the variables have on FDI inflows in India, data regarding real exchange rate, trade openness, and infrastructure quality were obtained from Thomson Datastream. Researchers used quarterly time series data to conduct this study, which stretches from 1999 to 2013, a period of 14 years (59 observations). One of the reason researchers use secondary data is to save time and also reduce cost of researching as data were made available and current researchers do not need to spend more time to obtain the data by themselves because the data were already collected and published for free and is available from many sources.

3.3 Data Processing

A few steps are involved in data processing. First, researchers will obtain the data needed from their available sources. After obtaining the data, researchers rearranges and edits the data before running an empirical analysis on EViews 7, a popular econometric software to estimate time series data. After carrying out the empirical analysis, researchers analyses and interprets the finding subjected to the research objective.

Figure 3.1: Steps of data processing



Source: Developed for the research

3.4 Data Description

Table 3.1: Description of data in tabular form

Variable	Unit	Source
Foreign Direct Investment (FDI)	USD	Thomson Datastream
Real Exchange Rate (REXR)	INR/USD	Thomson Datastream
Trade Openness (TO)	USD	Thomson Datastream
Infrastructure Quality (INFQ)	USD	Thomson Datastream

Source: Developed for the research

3.4.1 Foreign Direct Investment (FDI)

Foreign direct investment is measured by the inflow of FDI into India. Components of FDI include equity investment, investment in directly and indirectly influenced or controlled enterprises, investment in fellow enterprises, and reverse investment.

3.4.2 Real Exchange Rate (REXR)

Real exchange rate is measured by real effective exchange rate, the purchasing power of Indian rupee in relative to US dollar taking in adjustment towards inflation. Real exchange rate is measured by multiplying the nominal exchange rate with the domestic price of a good divided by the foreign price of the item.

The expected sign for real exchange rate is positive, as an increase in exchange rate will raise the value of foreign currency and decrease the cost of production in host currency (Khan, Rahman & Sattar, 2012).

3.4.3 Trade Openness (TO)

Trade openness is computed by adding up the total of exports and imports of India.

The expected sign for trade openness is positive because trade openness is able to indicate a country's willingness to take in foreign investment (Demirhan & Masca, 2008).

3.4.4 Infrastructure Quality

Infrastructure quality is measured by the sum of supply of delivery systems for gas, water, and electric services in India.

The expected sign for infrastructure quality is positive as good infrastructure lowers transaction and production costs while increasing the country's attractiveness as an investment destination (Gwenhamo, 2009).

3.5 Model Specification

The initial model is specified as follows. *FDI* is the dependent variable, whereas the remaining independent variables, *REXR*, *TO*, and *INFQ* represents real exchange rate, trade openness, and infrastructure quality respectively.

$$FDI = f\,(REXR, TO, INFQ) \tag{1}$$

$$FDI_t = \beta_0 + \beta_1 TO_t + \beta_2 REXR_t + \beta_3 INFQ_t + \varepsilon_t \tag{2}$$

where,

FDI = foreign direct investment inflow

$REXR$ = real exchange rate

TO = trade openness

$INFQ$ = infrastructure quality

β_0 = intercept

ε_t = error term

t = time trend

The variables are then transformed into logarithmic form in order to reduce the skewness of data, making results more interpretable.

$$LFDI_t = \beta_0 + \beta_1 LTO_t + \beta_2 LREXR_t + \beta_3 LINFQ_t + \mu_t \tag{3}$$

where,

$LFDI$ = natural log of foreign direct investment inflow

$LREXR$ = natural log of real exchange rate

LTO = natural log of trade openness

$LINFQ$ = natural log of infrastructure quality

β_0 = intercept

μ_t = random error term

t = time trend

3.6 Methodology

3.6.1 Unit Root Test

In this study, unit root test is performed to determine the stationarity of the data. The data with stationary time series have constant mean and variance over a time period while the data with non-stationary time series will have inconstant mean and variance over period. Time series data that are not stationary do not have a long run mean which the series return. Furthermore, the variance is dependent over time and goes to infinity as sample period approaches infinity. According to Granger and Newbold (1974), the estimated regression result will be spurious if there exist random walks between the dependent and independent variable. It could cause econometric problem where the normality assumption of hypothesis testing such as T-statistics to become useless and invalid. So, we use Augmented Dickey-Fuler (ADF) and Phillips-Perron (PP) test to test the stationary of the model.

ADF and PP are used to identify the problem of having a unit root in the model. ADF test is a parametric test which assumes that a model is normally distributed and there is a need to increase the lag length in order to remove the impact of serial correlation (Phillips & Xiao, 1998). PP test is the opposite of ADF test, which is non-parametric as it does not assume a normal distribution and the expansion of lag length when there exist serial correlation.

The parametric test for stationary, ADF test, and the non-parametric test, PP test, have identical null hypothesis (H_0) and alternative hypothesis (H_1) where H_0 depicts that there is unit root (non-stationary) and H_1 means there is no unit root (stationary). To conduct these tests, two ways can be used to choose an appropriate lag length which is Schwarz Information Criterion (SIC) and Akaike Information Criterion (AIC). According to Ayalew, Babu, and Rao (2012), SIC is advantageous towards ample statistical problems as it is order consistent; when the sample size raises to infinity, the odds of selecting the correct model converges to unity. This leads to additional parsimonious models. Identical to the AIC, a lower value a SIC obtained means the better the model will be. The difference between AIC and SIC is that AIC is designed to select model which can predict better and is less concerned with having too many parameters which can cause overestimation of true lag length and pick inconsistent correct lag length.

3.6.2 Johansen-Juselius Cointegration Test

Johansen-Juselius cointegration test is carried out to determine an existing long run equilibrium relationship between the macroeconomic variables. The test suggests that time series variables cannot move far away from one another if there is a stationary long run relationship between the integrated variables. This technique is based on the vector autoregressive (VAR) models and permits the testing of hypothesis regarding the equilibrium relationship between the variables (Abubakar & Abudllahi, 2013). The cointegration test also helps reduce the spurious rejection frequency. Nevertheless, the mentioned frequency seems to increase in relation with the number of variables and stays large despite applying several specification tests (Hjalmarsson & Osterholm, 2007).

Another cointegration test is known as the Engle-Granger (EG) approach. Johansen-Juselius is a much better approach compared to EG approach. This is because researchers are more likely to apply the results of Johansen-Juselius on the asymptotic distribution of the likelihood ratio test. These distributions are given in terms of a multivariate Brownian motion process (Johansen and Juselius, 1990). On the other hand, EG approach can only include up to two variables in the model. Besides, most of the researchers conduct this test by using Trace and Maximum Eigenvalue test in order to examine the cointegration of the model. If the null hypothesisis rejected, there exists a cointegrating relationship. Gonzalo (1994) concluded that the Johansen's approach performs better when the errors are not normally distributed, or when the dynamic of the vector error-correction model (VECM) are unknown and additional lags are included in VECM.

3.6.3 Vector Autoregressive (VAR) Model

Vector autoregressive (VAR) models are flexible and easy to implement models to capture co-movements regarding multivariate time series. VAR models are simple as there it regards endogenous and exogenous variables to be similar. Other than that, VAR models are normally presented via impulse responses to illustrate the effects of shock on the adjustment path of the variables while variance decomposition measure the relative importance of different shocks to the variation in different variables. The unrestricted VAR can also be known as reduced form VAR, and innovation generated by the model is therefore unexplainable.

A VAR in reduced form states each variable as a linear function of its own past values and the past values of all other variables used as well as a serially uncorrelated error term. The importance of VAR is to determine the lag length and it is a trade-off between the curse of dimensionality and appropriate models. In practice, Akaike information criteria (AIC) and Schwarz information criteria (SIC) are used to find out the lag length of all the variables in the system.

$$\Delta LFDI_t = \beta_{0,1} + \beta_{1,1}\Delta LFDI_{t-1} + \beta_{2,1}\Delta LREXR_{t-1} + \beta_{3,1}\Delta LTO_{t-1} + \beta_{4,1}\Delta LINFQ_{t-1} + \varepsilon_{t_{1,t}}$$

where,

$LFDI$	=	natural log of foreign direct investment inflow
$LREXR$	=	natural log of real exchange rate
LTO	=	natural log of trade openness
$LINFQ$	=	natural log of infrastructure quality

β_0 = intercept

ε_t = error term

t = time trend

t_{-1} = one period lagged value

3.6.4 Granger Causality Test

Granger (1969) developed a moderately straightforward test that defined causality as variable Y is said to Granger cause X, if X can be predicted with greater accuracy by using past values of variable Y rather than not using such past values, all other terms remain unaffected. Since future cannot predict the past, if variable X Granger causes variable Y, then changes in X should precede changes in Y. The concept of Granger Causality test is defined in terms of predictability and exploits the direction of the flow of time to achieve a causal ordering of associated variables. Since it does not rely on the specification of an econometric model, it is particularly suited for empirical model building strategies as such suggested by Sims (1980). According to Foresti (2007), Granger-causality test can be applied when under three different circumstances. First, a simple Granger-causality test between two variables and their lags. Second, a simple Granger-causality test between more than two variables and their lags. Last, a VAR framework, in this case the multivariate model is enlarged in order to test for the simultaneity of each and every one of the included variables.

Aravanan and Raza (2014) stated that Granger causality test requires all data series involved to be stationary. Otherwise, the inference from the F-statistics might be spurious because the test statistics will have non-standard distributions. The null hypothesis (H_0) is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X. In conclusion, one variable (X_t) is said to Granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice versa.

3.6.5 Variance Decomposition

Variance decomposition is used to capture how much of the forecasted error variance for variables in the system is explained by innovations to each explanatory variable including its own in the system over a series of time horizons. The shock (error term) does not necessarily affect other variables in the system, but also affects other shocks in the same system. According to Lastrapes (1992), variance decomposition analysis suggests that fluctuations in real and nominal exchange rates are due primarily to real shocks. Thus, real shocks dominate nominal shocks for both exchange rate series over short and long frequencies. Other than that, the behavior of the conditions of the real exchange rate differs greatly between countries with the characteristics just described and the industrial countries for which variance decompositions of real exchange rates are normally applied (Mendoza, 2000). Furthermore, Morales-Zumaquero (2006) proved that non-stability in the variance decomposition of the real exchange rates for advanced economies across samples saw a growing importance of nominal shocks.

3.6.6 Impulse Response Function (IRF)

Impulse response function (IRF) is a form of output of a dynamic system which refers to a reaction of a dynamic system when external changes occur. IRF shows the effects of shocks on the adjustment path of the variables and projects a time path for a variable explained in a VAR model. Pesavento and Rossi (2005) found IRFs to play a vital role in relating the impact that shocks have on the variables and are normally obtained from VAR. The impulse response function (IRF) is employed to determine the responsiveness of each of the macroeconomic variables towards an oil price shock (Enders & Serletis, 2010). In general, an impulse response refers to the response of any dynamic system in reaction to several external change (Lu & Xin, 2010). In addition, Borovicka, Hansen and Scheinkman

(2014) found that impulse response function characterize the impact of a stream of erratic shocks on dynamic economic models. For instance, they measure the consequences of alternative shocks on the future variables within the dynamic system.

3.7 Conclusion

This chapter provides discussion of data collection, data processing, data description, and also the methodologies to be used in the following chapter. The methodologies discussed are made up of unit root tests, cointegration test, error correction model, variance decomposition, and impulse response functions. These tests can be applied in order to find out the impact real exchange rate, trade openness, and infrastructure quality have on FDI. The following chapter is data analysis, where results from the mentioned tests will be presented and interpreted clearly.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In this chapter, empirical results were discussed for several forms of test. First, augmented Dickey-Fuller (ADF) and Philip Perron (PP) unit root test will be performed to check for the existence of unit root in the time series data. Next, Johansen Cointegration Test is used to test for cointegration between the time series. Vector Autogressive (VAR) model is then used in order to proceed to the remaining tests. Granger causality test is then performed to verify how useful a time series is in forecasting another set of time series followed by variance decomposition and impulse response function (IRFs).

4.1 Unit Root Test

Augmented Dickey-Fuller (ADF) and Philip Perron (PP) test were ran to detect whether a unit root exists in the time series data and to ensure that the series are stationary in order to avoid spurious results.

H_0 : *There is a unit root (Non-stationary).*

H_1 : *There is no unit root (Stationary).*

4.1.1 Augmented Dickey-Fuller (ADF) Test

Table 4.1: Augmented Dickey-Fuller Unit Root Test

	Augmented Dickey-Fuller			
	Constant without trend		**Constant with trend**	
Variables	**Level**	**First difference**	**Level**	**First difference**
FDI inflows	-2.006893 (0)	-10.24430 (0)**	-2.628853 (0)	-10.26656 (0)**
Infrastructure quality	-0.133356 (0)	-9.161224 (0)**	-3.847539 (0)	-9.122501 (0)**
Real exchange rate	-1.381704 (0)	-6.941364 (0)**	-2.664223 (0)	-6.875963 (0)**
Trade openness	-1.173054 (0)	-6.745398 (0)**	-1.040410 (0)	-6.767377 (0)**

Source: Obtained from EViews

Notes:
** and * indicates 1% and 5% significance level respectively. The number in parenthesis depicts the optimum lag length selected based on Schwarz Information Criterion (SIC).

4.1.2 Philip Perron (PP) Test

Table 4.2: Philip Perron Unit Root Test

	Philip Perron			
	Constant without trend		**Constant with trend**	
Variables	**Level**	**First difference**	**Level**	**First difference**
FDI inflows	-1.937250 (10)	-10.91011 (12)**	-2.399607 (1)	-12.39229 (17)**
Infrastructure quality	0.121154 (4)	-9.362010 (3)**	-3.847539 (0)*	-9.443090 (4)**
Real exchange rate	-1.233982 (7)	-7.517498 (14)**	-2.794157 (4)	-7.411896 (14)**
Trade openness	-1.150415 (4)	-6.726210 (5)**	-1.350342 (2)	-6.743186 (5)**

Source: Obtained from EViews

Notes:
** and * indicates 1% and 5% significance level respectively. The number in square bracket represents the bandwidth selected Newey-West Automatic Bandwidth Selection.

Results from the unit root tests revealed the variables to not be stationary at 1% significance level during level form, but infrastructure quality has a constant with trend that is stationary at level form at 5% significance level so the variables are differenced to their first order and all the variables are stationary at 1% significance level after the first difference. Thus, the null hypothesis is rejected.

This means all the variables are of stationary form and does not contain a unit root., implying the series are integrated of order one, *I*(1). Therefore, the time series are suitable to be used in this research.

4.2 Johansen Cointegration (JC) Test

Johansen cointegration test is a very popular method to detect cointegrating relationships between two or more variables. Despite being popular, one of the limitations of this test is that it is extremely sensitive to the lag length chosen to estimate the model. For that reason, lag length criteria is used to decide the exact amount of lag length to be used.

Table 4.3: Lag Length Selection Criterion

Lag	AIC	SIC
0	-2.098517	-1.951185
1	-8.522807	-7.786146 *
2	-8.519190	-7.193201
3	-8.862806*	-6.947488
4	-8.712630	-6.207983
5	-8.727048	-5.633073

Source: Obtained from EViews

Notes:
* represents the lag order decided by the criterion.
AIC : Akaike Information Criterion
SIC : Schwarz Information Criterion

Two criteria were used to obtain an appropriate lag length; Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). While SIC recommended lag length of 1 as the optimum lag, AIC suggested 3 lag length as optimum. Nevertheless, 1 lag length was selected as recommended by SIC as SIC is more accurate compared to AIC (Mukhtar & Rasheed, 2010). After selecting an optimum lag length, Johansen cointegration test is employed to find out the number of cointegrating vectors in the model.

Table 4.4: Johansen Cointegration Test

Hypothesized No. of CE(s)	**Trace Statistic**	**Max-Eigen Statistic**	**1% Critical Value**	
			Trace	**Maximum Eigenvalue**
r = 0	46.54794	30.96309	54.68150	32.71527
r ≤ 1	15.58484	11.78853	35.45817	25.86121
r ≤ 2	3.796310	3.789623	19.93711	18.52001
r ≤ 3	0.006687	0.006687	6.634897	6.634897

Source: Obtained from EViews

Notes:
r represents the number of cointegrated vectors.

H_0 : *There is no long run equilibrium relationship between the variables.*

H_1 : *There is long run equilibrium relationship between the variables.*

According to the table above, the existence of cointegrating relationships is not found when both trace and maximum eigenvalue test is used. With a cointegrating relationship, the variables are not associated in the long run.

This means that no cointegration is found, which means there is no long run relationship between FDI and its respective determinants in India. By not having a long run relationship, this implies that FDI, real exchange rate, trade openness, and infrastructure quality do not move together in the long run.

4.3 Vector Autoregressive (VAR) Model

After determining that no cointegrating relationship exists between the variables, so the following VAR model is estimated.

Model specification:

$$LFDI_t = 12.13 + 0.64LFDI_{t-1} + 0.71LTO_{t-1} + 0.89LREXR_{t-1} - 0.99LINFQ_{t-1}$$

According to the estimated model, the actual sign of each of the variables are determined.

Table 4.5: Comparison between expected and actual signs of each variable

Variable(s)	Expected sign	Actual sign
Trade openness	Positive	Positive
Real exchange rate	Positive	Positive
Infrastructure quality	***Positive***	***Negative***

Source: Obtained from EViews

Results have shown that there exists a positive short-run relationship between trade openness and FDI inflow in India. This is consistent with the research done by Albert and Stuart (2008) that study the impact of changes in macroeconomic variables by using a VAR model, and found that greater degree trade openness is favorable as it has a positive influence on FDI inflow. According to Khan, Rahman and Sattar (2012), the effectiveness of exchange rate on FDI was investigated and a positive relationship was found where an increase in exchange rate will raise the value of foreign currency, which in turn decreases the cost of production in local currency. However, the actual sign of infrastructure quality on FDI is of a negative relation, which differs from our expected sign. This is consistent with a study done by Head, Ries and Swenson (1999) where there is a negative effect between FDI inflow and infrastructure.

4.4 Granger Causality Test

Granger causality test is used in order to find out the causality between the times series and whether one of the time series can be employed in order to forecast another time series. Thus, if there exists a causal relationship between the variable, it can be used in forecasting FDI in India.

Table 4.6: Granger causality test between all the variables

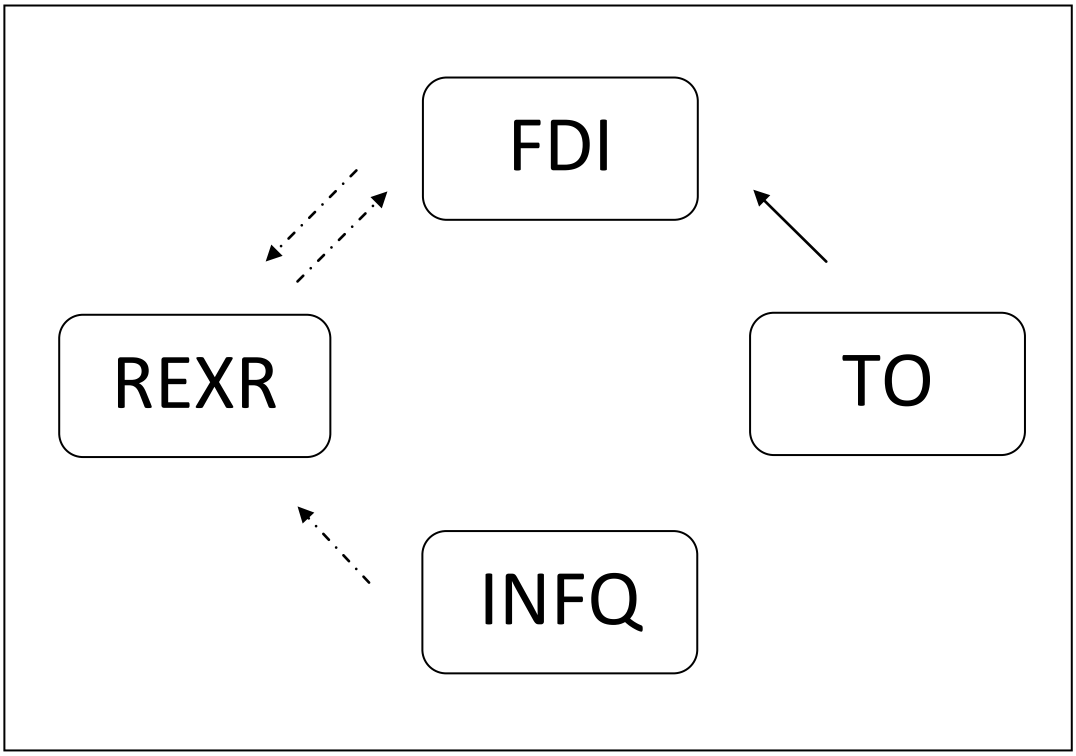
Variables	**FDI**	**TO**	**REXR**	**INFQ**
	←			
FDI		0.0082 **	0.0124 *	0.0507
TO	0.5142		0.1109	0.1774
REXR	0.0180 *	0.0306		0.0219 *
INFQ	0.4185	0.0619	0.6792	

Source: Obtained from Eviews

Notes:

** and * indicates 1% and 5% significance level respectively. The arrow pointing from the right direction to the left direction indicate the direction of the granger causality, as TO granger causes FDI, REXR granger causes FDI, INFQ granger causes FDI.

Figure 4.1: Granger causal relationships between the variables



Source: Developed for the research

→ Granger cause at 1% significance level

-·-·-→ Granger cause at 5% significance level

The figure illustrates the causality relationship between FDI and the independent variables which are real exchange rate, trade openness, and infrastructure quality.

4.4.1 Trade Openness (TO)

H_0: There is no short run causality from trade openness to FDI inflow.

H_1: There is short run causality from trade openness to FDI inflow.

Based on the results shown above, trade openness granger causes FDI at 1% significance level with a p-value of 0.0082, 0.82%. Hence, the null hypothesis is rejected and shows unidirectional relationship running from trade openness to FDI inflow. This finding is similar to that of Ay, Mangir and Sarac (2012) as the outcome of the test shows that there is unidirectional causality between FDI and trade openness in Turkey.

There is a unidirectional causality from trade openness to FDI at 1% significance level.

4.4.2 Real Exchange Rate (REXR)

H_0: There is no short run causality from real exchange rate to FDI inflow.

H_1: There is short run causality from real exchange rate to FDI inflow.

From Figure 4.1, a bidirectional causality can be observed between real exchange rate and FDI inflow, where real exchange rate granger causes FDI at 5% significance level with a p-value of 0.0124, 1.24% and a reverse causality with a p-value of 0.0180, 1.80%. Thus, the alternative hypothesis is accepted and the finding is consistent with previous studies done by Khan, Rehamn and Sattar (2012) where a bidirectional causality relationship was found between FDI and real exchange rate.

There is bidirectional causality running from real exchange rate to FDI and a reverse causality from FDI to real exchange rate at 5% significance level.

4.4.3 Infrastructure Quality (INFQ)

H_0: *There is no short run causality from infrastructure quality to FDI inflow.*

H_1: *There is short run causality from infrastructure quality to FDI inflow.*

For infrastructure quality, there is no granger causal relationship towards FDI in the short run at both 5% and 1% significance level. A research done by Sathye (2011) too did not manage to find a relationship between infrastructure and FDI. This is consistent with our finding.

4.5 Variance Decomposition

Table 4.7: Variance decomposition in tabular form

Quarter	S.E	LFDI	LTO	LREXR	LINFQ
1	0.314110	96.56966	0.001536	2.036003	1.392803
2	0.376662	95.37741	1.711451	1.501433	1.409704
3	0.411672	91.72147	4.505501	1.445062	2.327965
4	0.437613	87.46919	7.436043	2.028162	3.06663
5	0.458802	83.51637	10.05144	3.015876	3.416316
6	0.476597	80.13731	12.24535	4.131928	3.485411
7	0.491647	77.33537	14.05787	5.195355	3.411407
8	0.504415	75.02476	15.56691	6.122302	3.286025
9	0.515288	73.10566	16.84575	6.891262	3.157328
10	0.524608	71.49012	17.95174	7.511994	3.046146

Source: Obtained from EViews

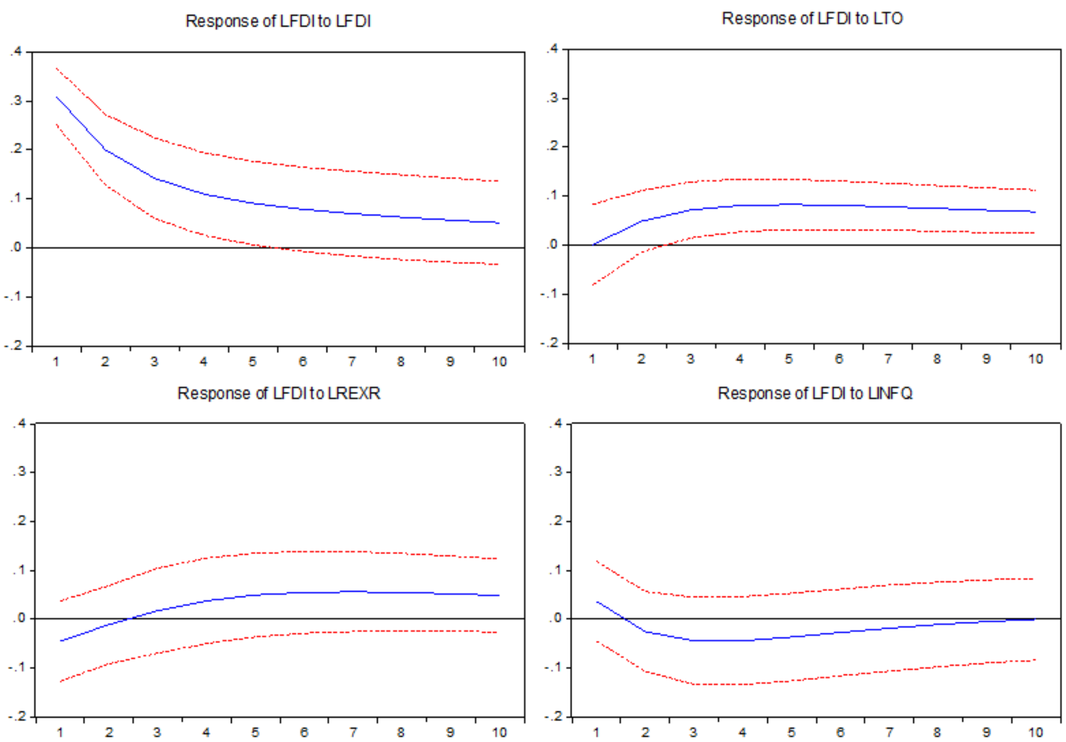
The table above depicts the output of variance decomposition of infrastructure quality, real exchange rate, and trade openness on FDI over a period of ten quarters. Results reveal that the variance of FDI mainly feeds on itself despite illustrating a decreasing trend over quarters, from 96.57 percent in the first quarter, to 71.49 percent in the tenth quarter. It still remains influential and plays an important role. The impact of trade openness on FDI is gradually increasing from nearly zero percent in the first quarter to 17.95 in the tenth period. This result is consistent with those of Hassan and Khan (2013), where trade openness is responsible in affecting FDI inflow.

Real exchange rate, on the other hand, has less impact on FDI when compared to trade openness. The impact of real exchange rate increases from period to period, from 2.04 percent in the first quarter to 7.51 percent in the tenth quarter. Chowdhury and Wheeler (2008) also found exchange rate to affect FDI in Japan, China, the United Kingdom, and the United States.

Last but not least, the impact of infrastructure quality on FDI is the least significant, from 1.39 percent in the first period to 3.05 percent in the tenth period. In conclusion, the unpredictability of FDI is mainly fed by its own discrepancy followed by the most impactful, trade openness, real exchange rate, and then infrastructure quality.

4.6 Impulse Response Function (IRFs)

Figure 4.2: Impulse response functions (IRFs) for ten periods



Source: Obtained from EViews

According to Figure 4.2, response to cholesky one standard deviation innovations were illustrated for up to ten quarters. The response of FDI to a change in FDI, real exchange rate, infrastructure quality, and trade openness indicates how FDI reacts to a change to these variables independently. First, by looking at the response of FDI to FDI, the reaction can be observed. If there is a positive shock of the standard deviation to FDI, FDI will decline gradually from the first quarter to the tenth quarter, depicting a downward trend of FDI in the future. The second graph illustrates the response of FDI to a change in trade openness. If one positive shock of standard deviation is given to trade openness, FDI will remain relatively stable from the first to the tenth quarter. In other words, trade openness and FDI have a stable and positive relationship in the future. Real exchange rate will cause FDI to grow from the first quarter to the fifth quarter. After fifth quarter, FDI still remains stable. At the first quarter, FDI and real exchange rate has a negative relationship. However, the trend became a positive one after the second quarter.

What about the response of FDI to infrastructure quality? If there is a positive shock on one standard deviation to infrastructure quality, FDI will decline from the first to third quarter, dropping to below zero. This means that there is a negative relationship where when infrastructure quality increases, FDI will decline at the same time and vice versa. Eventually, FDI performs steadily at zero equilibrium level.

4.7 Conclusion

By carrying out various data analysis such as Unit Root Test, estimating lag length criteria, finding the cointegrating relationship via Johansen Cointegration test, estimating VAR to find out the actual sign of the variables, and then Variance Decomposition and Impulse Response Function, the trend of the chosen independent variables towards FDI can be known. This next chapter discusses about our conclusion and also includes policy implications and limitations of study. Last but not least, policy recommendations will be made to improve the country’s condition in relation to FDI.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

This chapter is structured as follows. First, a summary of statistical analyses done in the previous chapter will be provided. Second, major findings of this study will be discussed in order to validate the research objective. In addition, policy implications for policy makers will be discussed before moving on to the limitations faced during the progress of completing this study. Last but not least, recommendations are made for future research in order to improve the results and findings.

5.1 Summary of Statistical Analyses

Before moving on to vector autoregressive (VAR) model and causality tests, the first requirement is to conduct unit root test as it serves as a purpose to ensure the time series data are of stationary form. Most of the time series data are of non-stationary form, so testing for unit root is extremely important because if data are non-stationary, results may be spurious. When spurious results are obtained, other econometric problems will happen which can cause the tests to become invalid, which means the whole study will become useless as the results are not accurate. By running ADF and PP test, all the variables are confirmed to be stationary at first difference and does not contain a unit root, which means the series are integrated of order one, $I(1)$. Thus, the time series are suitable to be used in this research.

After testing for unit root, Johansen cointegration test is used to determine any long run equilibrium relationship within the variables. In this case, no cointegrating vector is found which means there is a long run equilibrium relationship within the model does not exists. Detecting for cointegrating vector is important as it determines what model to use in the next step, vector autoregressive (VAR) or vector error correction (VEC) model. In this case, VAR model will be used as no long run relationship is found between FDI and the independent variables, and the purpose of using VAR model is to determine how short run dynamics of the time series moves. Results from VAR model shows that both the coefficients of trade openness and real exchange rate is of a positive value, which means trade openness and real exchange rate has a positive relationship with FDI.

Of course, just by obtaining the coefficients to explain the model is not sufficient so Granger causality test have to be carried out to detect short run causality between the variables. By doing so, directional causal relationships can be detected between variables and it will show whether a variable is unidirectional or bidirectional causal towards FDI. By knowing which variable is responsible in causing another variable, policy and recommendations towards improving FDI can be more accurate as the time series can be used to forecast FDI in the future.

After detecting for short run causality, variance decomposition and impulse response function were carried out. Variance decomposition shows the changes in dependent variable caused by its own error term and the impact of other variables on itself. By using variance decomposition, researchers will be able to know how much exactly this particular independent variable is influencing the dependent variable. The larger the percentage shown out of a hundred of an independent variable, the more influential that variable is. In this study, trade openness has the highest percentage in influencing FDI compared to real exchange rate and infrastructure quality. Impulse response function, on the other hand, studies the effect of a shock in the independent variable to the response of the dependent variable, in this case, the response of FDI to a change in real exchange rate, infrastructure quality and trade openness.

5.2 Discussion of Major Findings

Several tests were conducted in this study such as unit root test, Johansen cointegration test, vector error correction (VAR) model, Granger causality test, variance decomposition, and impulse response function. The purpose of running these entire tests is to determine the relationship between the variables to FDI and also its causality and impact. Johansen cointegration test was carried out to determine the long run relationship between the variables and results illustrates the non-existence of a long run relationship. Hence, VAR model was constructed and the actual sign of the independent variables were identified as well. Granger causality test was then used to determine short run causality relation. Based on the causality test, only real exchange rate and trade openness has a granger causal relationship with FDI while infrastructure quality does not granger causes FDI. Moving forward to variance decomposition, results show that all variables influencing FDI despite infrastructure quality having a smaller impact compared to the other two variables. Impulse response function was then used and findings show that FDI will tend to be affected in the first few quarters but will stabilize over time when the time period is longer.

In this study, real exchange rate, trade openness, and infrastructure quality were examined in terms of its impact on FDI inflows. Based on the result attained, trade openness has a huge impact on FDI in India. It is found to be significant and have a positive relationship with FDI inflows, which is consistent to the findings by Dinda (2009) who stated that this can be explained by resource seeking FDI. This means that if India is a country with high level of openness to trade, it will attract FDI inflow as it will be easier to trade with other countries as there are no barriers on trade. Besides, Esew and Yaroson (2014) found a significant and positive relationship between trade openness and FDI. In addition, Liargovas and Skandalis (2013) found free trade agreements (FTA) to be helpful in attracting FDI inflow. All these studies indicate that if trade openness increases, it will boost the inflow of FDI into a country.

Real exchange rate too has a positive relationship with FDI in India. Based on the results obtained, real exchange rate does have some impact on FDI but it is not as strong as the impact given by trade openness. The positive relationship between FDI and real exchange rate is similar as a research done by Nyamruda (2012) depicts a positive influence between exchange rate and FDI inflow. Besides, an appreciation towards exchange rate will raise the value of foreign currency and decrease the cost of production in host currency. Hence, a positive relationship exists among FDI and exchange rate as it will be able to attract FDI inflow. In addition, infrastructure quality is found to not have so much of an impact on FDI inflows and this finding is consistent to that of Onyeiwe and Shrestha (2004) where infrastructure is less influential to FDI inflows because poor infrastructure is not as important as other factors such as availability of natural resources, trade openness and other macroeconomic variables which may be more significant in influencing FDI inflows.

Moreover, a research done by Pradhan (2008) found a negative relationship between infrastructure quality and FDI inflow, where an increase in infrastructure quality tend to lower foreign investment inflow. This is due to more competition in the domestic market, which restricts FDI inflows. All these findings are very informative and powerful to policymakers and foreign investors as all the determinants studied upon are important variable which can be used to forecast and determine the trend of FDI inflow of India.

5.3 Policy Implications

During post reform period, India’s competence in drawing in FDI as a host has been relatively low compared to other developing countries. Investment climate, fluctuating foreign exchange rate, poor infrastructure are a few of the reasons for low FDI inflows (Ahktar, 2013).

Main reasons for these low FDI inflows has been related to the investment climate, poor infrastructure, foreign exchange rate fluctuation and business facilitation, which are comparatively at a lower level (Akhtar, 2013). Therefore, policies should focus on improving trade openness and stability of exchange rate.

In another case, trade openness should be promoted in attracting FDI. Dinda (2009) stated that the policymakers should intensify the trade liberalization policy which was initiated under the structural adjustment program in 1986, so as to increase the openness of the economy that attract FDI to and should be cautious about political crises and social unrest that discourage foreign investment. Thus, Indian policymakers should concerns about the critical of the trade openness that would bring a negative impact on FDI inflows to the country. When trade is being liberalized, the Indian economy grows rapidly over the past decade. Government has reduced the tariff rate on imports and reduced export constraint. However, the level of protection through tariff remains relatively high. Eventually, it is crucial to address the problem of fiscal deficits which reduces public spending. Therefore, policymakers should reduce the tariff given the acceptance level of protection. According to Topalova (2010), he examines that the decline in tariffs was followed by a substantial increase in trade flows.

India devalued its Indian rupee in 1991 as part of the economic liberalization. When a currency depreciates, its value declines relative to the value of another currency which reduces that country's wages and production costs relative to those of its foreign counterpart (Goldberg, 2006). By devaluing its currency, it also increases the attractiveness from foreigners. Therefore, it has been proven that the exchange rate depreciation improves the rate of return to foreigners considering an investment project overseas in this country. In other word, the exchange rate depreciation will inversely affect the FDI inflows from the country. Besides, India had implemented fixed exchange rate. This system will minimize the exchange rate volatility towards the country. For this purpose, it is crucial to improve domestic competitiveness and build the investor's confidence. Thus, government is advised to keep the exchange rate at a relatively stable value. After 1993, government started to implement the floating exchange rate regime. The floating exchange rate system is relatively riskier than fixed exchange rate because the it will introduces instability as well as uncertainty into trade at each time period. However, it would be more competitive given their inflation rate than fixed exchange rate. In addition, the floating exchange rate permits a country to re-adjust flexibly to peripheral shock. Azim, Haider and Ullah (2012) highlighted that their policy recommendation is to minimize the exchange rate volatility and keep exchange rates in at a stable value.

Based on the findings, the level of infrastructure of India has a minor impact on FDI inflows. According to Thilakaweera (2014), she found that strategies to enhance level of infrastructure of the country should be developed by the policy makers to enhance the economic growth of Sri Lanka. MNCs seeking to invest in infrastructure development also consider the income level of the host country and structure of the income distribution in order to assess the expected return on their investments. Initially, it is advisable for the government of India to enhance the income level of India thus increase the infrastructure development. In other word, when the income level of the country increases, more funding will be allocated to be spent on infrastructure development. However, India does not possess such funding for it to spend on developing infrastructure as the income level of India is lower compared to other such as the United States and China. According to Renard (2011), China has developed industries and competitive services with special expertise in the execution of public work based on constructing huge infrastructure projects. Therefore, China has a larger income level to develop on its infrastructure compared to India.

In order to attract FDI inflows in India, government is advised to focus on improving these three components by using appropriate and efficient policies. For instance, implementing a stable exchange rate in the country to improve the investor’s confidence can lead to an increase in FDI inflows. On the other hand, the Indian government should also be obligated to liberalize the trade policy to increase openness in the country. These are essential in order to achieve long term goals of the country. Since India is a developing country, there are a lot of underdeveloped sectors that needs attention and improvement. Nevertheless, policymakers should also be more concerned with other macroeconomic variables that are useful in attracting FDI inflows in India.

5.4 Limitations of Study

During the progress of completing this paper, several limitations have been found. The main problem is due to limited sources of data. First, only three forms of independent variable are studied upon in order to find out the relationship on FDI inflow. Initially this research consists of over 6 independent variables some of which are education, market size, and inflation. The problem is with the missing values in some of the periods for the mentioned variables. Therefore, the results obtained from data analysis may not be accurate as the missing values may have cause the model to be spurious. That is why the mentioned variables were not included into this study. This limitation will cause researchers to omit possibly important determinants that may be influential and useful to the study and end up causing model specification bias and inaccuracy to the research.

In addition, the sample size of this study is considered as a small sample size, consisting of a mere 59 quarterly observations ranging from 1999 to 2013. With such a small sample size, the model may not be as precise compared to a model with a huge sample size, causing the small sample sized model to lose information.

Besides, this limitation will result in less precise results, as a small sample size has confidence interval which tends to be wider. Furthermore, time constraint is another limitation while carrying out this study. Under normal circumstances, researchers will allocate a lot of time for reading materials such as literature, journal articles and books in order to understand more about the research, compare between several studies, and many other details so that they are able to perfect their results and thesis. Due to time constraint, not enough time was allocated and only three variables were chosen to study upon.

5.5 Recommendations for Future Research

Since the main limitations encountered during this study are data constraint, insufficient sample size and time constraint, recommendations will be provided to future researchers who are interested in further researching this title or paper. First, it is correct that 30 observations is the minimum sample period to study a linear regression model, but for VAR model, the sample size needs to exceed more than a mere 30 observations as it has to go through a particular process in VAR model such as the lag length criteria process and the 59 observations used in this study is just sufficient. So, the number of observations should be increased accordingly to the increase in independent variable. In this paper, the interval for time series data is of a quarterly trend and it is more appropriate to use monthly data instead of quarterly and annual. The larger the sample size, the lower the probability of the model experiencing econometric problems such as specification bias, heteroscedasticity, autocorrelation, and so on.

Second, due to data collection constraint, future researchers are encouraged to obtain data from institutional database instead. There are many alternatives for data collection such as International Monetary Fund (IMF), World Bank Database, Yahoo Finance, Mundi Index which provides not just annually, but also quarterly and monthly too. In addition, the government official website such as India Finance Department and India Statistics Department will also provide free and accurate data as the departments mentioned above are fully funded by the government to implement census annually, quarterly, and monthly.

Third, as this study focuses mainly on time series data and India, researchers are suggested to employ panel data to conduct their research for this topic as these countries are the fastest growing FDI inflow recipients and share similar backgrounds thus is suitable for comparison. By doing so, researchers may provide a totally different perspective on studying the impact of variables on FDI inflows. Therefore, it is recommended that future researchers employ panel data to avoid the limitations caused by time series data.

Besides, future researchers who intend to conduct a study based on this title are advised to use other proxies such as the availability of telecommunications (landlines, internet) and availability of transport (roads, railways, ports) for infrastructure quality besides electric, water and gas supply as it only represents part of a country's infrastructure quality but not as a whole. Future researchers should replace it with a better proxy in order to attain the best result. Moreover, other variables can be included in order to estimate a better and more relevant model.

5.6 Conclusion

By understanding the dynamics between these variables, the objectives of this study are fulfilled. First, the trend of FDI can be seen from the impulse responses by understanding how does FDI react to a shock in trade openness, real exchange rate, and infrastructure quality. Second, the nexus between FDI and the mentioned variables above is clarified as the percentage of the variables in causing FDI independently is shown by variance decomposing them. Besides, limitations of this study were also pointed out and recommendations were given in order to curb the said limitations.

In conclusion, this study sheds light on the nexus between FDI inflow, trade openness, real exchange rate and infrastructure quality in India. Trade openness is indeed a major influence towards FDI as it has a positive relationship with FDI inflow in India. Besides trade openness being an impact, real exchange rate was found to have a positive impact on FDI too, just not that much compared to trade openness. Despite this, infrastructure quality which was thought to have a major impact towards FDI was found to have a negative relationship with FDI and was found to only have a mere 3 percent or lesser impact in a time span of ten quarters. The findings of this study can be used as a reference for the policymakers of India to stimulate FDI inflow.

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APPENDICES

Appendix 1: Unit Root Test on Foreign Direct Investment

ADF Test at Level Form with Intercept

Null Hypothesis: LFDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.006893	0.2832
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI)
Method: Least Squares
Date: 07/23/14 Time: 16:13
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI(-1)	-0.089748	0.044720	-2.006893	0.0496
C	1.797340	0.874805	2.054561	0.0446

R-squared	0.067096	Mean dependent var	0.043933
Adjusted R-squared	0.050437	S.D. dependent var	0.344772
S.E. of regression	0.335965	Akaike info criterion	0.690252
Sum squared resid	6.320845	Schwarz criterion	0.761302
Log likelihood	-18.01732	Hannan-Quinn criter.	0.717928
F-statistic	4.027621	Durbin-Watson stat	2.522970
Prob(F-statistic)	0.049598		

ADF Test at First Difference with Intercept

Null Hypothesis: D(LFDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.24430	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI,2)
Method: Least Squares
Date: 07/23/14 Time: 16:20
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	-1.320607	0.128911	-10.24430	0.0000
C	0.055037	0.044254	1.243671	0.2189

R-squared	0.656133	Mean dependent var	-0.013556
Adjusted R-squared	0.649881	S.D. dependent var	0.558150
S.E. of regression	0.330262	Akaike info criterion	0.656596
Sum squared resid	5.999013	Schwarz criterion	0.728282
Log likelihood	-16.71299	Hannan-Quinn criter.	0.684456
F-statistic	104.9457	Durbin-Watson stat	1.997376
Prob(F-statistic)	0.000000		

ADF Test at Level Form with Trend and Intercept

Null Hypothesis: LFDI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.628853	0.2696
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI)
Method: Least Squares
Date: 07/23/14 Time: 16:21
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI(-1)	-0.241850	0.091998	-2.628853	0.0111
C	4.468425	1.658993	2.693457	0.0094
@TREND(5/01/1999)	0.010188	0.005421	1.879334	0.0655

R-squared	0.123389	Mean dependent var	0.043933
Adjusted R-squared	0.091512	S.D. dependent var	0.344772
S.E. of regression	0.328618	Akaike info criterion	0.662497
Sum squared resid	5.939436	Schwarz criterion	0.769071
Log likelihood	-16.21240	Hannan-Quinn criter.	0.704010
F-statistic	3.870807	Durbin-Watson stat	2.297219
Prob(F-statistic)	0.026742		

ADF Test at First Difference with Trend and Intercept

Null Hypothesis: D(LFDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.26656	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI,2)
Method: Least Squares
Date: 07/23/14 Time: 16:23
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	-1.329784	0.129526	-10.26656	0.0000
C	0.127934	0.092051	1.389810	0.1703
@TREND(5/01/1999)	-0.002414	0.002672	-0.903582	0.3702

R-squared	0.661255	Mean dependent var	-0.013556
Adjusted R-squared	0.648709	S.D. dependent var	0.558150
S.E. of regression	0.330814	Akaike info criterion	0.676677
Sum squared resid	5.909661	Schwarz criterion	0.784206
Log likelihood	-16.28531	Hannan-Quinn criter.	0.718467
F-statistic	52.70597	Durbin-Watson stat	2.013278
Prob(F-statistic)	0.000000		

PP Test at Level Form with Intercept

Null Hypothesis: LFDI has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.937250	0.3134
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Residual variance (no correction)	0.108980
HAC corrected variance (Bartlett kernel)	0.072193

Phillips-Perron Test Equation
Dependent Variable: D(LFDI)
Method: Least Squares
Date: 07/23/14 Time: 16:27
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI(-1)	-0.089748	0.044720	-2.006893	0.0496
C	1.797340	0.874805	2.054561	0.0446

R-squared	0.067096	Mean dependent var	0.043933
Adjusted R-squared	0.050437	S.D. dependent var	0.344772
S.E. of regression	0.335965	Akaike info criterion	0.690252
Sum squared resid	6.320845	Schwarz criterion	0.761302
Log likelihood	-18.01732	Hannan-Quinn criter.	0.717928
F-statistic	4.027621	Durbin-Watson stat	2.522970
Prob(F-statistic)	0.049598		

PP Test at First Difference with Intercept

Null Hypothesis: D(LFDI) has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.91011	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Residual variance (no correction)	0.105246
HAC corrected variance (Bartlett kernel)	0.074897

Phillips-Perron Test Equation
Dependent Variable: D(LFDI,2)
Method: Least Squares
Date: 07/23/14 Time: 16:28
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	-1.320607	0.128911	-10.24430	0.0000
C	0.055037	0.044254	1.243671	0.2189

R-squared	0.656133	Mean dependent var	-0.013556
Adjusted R-squared	0.649881	S.D. dependent var	0.558150
S.E. of regression	0.330262	Akaike info criterion	0.656596
Sum squared resid	5.999013	Schwarz criterion	0.728282
Log likelihood	-16.71299	Hannan-Quinn criter.	0.684456
F-statistic	104.9457	Durbin-Watson stat	1.997376
Prob(F-statistic)	0.000000		

PP Test at Level Form with Trend and Intercept

Null Hypothesis: LFDI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.399607	0.3759
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Residual variance (no correction)	0.102404
HAC corrected variance (Bartlett kernel)	0.084912

Phillips-Perron Test Equation
Dependent Variable: D(LFDI)
Method: Least Squares
Date: 07/23/14 Time: 16:29
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI(-1)	-0.241850	0.091998	-2.628853	0.0111
C	4.468425	1.658993	2.693457	0.0094
@TREND(5/01/1999)	0.010188	0.005421	1.879334	0.0655

R-squared	0.123389	Mean dependent var	0.043933
Adjusted R-squared	0.091512	S.D. dependent var	0.344772
S.E. of regression	0.328618	Akaike info criterion	0.662497
Sum squared resid	5.939436	Schwarz criterion	0.769071
Log likelihood	-16.21240	Hannan-Quinn criter.	0.704010
F-statistic	3.870807	Durbin-Watson stat	2.297219
Prob(F-statistic)	0.026742		

PP Test at First Difference with Trend and Intercept

Null Hypothesis: D(LFDI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.39229	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Residual variance (no correction)	0.103678
HAC corrected variance (Bartlett kernel)	0.046241

Phillips-Perron Test Equation
Dependent Variable: D(LFDI,2)
Method: Least Squares
Date: 07/23/14 Time: 16:31
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	-1.329784	0.129526	-10.26656	0.0000
C	0.127934	0.092051	1.389810	0.1703
@TREND(5/01/1999)	-0.002414	0.002672	-0.903582	0.3702

R-squared	0.661255	Mean dependent var	-0.013556
Adjusted R-squared	0.648709	S.D. dependent var	0.558150
S.E. of regression	0.330814	Akaike info criterion	0.676677
Sum squared resid	5.909661	Schwarz criterion	0.784206
Log likelihood	-16.28531	Hannan-Quinn criter.	0.718467
F-statistic	52.70597	Durbin-Watson stat	2.013278
Prob(F-statistic)	0.000000		

Appendix 2: Unit Root Test on Infrastructure Quality

ADF Test at Level Form with Intercept

Null Hypothesis: LINFQ has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.133356	0.9404
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFQ)
Method: Least Squares
Date: 07/23/14 Time: 16:32
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFQ(-1)	-0.002567	0.019247	-0.133356	0.8944
C	0.077389	0.426656	0.181385	0.8567

R-squared	0.000317	Mean dependent var	0.020501
Adjusted R-squared	-0.017534	S.D. dependent var	0.057812
S.E. of regression	0.058317	Akaike info criterion	-2.811987
Sum squared resid	0.190446	Schwarz criterion	-2.740937
Log likelihood	83.54763	Hannan-Quinn criter.	-2.784312
F-statistic	0.017784	Durbin-Watson stat	2.409081
Prob(F-statistic)	0.894390		

ADF Test at First Difference with Intercept

Null Hypothesis: D(LINFQ) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.161224	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFQ,2)
Method: Least Squares
Date: 07/23/14 Time: 16:33
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFQ(-1))	-1.209434	0.132017	-9.161224	0.0000
C	0.025029	0.008106	3.087897	0.0032

R-squared	0.604112	Mean dependent var	-0.000252
Adjusted R-squared	0.596914	S.D. dependent var	0.090630
S.E. of regression	0.057540	Akaike info criterion	-2.838203
Sum squared resid	0.182099	Schwarz criterion	-2.766517
Log likelihood	82.88879	Hannan-Quinn criter.	-2.810344
F-statistic	83.92803	Durbin-Watson stat	2.044251
Prob(F-statistic)	0.000000		

ADF Test at Level Form with Trend and Intercept

Null Hypothesis: LINFQ has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.847539	0.0208
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFQ)
Method: Least Squares
Date: 07/23/14 Time: 16:34
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFQ(-1)	-0.381776	0.099226	-3.847539	0.0003
C	8.212076	2.130737	3.854101	0.0003
@TREND(5/01/1999)	0.009151	0.002358	3.880471	0.0003

R-squared	0.215186	Mean dependent var	0.020501
Adjusted R-squared	0.186647	S.D. dependent var	0.057812
S.E. of regression	0.052138	Akaike info criterion	-3.019495
Sum squared resid	0.149512	Schwarz criterion	-2.912921
Log likelihood	90.56537	Hannan-Quinn criter.	-2.977982
F-statistic	7.540152	Durbin-Watson stat	2.089114
Prob(F-statistic)	0.001277		

ADF Test at First Difference with Trend and Intercept

Null Hypothesis: D(LINFQ) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.122501	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFQ,2)
Method: Least Squares
Date: 07/23/14 Time: 16:35
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFQ(-1))	-1.215319	0.133222	-9.122501	0.0000
C	0.017093	0.016039	1.065763	0.2913
@TREND(5/01/1999)	0.000269	0.000467	0.574636	0.5679

R-squared	0.606518	Mean dependent var	-0.000252
Adjusted R-squared	0.591944	S.D. dependent var	0.090630
S.E. of regression	0.057894	Akaike info criterion	-2.809212
Sum squared resid	0.180992	Schwarz criterion	-2.701683
Log likelihood	83.06253	Hannan-Quinn criter.	-2.767422
F-statistic	41.61808	Durbin-Watson stat	2.046478
Prob(F-statistic)	0.000000		

PP Test at Level Form with Intercept

Null Hypothesis: LINFQ has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.121154	0.9647
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Residual variance (no correction)	0.003284
HAC corrected variance (Bartlett kernel)	0.001929

Phillips-Perron Test Equation
Dependent Variable: D(LINFQ)
Method: Least Squares
Date: 07/23/14 Time: 16:37
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFQ(-1)	-0.002567	0.019247	-0.133356	0.8944
C	0.077389	0.426656	0.181385	0.8567

R-squared	0.000317	Mean dependent var	0.020501
Adjusted R-squared	-0.017534	S.D. dependent var	0.057812
S.E. of regression	0.058317	Akaike info criterion	-2.811987
Sum squared resid	0.190446	Schwarz criterion	-2.740937
Log likelihood	83.54763	Hannan-Quinn criter.	-2.784312
F-statistic	0.017784	Durbin-Watson stat	2.409081
Prob(F-statistic)	0.894390		

PP Test at First Difference with Intercept

Null Hypothesis: D(LINFQ) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.362010	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Residual variance (no correction)	0.003195
HAC corrected variance (Bartlett kernel)	0.002660

Phillips-Perron Test Equation
Dependent Variable: D(LINFQ,2)
Method: Least Squares
Date: 07/23/14 Time: 16:39
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFQ(-1))	-1.209434	0.132017	-9.161224	0.0000
C	0.025029	0.008106	3.087897	0.0032

R-squared	0.604112	Mean dependent var	-0.000252
Adjusted R-squared	0.596914	S.D. dependent var	0.090630
S.E. of regression	0.057540	Akaike info criterion	-2.838203
Sum squared resid	0.182099	Schwarz criterion	-2.766517
Log likelihood	82.88879	Hannan-Quinn criter.	-2.810344
F-statistic	83.92803	Durbin-Watson stat	2.044251
Prob(F-statistic)	0.000000		

PP Test at Level Form with Trend and Intercept

Null Hypothesis: LINFQ has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.847539	0.0208
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Residual variance (no correction)	0.002578
HAC corrected variance (Bartlett kernel)	0.002578

Phillips-Perron Test Equation
Dependent Variable: D(LINFQ)
Method: Least Squares
Date: 07/23/14 Time: 16:40
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFQ(-1)	-0.381776	0.099226	-3.847539	0.0003
C	8.212076	2.130737	3.854101	0.0003
@TREND(5/01/1999)	0.009151	0.002358	3.880471	0.0003

R-squared	0.215186	Mean dependent var	0.020501
Adjusted R-squared	0.186647	S.D. dependent var	0.057812
S.E. of regression	0.052138	Akaike info criterion	-3.019495
Sum squared resid	0.149512	Schwarz criterion	-2.912921
Log likelihood	90.56537	Hannan-Quinn criter.	-2.977982
F-statistic	7.540152	Durbin-Watson stat	2.089114
Prob(F-statistic)	0.001277		

PP Test at First Difference with Trend and Intercept

Null Hypothesis: D(LINFQ) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.443090	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Residual variance (no correction)	0.003175
HAC corrected variance (Bartlett kernel)	0.002419

Phillips-Perron Test Equation
Dependent Variable: D(LINFQ,2)
Method: Least Squares
Date: 07/23/14 Time: 16:44
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFQ(-1))	-1.215319	0.133222	-9.122501	0.0000
C	0.017093	0.016039	1.065763	0.2913
@TREND(5/01/1999)	0.000269	0.000467	0.574636	0.5679

R-squared	0.606518	Mean dependent var	-0.000252
Adjusted R-squared	0.591944	S.D. dependent var	0.090630
S.E. of regression	0.057894	Akaike info criterion	-2.809212
Sum squared resid	0.180992	Schwarz criterion	-2.701683
Log likelihood	83.06253	Hannan-Quinn criter.	-2.767422
F-statistic	41.61808	Durbin-Watson stat	2.046478
Prob(F-statistic)	0.000000		

Appendix 3: Unit Root Test on Real Exchange Rate

ADF Test at Level Form with Intercept

Null Hypothesis: LREXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.381704	0.5851
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREXR)
Method: Least Squares
Date: 07/23/14 Time: 16:45
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREXR(-1)	-0.063411	0.045893	-1.381704	0.1726
C	0.275617	0.196824	1.400323	0.1669

R-squared	0.032967	Mean dependent var	0.003796
Adjusted R-squared	0.015699	S.D. dependent var	0.047018
S.E. of regression	0.046647	Akaike info criterion	-3.258521
Sum squared resid	0.121855	Schwarz criterion	-3.187471
Log likelihood	96.49711	Hannan-Quinn criter.	-3.230846
F-statistic	1.909107	Durbin-Watson stat	1.817986
Prob(F-statistic)	0.172550		

ADF Test at First Difference with Intercept

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.941364	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREXR,2)
Method: Least Squares
Date: 07/23/14 Time: 16:46
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREXR(-1))	-0.956712	0.137828	-6.941364	0.0000
C	0.003984	0.006336	0.628773	0.5321

R-squared	0.466964	Mean dependent var	0.001629
Adjusted R-squared	0.457273	S.D. dependent var	0.064841
S.E. of regression	0.047768	Akaike info criterion	-3.210462
Sum squared resid	0.125498	Schwarz criterion	-3.138776
Log likelihood	93.49816	Hannan-Quinn criter.	-3.182602
F-statistic	48.18254	Durbin-Watson stat	1.896435
Prob(F-statistic)	0.000000		

ADF Test at Level Form with Trend and Intercept

Null Hypothesis: LREXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.664223	0.2549
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREXR)
Method: Least Squares
Date: 07/23/14 Time: 16:47
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREXR(-1)	-0.236261	0.088679	-2.664223	0.0101
C	0.969628	0.362267	2.676553	0.0098
@TREND(5/01/1999)	0.001591	0.000707	2.250260	0.0285

R-squared	0.114493	Mean dependent var	0.003796
Adjusted R-squared	0.082293	S.D. dependent var	0.047018
S.E. of regression	0.045042	Akaike info criterion	-3.312110
Sum squared resid	0.111582	Schwarz criterion	-3.205535
Log likelihood	99.05119	Hannan-Quinn criter.	-3.270597
F-statistic	3.555656	Durbin-Watson stat	1.683660
Prob(F-statistic)	0.035300		

ADF Test at First Difference with Trend and Intercept

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.875963	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREXR,2)
Method: Least Squares
Date: 07/23/14 Time: 16:48
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREXR(-1))	-0.958302	0.139370	-6.875963	0.0000
C	0.005985	0.013323	0.449241	0.6551
@TREND(5/01/1999)	-6.66E-05	0.000389	-0.171210	0.8647

R-squared	0.467253	Mean dependent var	0.001629
Adjusted R-squared	0.447522	S.D. dependent var	0.064841
S.E. of regression	0.048195	Akaike info criterion	-3.175917
Sum squared resid	0.125430	Schwarz criterion	-3.068388
Log likelihood	93.51362	Hannan-Quinn criter.	-3.134127
F-statistic	23.68074	Durbin-Watson stat	1.895321
Prob(F-statistic)	0.000000		

PP Test at Level Form with Intercept

Null Hypothesis: LREXR has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.233982	0.6539
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Residual variance (no correction)	0.002101
HAC corrected variance (Bartlett kernel)	0.001624

Phillips-Perron Test Equation
Dependent Variable: D(LREXR)
Method: Least Squares
Date: 07/23/14 Time: 16:50
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREXR(-1)	-0.063411	0.045893	-1.381704	0.1726
C	0.275617	0.196824	1.400323	0.1669

R-squared	0.032967	Mean dependent var	0.003796
Adjusted R-squared	0.015699	S.D. dependent var	0.047018
S.E. of regression	0.046647	Akaike info criterion	-3.258521
Sum squared resid	0.121855	Schwarz criterion	-3.187471
Log likelihood	96.49711	Hannan-Quinn criter.	-3.230846
F-statistic	1.909107	Durbin-Watson stat	1.817986
Prob(F-statistic)	0.172550		

PP Test at First Difference with Intercept

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.517498	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Residual variance (no correction)	0.002202
HAC corrected variance (Bartlett kernel)	0.000758

Phillips-Perron Test Equation
Dependent Variable: D(LREXR,2)
Method: Least Squares
Date: 07/23/14 Time: 16:51
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREXR(-1))	-0.956712	0.137828	-6.941364	0.0000
C	0.003984	0.006336	0.628773	0.5321

R-squared	0.466964	Mean dependent var	0.001629
Adjusted R-squared	0.457273	S.D. dependent var	0.064841
S.E. of regression	0.047768	Akaike info criterion	-3.210462
Sum squared resid	0.125498	Schwarz criterion	-3.138776
Log likelihood	93.49816	Hannan-Quinn criter.	-3.182602
F-statistic	48.18254	Durbin-Watson stat	1.896435
Prob(F-statistic)	0.000000		

PP Test at Level Form with Trend and Intercept

Null Hypothesis: LREXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.794157	0.2053
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Residual variance (no correction)	0.001924
HAC corrected variance (Bartlett kernel)	0.002142

Phillips-Perron Test Equation
Dependent Variable: D(LREXR)
Method: Least Squares
Date: 07/23/14 Time: 16:53
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREXR(-1)	-0.236261	0.088679	-2.664223	0.0101
C	0.969628	0.362267	2.676553	0.0098
@TREND(5/01/1999)	0.001591	0.000707	2.250260	0.0285

R-squared	0.114493	Mean dependent var	0.003796
Adjusted R-squared	0.082293	S.D. dependent var	0.047018
S.E. of regression	0.045042	Akaike info criterion	-3.312110
Sum squared resid	0.111582	Schwarz criterion	-3.205535
Log likelihood	99.05119	Hannan-Quinn criter.	-3.270597
F-statistic	3.555656	Durbin-Watson stat	1.683660
Prob(F-statistic)	0.035300		

PP Test at First Difference with Trend and Intercept

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.411896	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Residual variance (no correction)	0.002201
HAC corrected variance (Bartlett kernel)	0.000750

Phillips-Perron Test Equation
Dependent Variable: D(LREXR,2)
Method: Least Squares
Date: 07/23/14 Time: 16:55
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREXR(-1))	-0.958302	0.139370	-6.875963	0.0000
C	0.005985	0.013323	0.449241	0.6551
@TREND(5/01/1999)	-6.66E-05	0.000389	-0.171210	0.8647

R-squared	0.467253	Mean dependent var	0.001629
Adjusted R-squared	0.447522	S.D. dependent var	0.064841
S.E. of regression	0.048195	Akaike info criterion	-3.175917
Sum squared resid	0.125430	Schwarz criterion	-3.068388
Log likelihood	93.51362	Hannan-Quinn criter.	-3.134127
F-statistic	23.68074	Durbin-Watson stat	1.895321
Prob(F-statistic)	0.000000		

Appendix 4: Unit Root Test on Trade Openness

ADF Test at Level Form with Intercept

Null Hypothesis: LTO has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.173054	0.6803
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTO)
Method: Least Squares
Date: 07/23/14 Time: 16:57
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTO(-1)	-0.014590	0.012437	-1.173054	0.2457
C	0.305993	0.228003	1.342055	0.1850

R-squared	0.023983	Mean dependent var	0.038784
Adjusted R-squared	0.006554	S.D. dependent var	0.075560
S.E. of regression	0.075312	Akaike info criterion	-2.300490
Sum squared resid	0.317623	Schwarz criterion	-2.229440
Log likelihood	68.71421	Hannan-Quinn criter.	-2.272815
F-statistic	1.376056	Durbin-Watson stat	1.815282
Prob(F-statistic)	0.245740		

ADF Test at First Difference with Intercept

Null Hypothesis: D(LTO) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.745398	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTO,2)
Method: Least Squares
Date: 07/23/14 Time: 16:58
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTO(-1))	-0.912805	0.135323	-6.745398	0.0000
C	0.034318	0.011482	2.988917	0.0042

R-squared	0.452738	Mean dependent var	-0.002476
Adjusted R-squared	0.442788	S.D. dependent var	0.102187
S.E. of regression	0.076280	Akaike info criterion	-2.274368
Sum squared resid	0.320021	Schwarz criterion	-2.202682
Log likelihood	66.81948	Hannan-Quinn criter.	-2.246508
F-statistic	45.50039	Durbin-Watson stat	1.993146
Prob(F-statistic)	0.000000		

ADF Test at Level Form with Trend and Intercept

Null Hypothesis: LTO has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.040410	0.9298
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTO)
Method: Least Squares
Date: 07/23/14 Time: 16:59
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTO(-1)	-0.071132	0.068369	-1.040410	0.3027
C	1.260984	1.158161	1.088781	0.2810
@TREND(5/01/1999)	0.002731	0.003247	0.841123	0.4039

R-squared	0.036379	Mean dependent var	0.038784
Adjusted R-squared	0.001338	S.D. dependent var	0.075560
S.E. of regression	0.075509	Akaike info criterion	-2.278789
Sum squared resid	0.313589	Schwarz criterion	-2.172214
Log likelihood	69.08487	Hannan-Quinn criter.	-2.237276
F-statistic	1.038178	Durbin-Watson stat	1.739299
Prob(F-statistic)	0.360934		

ADF Test at First Difference with Trend and Intercept

Null Hypothesis: D(LTO) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.766377	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTO,2)
Method: Least Squares
Date: 07/23/14 Time: 17:00
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTO(-1))	-0.923610	0.136500	-6.766377	0.0000
C	0.049308	0.022341	2.207082	0.0316
@TREND(5/01/1999)	-0.000485	0.000619	-0.783143	0.4370

R-squared	0.458884	Mean dependent var	-0.002476
Adjusted R-squared	0.438843	S.D. dependent var	0.102187
S.E. of regression	0.076549	Akaike info criterion	-2.250573
Sum squared resid	0.316427	Schwarz criterion	-2.143044
Log likelihood	67.14134	Hannan-Quinn criter.	-2.208784
F-statistic	22.89690	Durbin-Watson stat	1.991908
Prob(F-statistic)	0.000000		

PP Test at Level Form with Intercept

Null Hypothesis: LTO has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.150415	0.6898
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

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

Residual variance (no correction)	0.005476
HAC corrected variance (Bartlett kernel)	0.006079

Phillips-Perron Test Equation
Dependent Variable: D(LTO)
Method: Least Squares
Date: 07/23/14 Time: 17:01
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTO(-1)	-0.014590	0.012437	-1.173054	0.2457
C	0.305993	0.228003	1.342055	0.1850

R-squared	0.023983	Mean dependent var	0.038784
Adjusted R-squared	0.006554	S.D. dependent var	0.075560
S.E. of regression	0.075312	Akaike info criterion	-2.300490
Sum squared resid	0.317623	Schwarz criterion	-2.229440
Log likelihood	68.71421	Hannan-Quinn criter.	-2.272815
F-statistic	1.376056	Durbin-Watson stat	1.815282
Prob(F-statistic)	0.245740		

PP Test at First Difference with Intercept

Null Hypothesis: D(LTO) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.726210	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Residual variance (no correction)	0.005614
HAC corrected variance (Bartlett kernel)	0.005332

Phillips-Perron Test Equation
Dependent Variable: D(LTO,2)
Method: Least Squares
Date: 07/23/14 Time: 17:02
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTO(-1))	-0.912805	0.135323	-6.745398	0.0000
C	0.034318	0.011482	2.988917	0.0042

R-squared	0.452738	Mean dependent var	-0.002476
Adjusted R-squared	0.442788	S.D. dependent var	0.102187
S.E. of regression	0.076280	Akaike info criterion	-2.274368
Sum squared resid	0.320021	Schwarz criterion	-2.202682
Log likelihood	66.81948	Hannan-Quinn criter.	-2.246508
F-statistic	45.50039	Durbin-Watson stat	1.993146
Prob(F-statistic)	0.000000		

PP Test at Level Formwith Trend and Intercept

Null Hypothesis: LTO has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.350342	0.8649
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Residual variance (no correction)	0.005407
HAC corrected variance (Bartlett kernel)	0.006704

Phillips-Perron Test Equation
Dependent Variable: D(LTO)
Method: Least Squares
Date: 07/23/14 Time: 17:06
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTO(-1)	-0.071132	0.068369	-1.040410	0.3027
C	1.260984	1.158161	1.088781	0.2810
@TREND(5/01/1999)	0.002731	0.003247	0.841123	0.4039

R-squared	0.036379	Mean dependent var	0.038784
Adjusted R-squared	0.001338	S.D. dependent var	0.075560
S.E. of regression	0.075509	Akaike info criterion	-2.278789
Sum squared resid	0.313589	Schwarz criterion	-2.172214
Log likelihood	69.08487	Hannan-Quinn criter.	-2.237276
F-statistic	1.038178	Durbin-Watson stat	1.739299
Prob(F-statistic)	0.360934		

PP Test at First Difference with Trend and Intercept

Null Hypothesis: D(LTO) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.743186	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

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

Residual variance (no correction)	0.005551
HAC corrected variance (Bartlett kernel)	0.005192

Phillips-Perron Test Equation
Dependent Variable: D(LTO,2)
Method: Least Squares
Date: 07/23/14 Time: 17:07
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTO(-1))	-0.923610	0.136500	-6.766377	0.0000
C	0.049308	0.022341	2.207082	0.0316
@TREND(5/01/1999)	-0.000485	0.000619	-0.783143	0.4370

R-squared	0.458884	Mean dependent var	-0.002476
Adjusted R-squared	0.438843	S.D. dependent var	0.102187
S.E. of regression	0.076549	Akaike info criterion	-2.250573
Sum squared resid	0.316427	Schwarz criterion	-2.143044
Log likelihood	67.14134	Hannan-Quinn criter.	-2.208784
F-statistic	22.89690	Durbin-Watson stat	1.991908
Prob(F-statistic)	0.000000		

Appendix 5: Lag Length Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LFDI LINFQ LREXR LTO
Exogenous variables: C
Date: 07/23/14 Time: 17:12
Sample: 5/01/1999 11/01/2013
Included observations: 54

Lag	LogL	LR	FPE	AIC	SC	HQ
0	60.65996	NA	1.44e-06	-2.098517	-1.951185	-2.041697
1	250.1158	343.8272	2.34e-09	-8.522807	-7.786146*	-8.238706*
2	266.0181	26.50392	2.38e-09	-8.519190	-7.193201	-8.007808
3	291.2958	38.38456*	1.73e-09*	-8.862806*	-6.947488	-8.124143
4	303.2410	16.36940	2.11e-09	-8.712630	-6.207983	-7.746686
5	319.6303	20.03135	2.26e-09	-8.727048	-5.633073	-7.533823

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix 6: Johansen Cointegration Test

Date: 07/23/14 Time: 17:16
Sample (adjusted): 11/01/1999 11/01/2013
Included observations: 57 after adjustments
Trend assumption: Linear deterministic trend
Series: LFDI LTO LREXR LINFQ
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None	0.419121	46.54794	54.68150	0.0660
At most 1	0.186831	15.58484	35.45817	0.7411
At most 2	0.064323	3.796310	19.93711	0.9193
At most 3	0.000117	0.006687	6.634897	0.9343

Trace test indicates no cointegration at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None	0.419121	30.96309	32.71527	0.0177
At most 1	0.186831	11.78853	25.86121	0.5687
At most 2	0.064323	3.789623	18.52001	0.8809
At most 3	0.000117	0.006687	6.634897	0.9343

Max-eigenvalue test indicates no cointegration at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LFDI	LTO	LREXR	LINFQ
1.525566	-4.146729	-17.21545	10.59092
-1.006219	8.922926	-13.24801	-11.00746
-1.617035	-0.186147	-7.418008	4.766095
-1.168988	-0.766804	-2.359828	6.907467

Unrestricted Adjustment Coefficients (alpha):

D(LFDI)	-0.129003	0.045926	0.058589	-0.000118
D(LTO)	0.015029	-0.013427	0.006204	-0.000491
D(LREXR)	0.026614	0.003632	0.004364	-5.92E-05
D(LINFQ)	0.008576	0.015629	-0.000644	-0.000419

1 Cointegrating Equation(s): Log likelihood 268.6156

Normalized cointegrating coefficients (standard error in parentheses)

LFDI	LTO	LREXR	LINFQ
1.000000	-2.718158	-11.28464	6.942293
	(0.90572)	(2.49243)	(1.82695)

Adjustment coefficients (standard error in parentheses)

D(LFDI)	-0.196802
	(0.06331)
D(LTO)	0.022927
	(0.01340)
D(LREXR)	0.040602
	(0.00793)
D(LINFQ)	0.013083
	(0.01153)

2 Cointegrating Equation(s): Log likelihood 274.5099

Normalized cointegrating coefficients (standard error in parentheses)

LFDI	LTO	LREXR	LINFQ
1.000000	0.000000	-22.09197	5.175543
		(4.55466)	(1.54990)
0.000000	1.000000	-3.975979	-0.649981
		(1.13662)	(0.38678)

Adjustment coefficients (standard error in parentheses)

D(LFDI)	-0.243013	0.944731
	(0.07493)	(0.40341)
D(LTO)	0.036438	-0.182131
	(0.01568)	(0.08440)
D(LREXR)	0.036947	-0.077952
	(0.00946)	(0.05091)
D(LINFQ)	-0.002644	0.103897
	(0.01322)	(0.07116)

3 Cointegrating Equation(s): Log likelihood 276.4047

Normalized cointegrating coefficients (standard error in parentheses)

LFDI	LTO	LREXR	LINFQ
1.000000	0.000000	0.000000	-1.376357
			(0.70103)
0.000000	1.000000	0.000000	-1.829152
			(0.14486)
0.000000	0.000000	1.000000	-0.296574
			(0.03716)

Adjustment coefficients (standard error in parentheses)

D(LFDI)	-0.337754	0.933825	1.177800
	(0.09802)	(0.39532)	(0.92209)
D(LTO)	0.026407	-0.183286	-0.126860
	(0.02082)	(0.08398)	(0.19588)
D(LREXR)	0.029890	-0.078764	-0.538676
	(0.01254)	(0.05056)	(0.11793)
D(LINFQ)	-0.001602	0.104017	-0.349916
	(0.01765)	(0.07117)	(0.16600)

Appendix 7: Vector Autoregressive Estimates

Vector Autoregression Estimates
Date: 07/23/14 Time: 17:25
Sample (adjusted): 8/01/1999 11/01/2013
Included observations: 58 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LFDI	LTO	LREXR	LINFQ
LFDI(-1)	0.648217	0.025683	0.019776	-0.003743
	(0.09977)	(0.02350)	(0.01425)	(0.01831)
	[6.49716]	[1.09296]	[1.38783]	[-0.20444]
LTO(-1)	0.707162	0.824073	-0.024910	0.119086
	(0.35056)	(0.08257)	(0.05007)	(0.06434)
	[2.01723]	[9.98051]	[-0.49752]	[1.85102]
LREXR(-1)	0.887914	0.276680	0.707943	-0.125230
	(0.79138)	(0.18640)	(0.11303)	(0.14524)
	[1.12198]	[1.48437]	[6.26352]	[-0.86225]
LINFQ(-1)	-0.991351	0.182647	0.090406	0.809712
	(0.61220)	(0.14419)	(0.08744)	(0.11235)
	[-1.61933]	[1.26670]	[1.03398]	[7.20695]
C	12.13093	-2.475077	-0.678115	2.666854
	(7.96938)	(1.87704)	(1.13820)	(1.46256)
	[1.52219]	[-1.31860]	[-0.59578]	[1.82342]
R-squared	0.901493	0.991924	0.896251	0.981110
Adj. R-squared	0.894059	0.991315	0.888420	0.979684
Sum sq. resids	5.229246	0.290094	0.106666	0.176123
S.E. equation	0.314110	0.073983	0.044862	0.057646
F-statistic	121.2585	1627.457	114.4615	688.1697
Log likelihood	-12.51933	71.34341	100.3578	85.81510
Akaike AIC	0.604115	-2.287704	-3.288200	-2.786728
Schwarz SC	0.781739	-2.110079	-3.110576	-2.609103
Mean dependent	19.58103	18.35356	4.290431	22.18405
S.D. dependent	0.965048	0.793851	0.134302	0.404437

Determinant resid covariance (dof adj.)	1.87E-09
Determinant resid covariance	1.31E-09
Log likelihood	264.0608
Akaike information criterion	-8.415890
Schwarz criterion	-7.705392

Appendix 8: Granger Causality Test

Pairwise Granger Causality Tests
Date: 07/23/14 Time: 17:32
Sample: 5/01/1999 11/01/2013
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LTO does not Granger Cause LFDI	58	7.51669	0.0082
LFDI does not Granger Cause LTO		0.43104	0.5142
LREXR does not Granger Cause LFDI	58	6.69113	0.0124
LFDI does not Granger Cause LREXR		5.94495	0.0180
LINFQ does not Granger Cause LFDI	58	3.98926	0.0507
LFDI does not Granger Cause LINFQ		0.66447	0.4185
LREXR does not Granger Cause LTO	58	2.62568	0.1109
LTO does not Granger Cause LREXR		4.92641	0.0306
LINFQ does not Granger Cause LTO	58	1.86663	0.1774
LTO does not Granger Cause LINFQ		3.63310	0.0619
LINFQ does not Granger Cause LREXR	58	5.56957	0.0219
LREXR does not Granger Cause LINFQ		0.17289	0.6792

Appendix 9: Variance Decomposition

Variance Decomposition of LFDI:

Period	S.E.	LFDI	LTO	LREXR	LINFQ
1	0.314110	96.56966	0.001536	2.036003	1.392803
2	0.376662	95.37741	1.711451	1.501433	1.409704
3	0.411672	91.72147	4.505501	1.445062	2.327965
4	0.437613	87.46919	7.436043	2.028162	3.066603
5	0.458802	83.51637	10.05144	3.015876	3.416316
6	0.476597	80.13731	12.24535	4.131928	3.485411
7	0.491647	77.33537	14.05787	5.195355	3.411407
8	0.504415	75.02476	15.56691	6.122302	3.286025
9	0.515288	73.10566	16.84575	6.891262	3.157328
10	0.524608	71.49012	17.95174	7.511994	3.046146

Variance Decomposition of LTO:

Period	S.E.	LFDI	LTO	LREXR	LINFQ
1	0.073983	0.000000	100.0000	0.000000	0.000000
2	0.104754	0.572745	97.12045	1.397643	0.909159
3	0.129165	1.413175	93.28266	3.109690	2.194476
4	0.150115	2.241580	89.76634	4.565954	3.426128
5	0.168589	2.960674	86.88234	5.684868	4.472117
6	0.185117	3.553896	84.60531	6.520233	5.320565
7	0.200059	4.033827	82.82393	7.144048	5.998194
8	0.213688	4.420476	81.42459	7.616073	6.538864
9	0.226217	4.733199	80.31368	7.980057	6.973060
10	0.237810	4.988241	79.41977	8.266627	7.325359

Variance Decomposition of LREXR:

Period	S.E.	LFDI	LTO	LREXR	LINFQ
1	0.044862	0.000000	27.14477	72.85523	0.000000
2	0.055956	1.190056	26.64838	71.29604	0.865524
3	0.061759	2.644930	26.68542	68.83402	1.835625
4	0.065284	3.864433	27.11500	66.43522	2.585346
5	0.067660	4.765715	27.78807	64.34291	3.103305
6	0.069414	5.400171	28.59430	62.55265	3.452883
7	0.070815	5.841146	29.46045	61.00367	3.694733
8	0.072004	6.149739	30.34027	59.63864	3.871354
9	0.073057	6.369522	31.20565	58.41536	4.009468
10	0.074017	6.529678	32.04046	57.30474	4.125119

Variance Decomposition of LINFQ:

Period	S.E.	LFDI	LTO	LREXR	LINFQ

1	0.057646	0.000000	18.54340	7.801127	73.65548
2	0.075257	0.023572	22.79622	5.825859	71.35435
3	0.086723	0.047862	27.07627	4.701181	68.17469
4	0.095547	0.054746	31.19041	4.019780	64.73506
5	0.102981	0.048748	35.01134	3.590507	61.34941
6	0.109587	0.045964	38.46959	3.329617	58.15483
7	0.115653	0.062427	41.54109	3.196177	55.20031
8	0.121333	0.108286	44.23357	3.163488	52.49465
9	0.126715	0.186946	46.57423	3.209482	50.02935
10	0.131850	0.296640	48.59992	3.314666	47.78878

Cholesky Ordering: LTO LREXR LINFQ LFDI

Appendix 10: Impulse Response Function