DETERMINANTS OF CHINESE RENMINBI EXCHANGE RATE

By

SONGHE RUAN

An Independent Study
Submitted in partial fulfillment of the requirements for the Degree of

MASTER OF SCIENCE IN FINANCE AND ECONOMICS

MARTIN DE TOURS SCHOOL OF MANAGEMENT AND ECONOMICS
Assumption University
Bangkok, Thailand

October, 2013
This Study by: Songhe Ruan

Entitled: Determinants of Chinese RMB Exchange Rate

has been approved as meeting the independent study requirement for the:

DEGREE OF MASTER OF SCIENCE IN FINANCE AND ECONOMICS

Dr. Wiyada Nittayagasetwat, Chairperson

Dr. Ing-wei Huang, Committee Member

Dr. Nopphon Tangjitprom, Committee Member

Dr. Wiyada Nittayagasetwat, Committee Member

Dr. Ing-wei Huang, Advisor

Date of Defense: "[Click here to type Month, Date, Year]"
Declaration of Authorship Form

I, Songhe Ruan

declare that this independent study and the work presented in it are my own and has been generated by me as the result of my own original research.

Determinants of Chinese RMB Exchange Rate

I confirm that:

1. This work was done wholly or mainly while in candidature for the M.Sc. degree at this University;

2. Where any part of this independent study has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

3. Where I have consulted the published work of others, this is always clearly attributed;

4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this independent study is entirely my own work;

5. I have acknowledged all main sources of help;

6. Where the independent study is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

7. None of this work has been published before submission

Signed: ___________________________ Date: _____________________
Student Name:  Songhe Ruan
ID:           5519593

ADVISOR’S STATEMENT

I confirm that this independent study has been carried out under my supervision and it represents the original work of the candidate.

Signed:

________________________________________
Dr. Ing-wei Huang, Advisor

Date:

________________________________________
ACKNOWLEDGEMENTS

I would like to express my greatest gratitude to all professors for helping me during the writing of this independent study. My grateful acknowledgement goes first to Dr. Ing-wei Huang, my dear advisor, for her constant encouragement and consideration. She has always guided me through all the stages of the writing of this independent study. In the preparation of this independent study, she has spent much time reading and revising of each draft and provided me with inspiring advices. This independent study cannot be finished without her insightful criticism, patient guidance and consistent instruction. And special thanks to Dr. Wiyada Nittayagasetwat, and Dr. Nopphon Tangjitprom for their guidance and help during the completion of this independent study.

I also would like to thank all the professors who have taught us for their exquisite teaching and enlightening lectures. I not only learned the academic knowledge needed for this study, but also learned the preciously conscientious attitude for both study and later life.

Last, my thanks would go to my beloved family for their great support and love, and to classmates who gave me help and happiness during this precious study time.

Songhe Ruan
November, 2013
ABSTRACT

Since the founding of New China, through several stages of development, the RMB exchange rate system which utilized a fixed exchange rate system had gradually moved towards a managed floating exchange rate system. In the period of fixed exchange rate regime, the RMB fluctuations are more in accordance to the current economic policies, where various factors on the impact of the RMB exchange rate are concealed. As China’s exchange rate regime continue to undergo reformation, the RMB exchange rate eventually come to the market, so research of the determinants of RMB exchange rate has become more important.

This study is to determine the factors that affect the RMB exchange rate during the year 2000 to 2012 by using simple Linear Regression model with ordinary least square method (OLS). In this paper, the dependent variable is RMB exchange rate; whereas the independent variables are money supply, GDP differential, trade balance, interest rate differential, exchange rate reserve, inflation rate differential, government spending and dummy variable exchange rate reform. The study utilize quarterly data from the first quarter of year 2000 to the last quarter of year 2012 totally consists of 52 observations.

This paper finds that foreign exchange reserve, interest rate differential, inflation rate differential and exchange rate reform dummy have impact on the RMB exchange rate. The foreign exchange reserve, interest rate differential and exchange rate reform have negative relationship with RMB exchange rate; on the other hand, the inflation rate differential is positively related to RMB exchange rate.

This study provides recommendation to Chinese government upon maintaining the RMB exchange rate stability. Further, financial institutions and multinational companies can also use this results to make the appropriate measure.
responses to RMB exchange rate change to reduce the losses caused by changes in exchange rate. The results of this paper also benefits for foreign investors make right investment in foreign exchange market. In terms of academic contribution, the results of this paper add more updated empirical evidence to existing economic literature in China.
### ABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMITTEE APPROVAL FORM</td>
<td>i</td>
</tr>
<tr>
<td>DECLARATION OF AUTHORSHIP FORM</td>
<td>ii</td>
</tr>
<tr>
<td>ADVISOR’S STATEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>PROOFREADER FORM</td>
<td>x</td>
</tr>
</tbody>
</table>

### CHAPTER I: GENERALITIES OF THE STUDY

1.1 Background of the Study .......................... 1
1.2 Statement of the Problem........................ 4
1.3 Research Objectives............................... 5
1.4 Research Questions............................... 5
1.5 Scope of the Research............................ 5
1.6 Limitations of the Research.................... 6
1.7 Significance of the Study....................... 7
1.8 Definition of Terms.............................. 8

### CHAPTER II: REVIEW OF RELATED LITERATURE AND STUDIES

2.1 Theories Related to the Study.................. 10
2.2 Dependent Variable: RMB Exchange Rate........ 12
2.3 Independent Variables........................... 13

### CHAPTER III: RESEARCH METHODOLOGY

3.1 Data Collection .................................... 21
3.2 Methodology ....................................... 22
3.3 Study Hypotheses .................................. 25
CHAPTER IV: PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

4.1 Pearson’s Correlation Coefficient.............................................................. 28
4.2 ADF Test Results.......................................................................................... 29
4.3 Ordinary Least Squares Results ................................................................. 30
4.4 The Relationship between RMB Exchange Rate and Each Independent Variable ......................................................................................................................... 32

CHAPTER V: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion.................................................................................................... 35
5.2 Implication..................................................................................................... 36
5.3 Recommendations for Future Research ...................................................... 37

BIBLIOGRAPHY ........................................................................................... 38

APPENDICES.................................................................................................. 44
Appendix A: White’s General Test Results....................................................... 44
Appendix B: Breusch-Godfrey Test Results...................................................... 45
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Summary of the empirical evidences from the prior studies</td>
</tr>
<tr>
<td>3.1</td>
<td>Measurements of all variables</td>
</tr>
<tr>
<td>3.2</td>
<td>The expected results (positive: RMB depreciation; negative: RMB appreciation)</td>
</tr>
<tr>
<td>4.1</td>
<td>Multicollinearity test result</td>
</tr>
<tr>
<td>4.2</td>
<td>Multicollinearity test result after delete money supply</td>
</tr>
<tr>
<td>4.3</td>
<td>Unit root test result</td>
</tr>
<tr>
<td>4.4</td>
<td>Results of least squares regression</td>
</tr>
</tbody>
</table>

LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The first four largest GDP from year 2000 to 2009</td>
</tr>
<tr>
<td>1.2</td>
<td>Chinese foreign exchange reserve (FER) from year 2000 to 2012</td>
</tr>
<tr>
<td>1.3</td>
<td>RMB to US Dollar exchange rate</td>
</tr>
</tbody>
</table>
CHAPTER I

GENERALITIES OF THE STUDY

1.1 Background of the Study

According to the information of International Monetary Fund (2010) and People’s Bank of China (2013), it can be found that over the past few decades, China maintains a sustained and rapid economic growth, current account surplus and continued expansion. The GDP of China has exceeded Germany and thereby became the third largest economy in 2008. Figure 1 show the increasing trend of Chinese GDP with respect to other countries. Meanwhile, China’s foreign reserve has also become the largest one in 2007, which can be seen in Figure 2.

Figure 1: The first four largest GDP from year 2000 to 2009

Source: International Monetary Fund (IMF) (2010)
The Vice President of People’s Bank of China Yi (2010) stated that with more developments of China’s economy, other countries think that the western countries’ inflation and the economic downturn are due to the undervaluation of RMB exchange rate. In one hand is that, a large number of high-quality and low-cost Chinese goods exported to the United States, Japan and other countries led to their national price decline. On the other hand, the value of RMB is too low, making the trade deficit continues to expand in those countries. Since the first half of 2002 the US Dollar decline, the RMB is associated with US Dollar also declined. Japanese Finance Minister Shiokawa (2002) stated that Chinese RMB is undervalued and is the culprit causing of global deflation. So whether RMB exchange rate is undervalue and slowing globed economy growth become the focus of global economy and politics. The CEO of people’s bank of China Zhou (2010) stated that the issue of RMB exchange rate is not only a pure economic problem, but has also become a political issue, whereby the subject of controversy also expanded from the level of the RMB exchange rate to the formation mechanism of exchange rate and exchange rate
system. So how to properly handle the exchange rate problem has great influence on China's economy and also the whole World Economy. The change in exchange rate depends on the exchange rate system and the situation of economic and financial environment, the managed floating exchange rate mainly depends on the basic determinants and the central bank’s foreign exchange intervention. Therefore, whether to use the floating rate or fixed exchange rate system, finding the suitable exchange rate level are important concerns among domestic and foreign politics, business and academic circles.

After 2000, China’s economy maintained a rapid and stable growth, during this time, according to the statement of China Society of Macroeconomics (2012), RMB exchange rate shows two major trends. The first period, from 2000 to 2005, due to the fixed exchange rate policy, the exchange rate was basically fixed. The second period, from 2005 to 2012, there were two exchange rate reforms whereby the RMB exchange rate against US Dollar appreciated a lot. The second period can be divided into three phases, and the first phase is from June 2005 to June 2008. Since the exchange rate reform in 2005, China abandoned the fixed exchange rate system and based on market supply and demand, implementing managed floating exchange rate system, so the RMB to US Dollar rose sharply. From the mid of June 2008, after the exchange rate reform to June 2010, the exchange rate of RMB to US Dollar maintained at about 6.8 Chinese yuan per US Dollar. In June 2010, China implemented the second exchange rate reform, the RMB exchange rate against US Dollar appreciate further, reached 6.24 Chinese yuan per US Dollar on October 2012. This trend is showed in the Figure 3.
1.2 Statement of the Problem

There had been several literatures on the theory of exchange rate determination, whereby important variables are utilized as the determinants including price level, benchmark interest rate, money supply, national income, foreign exchange reserves and so on. Due to different point of view, there are a variety of mainstream theories about the determinants of exchange rate, such as the theory of purchasing power parity, interest rate parity theory and the theory of international balance of payment. Based on this, there are a series of exchange rate determination model whereby these models can be divided into two categories: the exchange rate model and random walk hypothesis. But so far, those theories still can’t be supported by the actual data. So it reflects the complexity in identifying factors impact the exchange rate.

Cornell (1977), Mussa (1979) and Frenkel (1981b) stated that the exchange rate changes are largely unpredictable. This result in the current database is still widespread. However, in the recent international financial research, several empirical results supported that the exchange rate should be viewed from the point of view of
assets price. The representative paper is Engel and West (2005), which concluded that the exchange rate as an asset price, mainly affected by the investors’ future economic trend expectation instead of the variables such as current trade and current account balance.

Although the economic debate is still existing, economic researchers are continuously studying this topic in order to find out the determinants of exchange rate both in developing and developed countries. For this paper, the main purpose is to find out the determinants of RMB exchange rate.

1.3 Research Objectives

To identify the factors that affect changes in the RMB exchange rate and the relationship between each factor and the RMB exchange rate.

1.4 Research Questions

What are the determinants of RMB exchange rate and how each variable affect RMB exchange rate?

1.5 Scope of the Research

To examine the determinants of RMB exchange rate, this study uses quarterly data from first quarter of 2000 to the last quarter of 2012. Since China joined WTO on November 2001, China has increasingly expanded ties with world economy. The exchange rate link between China and foreign trade becomes more important. On July 21, 2005, China began to implement a market-based, a managed floating exchange rate system. After that RMB is no longer just pegged to the US Dollar, but with reference to a basket of currencies. After the RMB exchange rate reform to the end of 2012, there lasted seven and a half years, so exchange rate reform results can be observed. From the analysis of the determinants of RMB exchange rate from 2000 to 2012, this paper can compare the difference result between the period before RMB
exchange rate reform and after the reform and analyze how RMB exchange rate reform affect RMB exchange rate. The independent variables are money supply, interest rate differential, trade balance, foreign exchange reserves, inflation rate differential, fiscal position, GDP differential, and exchange rate reform. The dependent variable is RMB exchange rate. All the data were coming from International Monetary Fund (IMF), International Financial Statistics (IFS), People’s bank of China, and Bloomberg database.

1.6 Limitations of the Research

1. The RMB exchange rate use RMB only against on US Dollar.
   This research focuses the use of RMB against US Dollar only not exactly the use of the RMB against all other countries’ currencies. Since the 1990s, the U.S. economy accounted for absolute advantage in many developed countries. From the data of Ministry of Commerce of China Department of American and Oceanian Affairs (2013), during the past few decades, US were the second largest trading partners for China only followed by European Union. For this paper, RMB to US Dollar exchange rate was taken as the research objective. But this paper might not capture the influence of the exchange rate between RMB and other important countries’ currencies, such as Japanese yen and Euro.

2. This study uses quarterly exchange rate data, where the exchange rate is taken from the last day of each quarter.
   The limitation is that the Exchange rate fluctuates is on daily basis, and the data used is on the last day of each quarter because many independent variables do not provide daily data. This may lead the data to be inaccurate enough as it representing average rate, and might not capture the true impact of exchange rate changes.

3. Non-macroeconomic factors, such as financial crisis, future exchange rate expectation and some other factors may also affect the exchange rate but had not been included in this paper.
This paper focuses mainly on the macroeconomic influences. However, many non-macroeconomic factors may also affect the exchange rate had not been included. Higgins (1998) and FRB Kansas (2004) stated that a higher share of the economically inactive dependent population reduces national saving and thereby reduce the current account balance whereby depreciate the country’s currency value. Rajan (2006) concluded the evidence and suggests that economic crises have effect on the exchange rate even after controlling for other macroeconomic factors. Saeed, Awan, H.Sial and Sher (2012) stated that the coefficient of the political instability is significantly related to nominal exchange rate. Although one country’s population, political instability and other non-macroeconomic factors are related to the changes in exchange rate, this study will not take into account those factors.

1.7 Significance of the Study

In the modern and open economic situation, exchange rate level is appropriate or not, is very important for a country economy’s harmonious development. Exchange rate misalignment will influence not only the sustainable development of the economy of a country, and may also cause friction in the international economy, even bring harm to a country’s international image. From the 1997 Asian financial crisis to China’s accession to the WTO, China has been facing the exchange rate adjustment pressure. Especially at present, RMB appreciation pressure is more and more seriously, so the quantitative research on the determinants of RMB exchange rate undoubtedly has a very important and practical significance. With the results from this study, the most influential factors to Chinese RMB exchange rate can be found out. Chinese government can stabilizing these variables directly induce the stability of Chinese RMB exchange rate. The government policy makers can pay more attention on these factors formulate a reasonable monetary and fiscal policy, to generate a faster and better economic development. This study can also help financial institutions and multinational corporations to understand RMB exchange rate changes better and to reduce foreign exchange rate risk. Moreover, this study can help foreign investors to predict the RMB against US Dollar exchange rate trend and make right investment.
### 1.8 Definition of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purchasing Power Parity theory</strong></td>
<td>A theory mentions that the bilateral currency exchange rate is defined by the ratio of the price levels in the two countries (Cassel, 1922).</td>
</tr>
<tr>
<td><strong>Keynesianism’s theory of exchange rate</strong></td>
<td>A theory mentions that the exchange rate is just one kind of market price and it is decided by the supply and demand power of both sides (Keynes 1936).</td>
</tr>
<tr>
<td><strong>New Keynesianism’s theory of exchange rate</strong></td>
<td>A theory mentions that the exchange rate is decided by the supply and demand of foreign currencies, and current account is the main factor to determine the supply and demand of foreign currencies (Argy 1981).</td>
</tr>
<tr>
<td><strong>Monetarism exchange rate theory</strong></td>
<td>A theory mentions that the exchange rate is the form of relative price of currency. If a country’s currency demand is relatively stable, and the money supply excessively increase compared to money demand, the currency price will drop (Johnson, 1969).</td>
</tr>
<tr>
<td><strong>Exchange rate</strong></td>
<td>The exchange rate that it is simply a price between two currencies that one currency will exchange for another (Copeland, 2000).</td>
</tr>
<tr>
<td><strong>ADF test</strong></td>
<td>ADF test is detection method for stationary test on a variable and ensure the accuracy of the results of the regression (Zhou, 2005).</td>
</tr>
</tbody>
</table>
Ordinary least square is a method to minimize the sum of squared vertical distances and which uses to estimate the unknown parameters in a linear regression model (Wooldridge, 2006).
CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

This section presents some main theories related to the determinants of exchange rate. It also includes the explanation of the independent variables and dependent variable in this research.

2.1 Theories Related to the Study

The exchange rate is the intermediary of economic development and international trade, and is also one of the financial market transaction tools. There had been several literatures on the theory of exchange rate determination, whereby important variables are utilized as the determinants including price level, benchmark interest rate, money supply, national income, foreign exchange reserves and so on. Due to different point of view, there are a variety of mainstream theories about the determinants of exchange rate, such as the theory of purchasing power parity, Keynesianism’s theory of exchange rate, New Keynesianism’s theory of exchange rate and Monetarism exchange rate theory.

1) Purchasing Power Parity theory

Purchasing power parity theory has a long economic history. Cassel (1922) published “Money and Foreign Exchange Rate after 1914”. In this book, he proposed in comparative maturity form of how the exchange rate decision theory of purchasing power parity. The main idea of the Purchasing Power Parity theory is that bilateral currency exchange rate is defined by the ratio of the price levels in the two countries. In a certain period of time, the two currencies are decided by the comparison between the purchasing power of the two currencies, and the buying power of a currency also can be used to represent both price levels.
Cassel (1922) Purchasing Power Parity is divided into absolute purchasing power parity and relative purchasing power parity. Absolute purchasing power parity refers to a certain point in time and the exchange rate is determined by purchasing power of two countries’ currencies. If by the reciprocal of the general price index represent their respective monetary purchasing power, then the two currencies exchange rate depends on the ratio between the general price levels. The relative purchasing power parity refers the relative change to purchasing power of money between the different countries, and is the deciding factor of exchange rate changes. It is considered the major factor of exchange rate and the relative change of monetary purchasing power or commodity price. When the two countries purchasing power ratio change, the exchange rate between the two countries will have to adjust. The relative purchasing power parity represents a period of exchange rate changes, taking into account inflation.

2) Keynesianism’s theory of exchange rate

Keynes (1936) stated that the exchange rate is just one kind of market price and it is decided by the supply and demand power of both sides. The supply and demand of foreign currency is determined by the balance of international payments especially payments of goods and services. The supply and demand equilibrium is the balance of international payment. Therefore, exchange rate depends on the balance of international payments, especially the current account balance of payments, and balance of current account payments which depends on a country’s national income.

3) New Keynesianism’s theory of exchange rate

Argy (1981) developed the Keynesianism’s exchange rate theory and provided a New Keynesianism’s exchange rate theory. This theory presented that the exchange rate is decided by the supply and demand of foreign currencies, and current-account is the main factor to determine the supply and demand of foreign currencies. However, it is different from Keynesianism’s theory of exchange rate. Argy considered that current-account is affected by the national income, the price levels in two countries and the exchange rate itself. The impact of national exports mainly depends on the exchange rate, the relative price level in two countries and the foreign national
income. The accumulation of residents’ foreign asset mainly affected by the interest rate difference and expectation of future exchange rate changes. Victor based on the relationship of independent variables gave the equilibrium rate of exchange equation: \( R = f(M, F, W, Y, P, I, Re) \). Equilibrium exchange rate level is determined by monetary policy, fiscal policy, monetary wage rate, the foreign income, price level, interest rate and the expectations of the exchange rate in two countries.

4) Monetarism exchange rate theory

Johnson (1969) established monetarism exchange rate theory. This theory thinks that the exchange rate is a form of relative price of currency. If a country’s currency demand is relatively stable, money supply will increase compared to money demand, the currency price will drop. A country’s exchange rate movements depend on three factors: first, the ratio of the two countries’ money supply increase; second, the ratio of the increasing rate of real income in both countries; third, the change of the expected inflation rate relative to foreign country expected inflation rate.

2.2 Dependent Variable: RMB Exchange Rate

Moosa and Bhatti (2009) stated that the exchange rate provides a key macroeconomic linkage for domestic economy and the foreign countries that take place through goods and assets market. The exchange rate is important because it helps convert one country’s currency into other countries’ currencies, hence, international trade such as purchases of goods and services or even transfer of funds between countries can be achieved. Exchange rate also can be used for price comparison of similar goods in different countries. So, the exchange rate is a key factor influencing the competitiveness of enterprises. Exchange rate plays an important role in the economy, and the movement of the exchange rate can affect a country’s domestic economy and foreign trade, and even affect the entire international economy.
Hirschman (1949) found that trade deficit would cause currency depreciation and reduce the national income and may lead to a decrease in aggregate demand. Diaz-Alejandro (1963) stated that for export and import competing industries, depreciation in local currency may raise the windfall profits. Krugman and Taylor (1978), and Barbone and Rivera-Batiz (1987) declared the same views. Ma and Kao (1990) stated that currency appreciation affects the stock market in export-dominant countries in a negative way, and affects the stock market in import-dominant countries in a positive way. The J-curve hypothesis predicts that, the balance of trade deteriorates in the short run, but ameliorates in the long run after the depreciation of exchange rate (Davies, 1962).

2.3 Independent Variables

2.3.1 Money Supply

The first independent variable included is money supply, which can be treated as an important indicator of the value of the currency. Equilibrium in exchange rate is determined at a point where the demand and supply of foreign currency equates in the foreign exchange market (Khan and Ismail, 2012).

Chong and Tan (2007) found that money supply can cause exchange rate volatility in Malaysia, Indonesia, Thailand and Singapore. MacDonald and Taylor (1993, 1994) tested the forecasting performance of unrestricted monetary model and random walk model for US Dollar and British Pound and find that more supply of US currency will depreciate the US Dollar value. Karim (2007) found the impact of monetary policy on New Zealand’s nominal and effective exchange rate by using quarterly data. Karfakis (2003) tested the exchange rate between Romanian Lei and US Dollar and stated that increase money supply would depreciate the domestic currency. Kandil and Dincer (2008) tested the relationship between money supply and exchange rate both in Egypt and Turkey. They stated that the increase of money supply would decrease the exchange rate both in Egypt and Turkey. Wilson (2009) examined the effective exchange rate between US Dollar and the weighted average trading partner of America, found that increase in money causes a decrease in the
value of currency. Hsieh (2009) studied the exchange rate of Indonesian Rupiah per unit of US Dollar, and that relatively more real money aggregate real depreciation for Indonesian Rupiah.

Saeed, Awan, H.Sial and Sher (2012) studied that an increase in relative stock of money would cause the increase in the nominal exchange rate. However, Jamal (2005) and Zada (2010) found the relationship between money supply and exchange rate in US is not statistically significant.

### 2.3.2 Interest Rate Differential

In recent studies, Chong and Tan (2007) examined the relationship between interest rate and exchange rate in Malaysia, Indonesia, Thailand and Singapore. They found higher interest rate would appreciate local countries’ currency. Maeso-Fernandez, Osbat and Schnatz (2001) found that an increase in the interest rate differential between euro area and abroad would bring appreciation of euro significantly. Ogun (2012), Dornbusch (1978), Makrydakis (2000), Moura (2010), Zada (2010) and Beasurto and Ghosh (2001) also found that an increase of interest rate would lead to an appreciation of local currency.

Kim (2000) found that high interest rate resulted in currency depreciation. Tom and Oistein (2000) examined the krone exchange rate and found in long-term, there is no significant effect. Jamal (2005) examined the relationship between exchange rate ratio and the interest rates in the US and the foreign country. However, he found the relationship statistically insignificant. Dekle, Hsiao, and Wang (2001, 2002) found insignificant relationship between currency value of Korea and interest rate during the Asian financial crisis period.

### 2.3.3 Trade Balance

Trade balance reflects the commodity trade between countries, which is an important indicator of the macroeconomic situation, and also the important indicator of fundamental analysis of foreign exchange transaction. The effect of exchange rate changes on trade balance become one of the important research in the economic
literature because exchange rate depreciation is assumed to have positive effects on the trade balance and output (Boumbouya, 2009). Meanwhile, trade balance also does have large impact on the exchange rate.

Chong and Tan (2007) examined the relationship between trade balance and exchange rate in Malaysia, Indonesia, Thailand and Singapore and suggested that trade balance influences the exchange rate volatility in Malaysia. Parveeb, Khan and Ismail (2012) found positive relationship between exchange rate and export, and negative relationship with import. Hyder and Mehboob (2005) examined the total trade balance increase would appreciate the real exchange rate. Hirschman (1949) points out currency depreciation from an initial trade deficit.

Zada (2010) found the relationship between variable trade balance and exchange rate is insignificant in Pakistan. Kriljenko and Habermeier (2004) stated that the trade balance was not strongly correlated with exchange rate volatility based on 85 developing and transition economies and broad cross section in 2001.

### 2.3.4 Foreign Exchange Reserves

Foreign exchange rate reserve is an important factor in foreign exchange transaction fundamental analysis, whose main function is to maintain stability in the foreign exchange market. Whether a country’s currency is stable or not depends on the degree of the exchange liquidity of foreign exchange reserves. Zada (2010) found significant relationship between variable foreign exchange reserve and exchange rate in Pakistan. Saeed, Awan, H.Sial and Sher (2012) concluded that the coefficient of the relative the foreign exchange reserve is negatively related to nominal exchange rate and significantly, estimates show that an increase in the relative balance of foreign exchange reserve would decrease nominal exchange rate.

However, Kriljenko and Habermeier (2004) stated that the adequacy of foreign exchange rate reserves was not strongly correlated with exchange rate
volatility based on 85 developing and transition economies and broad cross section in 2001.

**2.3.5 Inflation Rate Differential**

From PPP theory, exchange rate is defined by the ratio of the price levels in the two countries. In a certain period of time, the two currencies are determined by the difference between the purchasing power of the two currencies, and the buying power of a currency can also use to represent both price levels. The relative purchasing power parity represents a period of exchange rate changes, taking into account the inflation.

Zada (2010) found that higher inflation in local country leads to depreciation of local currency in Pakistan. Parveeb, Khan and Ismail (2012) examined that high inflation also devalues the currency in Pakistan. Jamal (2005) examined the CPI ratio differential between US and UK, and found that US and Japan, both showed negative relationship between exchange rate and CPI ratio, whereby high CPI will devalue the local currency. Ogun (2012) also found negative relationship between inflation rate differential and exchange rate in developing countries.

**2.3.6 Government spending**

The relationship between fiscal balance and exchange rate is also interesting since it constitutes one of the key components of national savings. Ahmed (1986) stated that a higher government budget balance increase savings and raises the balance of current account from some evidence in United Kingdom. Chinn (2005) according to Council on Foreign Relations also find this result. Frenkel and Mussa (1988) stated that fiscal tightening cause appreciation of its exchange rate in the longer term. Maeso-Fernandez, Osbat and Schnatz (2001) found positive relationship between government expenditure and RMB exchange rate. Ostry (1994), Gregorio, Giovannini and Wolf (1994) examined that a raise in government spending is likely to appreciate the real exchange rate. Rajan (2006) found that an increase in the government expenditure to GDP ratio would lead to appreciation of the real exchange rate. Ogun (2012) also found positive relationship between fiscal deficit rate
differential and exchange rate in developing countries. Kandil and Dincer (2008) studied that an increase in government spending relative to GDP will result in an appreciation of the exchange rate.

Hyder and Mehboob (2005) found that increase in government consumption will depreciate the real effective exchange rate. However, Ansari, Gordon and Akuamoah (1997) showed that government spending is insignificant with exchange rate.

2.3.7 GDP differential

The GDP differential is the increase in GDP rate difference between China and US at the same period. GDP during a certain period of time-refers to the value of all final goods and services in a country or area, which often is regarded as the best measure of national economic conditions.

According to Obstfeld and Rogoff (1996), economies in the early stages of economic development have a need for investment and tend to finance investment through external borrowing. The stronger economic growth compared to their main trading partners, the lower would be the current account. Makrydakis (2000) studied the productivity variable (measured as real GDP per employee) positively effect on the exchange rate by using the quarter data from the first quarter of 1980 to the second quarter of 1999. Maeso-Fernandez, Osbat and Schnatz (2001) found positive relationship between productivity differential and real exchange rate in Euro by using BEER/PEER approach. Rajan (2006), Faruqee (1995) also found positive relationship between productivity differential and exchange rate. Balassa (1964) find the relationship between GDP and exchange rate is positive through a reappraisal of the purchasing-power parity doctrine. Samuelson (1964), Parveeb, Khan and Ismail (2012), Hyder and Mehboob (2005) found the relationship between GDP and exchange rate is also positive. However, Amuedo-Dorantes and Pozo (2001), Zada (2010), Saeed, Awan, H.Sial and Falak Sher (2012), found the relationship between variable GDP and exchange rate to be insignificant.

2.3.8 Exchange rate Reform Dummies
RMB exchange rate tended to appreciate after the People’s Bank of China reformed RMB exchange rate regime on 21 July, 2005. Until April 6, 2012, the exchange rate of RMB to US Dollar accumulatively appreciates by 27.9 percent and declined from 8.0702 yuan per US Dollar on April 4, 2006 to 6.3070 yuan per US Dollar on June 1, 2012.

Mussa (1986) studied that flexible exchange rate regimes display much higher real exchange rate variability than pegged exchange rate regimes, especially in the developed countries since exchange rates were mainly driven by capital flows. He stated that both nominal and real exchange rate changes substantially and systematically with the exchange rate. Flood and Rose (1995) pointed out that exchange rate volatility differs with the exchange rate regime, and under flexible rate regimes similar macroeconomic environments produce much more exchange rate volatility. Killeen, Lyons, and Moore (2000) also found that exchange rate volatility differs with the exchange rate regime. Chinn and Wei (2008) found that under flexible regimes, current account balances seem to be no less persistent than under fixed regimes. However, Baxter and Stockman (1989) found no evidence that the cyclic behavior of real macroeconomic aggregates systematically depends on the exchange rate regime.

Review on all independent variables summarized in table 2.1.
<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Relationship with exchange rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>positive</td>
</tr>
<tr>
<td></td>
<td>Karim, 2007</td>
</tr>
<tr>
<td></td>
<td>Karfakis, 2003</td>
</tr>
<tr>
<td></td>
<td>Kandil and Dincer, 2008</td>
</tr>
<tr>
<td></td>
<td>Wilson, 2009</td>
</tr>
<tr>
<td></td>
<td>Hsieh, 2009</td>
</tr>
<tr>
<td></td>
<td>Saeed, Awan, H.Sial and Sher, 2012</td>
</tr>
<tr>
<td></td>
<td>Jamal, 2005</td>
</tr>
<tr>
<td></td>
<td>Zada, 2010</td>
</tr>
<tr>
<td>2. Interest Rate</td>
<td>Kim, 2000</td>
</tr>
<tr>
<td>Differential</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Trade Balance</td>
<td>Chong and Tan, 2007</td>
</tr>
<tr>
<td></td>
<td>Parveeb, Khan and Ismail, 2012</td>
</tr>
<tr>
<td></td>
<td>Hyder and Mehboob, 2005</td>
</tr>
<tr>
<td></td>
<td>Hirschman, 1949</td>
</tr>
<tr>
<td>4. Foreign Exchange</td>
<td>Zada, 2010</td>
</tr>
<tr>
<td>Reserves</td>
<td>Saeed, Awan, H. Sial and Sher, 2012</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Inflation Rate</td>
<td>Zada, 2010</td>
</tr>
<tr>
<td>Differential</td>
<td>Parveeb, Khan and Ismail, 2012</td>
</tr>
<tr>
<td></td>
<td>Jamal, 2005</td>
</tr>
<tr>
<td></td>
<td>Ogun, 2012</td>
</tr>
<tr>
<td>6. Government</td>
<td>Hyder and Mehboob, 2005</td>
</tr>
<tr>
<td>Spending</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ahmed, 1986</td>
</tr>
<tr>
<td></td>
<td>Chinn, 2005</td>
</tr>
<tr>
<td></td>
<td>Frenkel and Mussa, 1988</td>
</tr>
<tr>
<td></td>
<td>Maeso-Fernandez, Osbat and Schnatz, 2001</td>
</tr>
<tr>
<td></td>
<td>Ostry, 1994</td>
</tr>
<tr>
<td></td>
<td>Gregorio, Giovannini and Wolf, 1994</td>
</tr>
<tr>
<td></td>
<td>Rajan, 2006</td>
</tr>
<tr>
<td></td>
<td>Ogun, 2012</td>
</tr>
<tr>
<td></td>
<td>Kandil and Dincer, 2008</td>
</tr>
<tr>
<td></td>
<td>Ansari, Gordon and Akumoah, 1997</td>
</tr>
<tr>
<td>Independent variables</td>
<td>Relationship with leverage level</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td>positive</td>
</tr>
<tr>
<td>7. GDP Differential</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Exchange Rate</td>
<td></td>
</tr>
<tr>
<td>Reform dummies</td>
<td></td>
</tr>
</tbody>
</table>

### 7. GDP Differential

- Makrydakis, 2000
- Maeso-Fernandez, Osbat and Schnatz, 2001
- Rajan, 2006
- Faruqee, 1995
- Balassa, 1964
- Samuelson, 1964
- Parveeb, Khan and Ismail, 2012
- Hyder and Mehboob, 2005

### 8. Exchange Rate Reform dummies

- Mussa, 1986
- Flood and Rose, 1995
- Killeen, Lyons, and Moore, 2000
- Chinn and Wei, 2008

- Amuedo-Dorantes and Pozo, 2001
- Zada, 2010
- Saeed, Awan, H.Sial and Falak Sher, 2012

- Baxter and Stockman, 1989
CHAPTER III
RESEARCH METHODOLOGY

This chapter will explain data collection, methodology and hypotheses testing.

3.1 Data Collection

The data in this research comes from International Monetary Fund (IMF), International Financial Statistics (IFS), People’s bank of China, and Bloomberg database. This study use quarterly data from the first quarter of year 2000 to the last quarter of year 2012 with totally of 52 observations.

According to the trade data information of International Trade Administration, the first important trading partner of China is United States. So the nominal effective exchange rate of China is using the exchange rate between RMB and US Dollar. The changes of RMB exchange rate is expressed as follows: the nominal exchange rate changes from of $ 1 against 8.7 yuan to $ 1 against 5.8 yuan, expressed as the appreciation of renminbi. Whereas the nominal exchange rate changes from $1 against 5.8 yuan to $ 1 against 8.7 yuan is expressed as the depreciation of renminbi.

Exchange rate data is the average nominal exchange rate between Chinese RMB and US Dollar which is come from People’s bank of China. Money supply data are the quarterly ending day’s total M2 from People’s bank of China. Trade balance is the data of amount of difference of total export and import in each quarterly from National bureau of statistics of China. Foreign exchange reserve is ending day’s total amount from People’s bank of China. Inflation of US is the US personal consumption expenditure core price index from Bureau of Economic Analysis. Inflation in China is the China CPI total at constant price 1978=100 from National bureau of statistics of China. Government spending is total china fiscal expenditure from National bureau of statistics of China. US GDP is US real GDP increasing rate from Bureau of Economic
analysis. Chinese GDP is the real GDP increasing rate from National bureau of
statistics of China. This paper uses 1 year lending rate minus 12 month LIBOR in US
as the interest rate difference. Since the absence of 12 month LIBOR in China, 1 year
lending rate used to replace.

3.2 Methodology

The main purpose of this research is to examine the determinants of RMB
exchange rate. This study applies the ordinary least squares regression firstly
proposed by Legendre in 1805. Ordinary least squares regression has been widely
applied in various fields, and has an important role in today’s data processing because
processing a large number of experimental data is most reliable by using the ordinary
least square method (Hutcheson 2011).

First, the correlation between each independent variable is tested by using
the Pearson’s Correlation Coefficient. If there exists multicollinearity problem
between two independent variables, one of the independent variable should be deleted.
After this, it is necessary to detect that all data are stationary. To inspect that data are
stationary, Augmented Dickey-Fuller test will be applied. If test results are found that
data are stationary, ordinary least squares regression for the determination of the
relationship between each independent variables and the RMB exchange rate change
can be used.

3.2.1 Pearson’s Correlation Coefficient

Pearson’s correlation testing is the common testing technique to check the
multicollinearity problem among those variables. The degree of correlation between
the two variables in the numeric range is between -1.0 and +1. The formula is showed
as below: (Spearman, 1904)

\[
r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}
\]
The implication of the result is that variables have no relationship to each other if \( r \) equal to 0. While -1.0 implies that the perfectly opposite relationship between two variables and +0.1 implies the perfectly positive relationship between the two variables. The correlation matrix will show the result of the Pearson’s correlation that testing. This test will help to improve the efficiency of the model through explaining some variables can be explained by other variables. Then one of them should be dropped out from the model to reduce the loss of explanatory power if they have high correlation.

### 3.2.2 ADF Test

To prevent spurious regression, this paper should examine the stationary of the variables. Unit root test is the most common method to determine the sequence of stationary. This paper uses Augmented Dickey-Fuller (ADF) test to detect the stationary of the data. 

ADF test generally is conducted by three steps:

1. Test the original time series. The second term elects level and the third option is none. If data do not pass the inspection, indicating that the original time series are not stationary.

2. Test after the first difference of the original time series. The second term elects 1th difference and the third term elects intercept. If data still does not pass inspection, a second difference transformation should be conducted.

3. Quadratic differential test sequence. The second term elects 2\(^{nd}\) difference and the fourth term elects trend and intercept. Usually time series become stationary in 1%, 5% or 10% level.

If the ADF test value (t value) is larger than a significant value, the test does not pass the inspection; there expect the existence of unit root. Then, check back of the order differential unit root to get the stationary time series.

### 3.2.3 Ordinary Least Squares
In order to test the factors that determine RMB exchange rate, a suitable model has to be applied. Since there are so many factors that would affect the RMB exchange rate, identified variables investigated in the literature review are included to find their relationship with changes in RMB exchange rate. The estimated regression equation model for this research is as follow:

\[ E_t = \alpha + \beta_1 \log(M_2) + \beta_2 \text{GDP}_{\text{dif}} + \beta_3 \text{Int}_{\text{dif}} + \beta_4 \text{CPI}_{\text{dif}} + \beta_5 \log(\text{FER}) + \beta_6 \text{TRD} + \beta_7 \log(\text{Gov}) + \beta_8 \text{Reform} + u_t \]

Where,  
- \( E_t \) = RMB to US Dollar exchange rate  
- \( \alpha \) = the intercept of the regression equation  
- \( M_2 \) = money supply  
- \( \text{GDP}_{\text{dif}} \) = GDP growth rate differential between China and US  
- \( \text{Int}_{\text{dif}} \) = interest rate differential between China and US  
- \( \text{CPI}_{\text{dif}} \) = inflation rate differential between China and US  
- \( \text{FER} \) = foreign exchange reserve  
- \( \text{TRD} \) = trade balance  
- \( \text{Gov} \) = government spending  
- \( \text{Reform} \) = exchange rate reform dummy
Table 3.1: Measurements of all variables

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>( M_2 )</td>
<td>Money supply</td>
<td>Notes and coins in circulation + traveler’s checks of non-bank issuers + demand deposits + OCDs + savings deposits + time deposits less than $100,000 + money-market deposit accounts for individuals in China</td>
</tr>
<tr>
<td>( \text{GDP}_{\text{dif}} )</td>
<td>GDP growth rate differential between China and US</td>
<td>GDP growth rate of China – GDP growth rate of US</td>
</tr>
<tr>
<td>( \text{Int}_{\text{dif}} )</td>
<td>Interest rate differential between China and US</td>
<td>One year deposit rate in China – 12 month LIBOR rate in US</td>
</tr>
<tr>
<td>( \text{CPI}_{\text{dif}} )</td>
<td>Inflation rate differential between China and US</td>
<td>Inflation rate in China – inflation rate in US</td>
</tr>
<tr>
<td>FER</td>
<td>Foreign exchange reserve</td>
<td>Total amount foreign exchange reserve in China</td>
</tr>
<tr>
<td>TRD</td>
<td>Trade balance</td>
<td>Amount of exports – amount of imports in China</td>
</tr>
<tr>
<td>Gov</td>
<td>Government spending</td>
<td>Total government spending in China</td>
</tr>
<tr>
<td>Reform</td>
<td>Exchange rate reform dummies</td>
<td>The exchange rate reform in China in 2005</td>
</tr>
</tbody>
</table>

### 3.3 Study Hypotheses

From Chapter 2, all independent variables may have effects on RMB exchange rate. The following hypotheses should be tested further:

**Variables-level hypothesis:**
H10: There is no significant relationship between RMB exchange rate and money supply.
H1a: There is a significant relationship between RMB exchange rate and money supply.

H20: There is no significant relationship between RMB exchange rate and GDP differential.
H2a: There is a significant relationship between RMB exchange rate and GDP differential.

H30: There is no significant relationship between RMB exchange rate and interest rate differential.
H3a: There is a significant relationship between RMB exchange rate and interest rate differential.

H40: There is no significant relationship between RMB exchange rate and inflation rate differential.
H4a: There is a significant relationship between RMB exchange rate and inflation rate differential.

H50: There is no significant relationship between RMB exchange rate and foreign exchange reserve.
H5a: There is a significant relationship between RMB exchange rate and foreign exchange reserve.

H60: There is no significant relationship between RMB exchange rate and trade balance.
H6a: There is a significant relationship between RMB exchange rate and trade balance.

H70: There is no significant relationship between RMB exchange rate and government spending.
H7a: There is a significant relationship between RMB exchange rate and government spending.

H80: There is no significant relationship between RMB exchange rate and exchange rate reform dummies.
H8a: There is a significant relationship between RMB exchange rate and exchange rate reform dummies.
Table 3.2: The expected results (positive: RMB depreciation; negative: RMB appreciation)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>positive</th>
<th>negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. money supply</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>2. interest rate differential</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>3. trade balance</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>4. foreign exchange reserves</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>5. inflation rate differential</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>6. government spending</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>7. GDP differential</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>8. Exchange rate reform dummies</td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

With the increase of money supply and inflation rate differential, the RMB is expected to appreciate. However, as the interest rate differential, trade balance, foreign exchange reserves, government spending and GDP differential increase, RMB is expected to depreciate.
CHAPTER IV
PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

The empirical results will be separately explained in 4 parts based on the methodology which are presented in chapter 3. In the first part, this paper will conduct correlation test to check the multicollinearity between the independent variables. In the second part, the stationary of the variables would be examined by using Unit root test. In the third part, the result of the ordinary least squares will be stated and will perform the check for Heteroskedasticity and serial correlation. In the fourth part, this paper will provide a detailed explanation on the results of least square regression.

4.1 Pearson’s Correlation Coefficient

To detect the multicollinearity problem, the robust correlation test is applied. The table 4.1 shows the correlation test for all variables. It is found that there is serious multicollinearity problem exists. Asterisk (*) represents variable with high correlation which should be deleted.

<table>
<thead>
<tr>
<th></th>
<th>GDP</th>
<th>INT</th>
<th>M2</th>
<th>FER</th>
<th>GOV</th>
<th>TRD</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1</td>
<td>0.060388</td>
<td>0.250247</td>
<td>0.34156</td>
<td>0.162487</td>
<td>0.343078</td>
<td>-0.02878</td>
</tr>
<tr>
<td>INT</td>
<td>0.060388</td>
<td>1</td>
<td>0.670657</td>
<td>0.609598</td>
<td>0.585524</td>
<td>0.23669</td>
<td>0.257923</td>
</tr>
<tr>
<td>M2</td>
<td>0.250247</td>
<td>0.670657</td>
<td>1</td>
<td>0.985716*</td>
<td>0.838051</td>
<td>0.628929</td>
<td>0.165798</td>
</tr>
<tr>
<td>FER</td>
<td>0.34156</td>
<td>0.609598</td>
<td>0.985716*</td>
<td>1</td>
<td>0.826561</td>
<td>0.666333</td>
<td>0.115009</td>
</tr>
<tr>
<td>GOV</td>
<td>0.162487</td>
<td>0.585524</td>
<td>0.838051</td>
<td>0.826561</td>
<td>1</td>
<td>0.670714</td>
<td>0.258947</td>
</tr>
<tr>
<td>TRD</td>
<td>0.343078</td>
<td>0.23669</td>
<td>0.628929</td>
<td>0.666333</td>
<td>0.670714</td>
<td>1</td>
<td>0.093791</td>
</tr>
<tr>
<td>CPI</td>
<td>-0.02878</td>
<td>0.257923</td>
<td>0.165798</td>
<td>0.115009</td>
<td>0.258947</td>
<td>0.093791</td>
<td>1</td>
</tr>
</tbody>
</table>

The highest correlation is at 0.9857 which is money supply and foreign exchange reserve. This means that money supply can be almost explained by foreign exchange reserve and either one should be deleted. Since money supply also have high correlation with other variables such as interest rate differential, government
spending and exchange rate reform, so this paper choose to delete money supply. After delete money supply, the Pearson’s correlation matrix table is shown in the table 4.2. It is found that there is no serious multicollinearity problem exists after deleting the independent variable money supply.

Table 4.2: Multicollinearity test result after delete money supply

<table>
<thead>
<tr>
<th></th>
<th>FER</th>
<th>INT</th>
<th>CPI</th>
<th>M2</th>
<th>TRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.34156</td>
<td>0.060388</td>
<td>-0.02878</td>
<td>0.250247</td>
<td>0.343078</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.609598</td>
<td>0.115009</td>
<td>0.985716</td>
<td>0.666333</td>
<td></td>
</tr>
<tr>
<td>0.609598</td>
<td>1</td>
<td>0.257923</td>
<td>0.670657</td>
<td>0.23669</td>
<td></td>
</tr>
<tr>
<td>0.115009</td>
<td>0.257923</td>
<td>1</td>
<td>0.165798</td>
<td>0.093791</td>
<td></td>
</tr>
<tr>
<td>0.985716</td>
<td>0.670657</td>
<td>0.165798</td>
<td>1</td>
<td>0.628929</td>
<td></td>
</tr>
<tr>
<td>0.666333</td>
<td>0.23669</td>
<td>0.093791</td>
<td>0.628929</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

4.2 ADF Test Results

To examine the stationary of the variables, Augmented Dickey-Fuller (ADF) test is used. The result of exchange rate, interest rate differential, trade balance, foreign exchange reserve and government spending is non-stationary which is shown in table 4.3.

Table 4.3: Unit root test result

<table>
<thead>
<tr>
<th>Variables</th>
<th>Augmented Dickey-Fuller test statistic</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX</td>
<td>0.204067</td>
<td>0.9703</td>
</tr>
<tr>
<td>INT</td>
<td>-2.43073</td>
<td>0.1387</td>
</tr>
<tr>
<td>FER</td>
<td>-2.296625</td>
<td>0.1769</td>
</tr>
<tr>
<td>GDP</td>
<td>-4.510751</td>
<td>0.0006</td>
</tr>
<tr>
<td>TRD</td>
<td>-1.039469</td>
<td>0.7315</td>
</tr>
<tr>
<td>CPI</td>
<td>-3.847945</td>
<td>0.0046</td>
</tr>
<tr>
<td>GOV</td>
<td>0.575286</td>
<td>0.9876</td>
</tr>
</tbody>
</table>
After doing log difference for exchange rate, and do difference for interest rate differential, trade balance, foreign exchange reserve and government spending, the probability of each variable less than 5%, this means that all are stationary.

4.3 Ordinary Least Squares Results

After solving the multicollinearity problem and non-stationary problem, it is time to run the least squares regression. This model includes all variables including dependent variable which is exchange rate, and all independent variables which consist of GDP differential, interest rate differential, trade balance, foreign exchange reserve, inflation rate differential, government spending and dummy variable exchange rate reform. The least squares results show both single and entire significance level, and also show signs of each variable and the coefficient estimation. The results of least squares regression are shown in Table 4.4:
Table 4.4: results of least squares regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.008539</td>
<td>0.003445</td>
<td>2.478841</td>
<td>0.0172</td>
</tr>
<tr>
<td>CPI</td>
<td>0.002521</td>
<td>0.000679</td>
<td>3.712736</td>
<td>0.0006</td>
</tr>
<tr>
<td>GDP</td>
<td>0.000401</td>
<td>0.000444</td>
<td>0.903541</td>
<td>0.3713</td>
</tr>
<tr>
<td>RINT</td>
<td>-0.005771</td>
<td>0.001731</td>
<td>-3.334022</td>
<td>0.0018</td>
</tr>
<tr>
<td>RFER</td>
<td>-0.13178</td>
<td>0.062479</td>
<td>-2.109179</td>
<td>0.0408</td>
</tr>
<tr>
<td>RTRD</td>
<td>4.77E-05</td>
<td>0.000111</td>
<td>0.427772</td>
<td>0.671</td>
</tr>
<tr>
<td>RGOV</td>
<td>-0.002726</td>
<td>0.00327</td>
<td>-0.833843</td>
<td>0.409</td>
</tr>
<tr>
<td>REF</td>
<td>-0.011865</td>
<td>0.002253</td>
<td>-5.266964</td>
<td>0</td>
</tr>
</tbody>
</table>

R-squared 0.553229  Mean dependent var - 0.005573
Adjusted R-squared 0.480498  S.D. dependent var - 0.008949
S.E. of regression 0.00645  Akaike info criterion 7.106346
Sum squared resid 0.001789  Schwarz criterion 6.803315
Log likelihood 189.2118  F-statistic 7.605684
Durbin-Watson stat 1.710143  Prob(F-statistic) 0.000006

After running the regression, the Heteroskedasticity is checked by using the White’s General Test and found that the null hypothesis cannot be rejected. Thus, there is no Heteroskedasticity which results are provided in appendix A. In checking for the Serial Correlation, the Breusch-Godfrey Test is used where finding identified that the null hypothesis cannot be rejected, so there is no Serial Correlation which results are provided in appendix B.

From the table 4.4, the probability of F-statistic is lower than 5%, which means that the whole regression is significant. The coefficient sign can show the effect on the RMB exchange rate. The positive sign means the increase in factors will
cause increase of the RMB to exchange for US Dollar, which means the effect will led to Chinese RMB depreciate. The negative sign means the increase in factors will cause reduce of the RMB to exchange for US Dollar, which means the effect will led to Chinese RMB appreciate. The least squares results will explained in the next section.

4.4 The relationship between RMB exchange rate and each independent variable

4.4.1 GDP Differential
For the GDP differential variable (GDP), since the null hypothesis cannot be rejected at 5% significant level, the coefficient is insignificant. This means that the GDP differential rate between China and US is not significantly related to Chinese RMB exchange rate. This finding is consistent with the study result of Amuedo-Dorantes and Pozo (2001), Zada (2010) and Saeed, Awan, H.Sial and Falak Sher (2012). This can be reasonable because the change in exchange rate also depend on the monetary policy in this country.

4.4.2 Interest rate differential
For the interest rate differential between China and U.S. (INT), the coefficient is found to be significant because the null hypothesis can be rejected at 5% significant level. This means that the interest rate differential is significantly negative related to Chinese Yuan exchange rate. This finding is consistent with the study result of Lee-Lee and Hui-Boon (2007), Maeso-Fernandez Osbat and Schnatz (2001), Ogun (2012), Dornbusch (1978), Makrydakis (2000), Moura (2010), Zada, (2010), Beasurto and Ghosh (2001). This implies that the interest rate differential will be one of the important sign to predict the Chinese RMB exchange rate. The negative relationship to exchange rate means that the increase of interest rate differential between China and U.S. led to less Chinese Yuan exchange for 1 U.S. Dollar, so Chinese Yuan appreciate.

4.4.3 Trade balance
For the trade balance variable (TRD), the null hypothesis cannot be rejected at 5% significant level so the coefficient is insignificant. This means that the trade balance of China is not significantly related to Chinese RMB exchange rate. This finding is consistent with the study result of Zada (2010), Kriljenko and Habermeier, (2004). This is also reasonable as the similar reason as GDP differential. The change in trade balance may not directly cause the exchange rate change apparently since when there is trade surplus or deficit the different monetary policy would affect the exchange rate in other way.

4.4.4 Foreign Exchange Reserve

For the foreign exchange reserve in China (FER), the coefficient is found significant because the null hypothesis can be rejected at 5% significant level. This means that the foreign exchange reserve is significantly negative related to Chinese Yuan exchange rate. This finding is consistent with the study result of Zada (2010), Saeed, Awan, H.Sial and Sher (2012). This implies that the foreign exchange reserve will be one of the important sign to predict the Chinese RMB exchange rate. The negative relationship to exchange rate means that the increase of foreign exchange reserve in China led to less Chinese Yuan exchange for 1 U.S. Dollar, so Chinese Yuan appreciate.

4.4.5 Inflation Rate Differential

For the inflation rate differential between China and U.S. (CPI), the coefficient is found significant because the null hypothesis can be rejected at 5% significant level. This means that the foreign exchange reserve is significantly positive related to Chinese Yuan exchange rate. This finding is consistent with the study result of Zada (2010), Parveeb, Khan and Ismail (2012), Jamal (2005) and Ogun (2012). This implies that the inflation rate differential will be one of the major sign to predict the Chinese RMB exchange rate. The positive relationship to exchange rate means that the increase of inflation rate differential between China and U.S. led to more Chinese Yuan exchange for 1 U.S. Dollar, so Chinese Yuan depreciate.

4.4.6 Government Spending
For the government spending variable (GOV), the null hypothesis cannot be rejected at 5% significant level so the coefficient is insignificant. This means that the Chinese government spending is not significantly related to Chinese RMB exchange rate. This finding is consistent with the study result of Ansari, Gordon and Akuamoah (1997). The change in government spending may not directly cause the exchange rate change apparently since when there is more or less government spending, government may use the different monetary policy affect the exchange rate in another way.

4.4.7 Exchange Rate Reform Dummy

For the exchange rate reform dummy (REF), the coefficient is found significant because the null hypothesis can be rejected at 5% significant level. This means that the exchange rate reform is significantly related to Chinese Yuan exchange rate. This finding is consistent with the study result of Mussa (1986), Flood and Rose (1995), Killeen, Lyons, and Moore (2000), Chinn and Wei (2008). This implies that the exchange rate reform in China in 2005 is significant influence the Chinese RMB exchange rate. The negative relationship to exchange rate means that the after the exchange rate reform in China, Chinese Yuan tend to appreciate.
CHAPTER V  
CONCLUSION, IMPLICATION AND FURTHER STUDY

5.1 Conclusion

The purpose of this study is to identify the factors that affect changes in the RMB exchange rate and identify the relationship between each factor and the RMB exchange rate. From the results of this study, Chinese government may know the factors causing the Chinese RMB variation and stabilizing these variables directly can induce the stability of Chinese RMB exchange rate. The findings may also help financial institutions and multinational corporations to reduce foreign exchange rate risk.

The results of this study indicate that interest rate differential, foreign exchange reserve, inflation rate differential and exchange rate reform have an impact on Chinese RMB exchange rate. Interest rate differential is negatively related to RMB exchange rate which are found to be concluded in the same way as previous studies of Maeso-Fernandez Osbat and Schnatz (2001), Ogun (2012), Dornbusch (1978), Makrydakis (2000), Moura (2010), Zada, (2010), Beasurto and Ghosh (2001). Foreign exchange reserve is negatively related to RMB exchange rate which is consistent with the findings of Zada (2010), Saeed, Awan, H.Sial and Sher (2012). Exchange rate reform is also negatively related to RMB exchange rate. Whereas one independent variable (inflation rate differential) have positive relationship between RMB exchange rate which can be support from results found by Zada (2010), Parveeb, Khan and Ismail (2012), Jamal (2005) and Ogun (2012). Chinese government can use foreign exchange reserve, interest rate and other means to maintain the RMB exchange rate stability. Financial institutions and multinational companies through the grasp of change in amount foreign exchange reserve and changes in interest rate or inflation
rate in China and US can predict the trend of RMB exchange rate, and make the appropriate response measures to reduce the losses caused by changes in exchange rate. Foreign investors can through changes of China’s foreign exchange reserve, the interest rate differential between China and US, and the inflation rate differential between China and US can predict the changes of RMB against US Dollar exchange rate in the future. When China’s foreign exchange reserve or the interest rate differential increase, or inflation rate differential decrease means that RMB will appreciate, investors can buy Yuan and sell US Dollar. If China’s foreign exchange reserve or the interest rate differential decrease, or inflation rate differential increase means that RMB will depreciate, investors can buy US Dollar and sell Yuan.

However, GDP differential (Amuedo-Dorantes and Pozo, 2001; Zada, 2010; Saeed, Awan, H.Sial and Falak Sher, 2012), trade balance (Zada, 2010; Kriljenko and Habermeier, 2004) and government spending (Gordon and Akuamoah, 1997) are insignificantly related to RMB exchange rate. This study finds the same result as previous studies. This result adds more information on the analysis of Chinese RMB against US Dollar exchange rate.

5.2 Implication

Results from the study may help Chinese government to stabilize the RMB exchange rate after understanding the factors that affect the RMB exchange rate. Further, the findings of determinants of RMB exchange rate may also help financial institutions and multinational companies to make the appropriate measures response to RMB exchange rate change to reduce the losses caused by changes in exchange rate. The result of this study also benefits foreign investors to make the right investment in foreign exchange market.

5.3 Recommendations for Future Research
Future research may include more independent variables and provide more contributions on the exchange rate, such as non-macroeconomic effect and political effect. Additionally, the RMB exchange rate may be measured by using exchange rate between RMB and other important countries’ currencies, such as Japanese yen and Euro which may result in a different outcome. Besides, more frequently data might be used and better capture the true impact of exchange rate changes.
BIBLIOGRAPHY


at both the London School of Economics and Political Science and The University of Chicago.


Saeed, A., Awan, R. U., Sial, M. H., & Sher, F. AN ECONOMETRIC ANALYSIS OF DETERMINANTS OF EXCHANGE RATE IN PAKISTAN.


APPENDICES

Appendix A. White’s General Test Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.008539</td>
<td>0.004203</td>
<td>2.031598</td>
<td>0.0484</td>
</tr>
<tr>
<td>CPI</td>
<td>0.002521</td>
<td>0.000802</td>
<td>3.145169</td>
<td>0.003</td>
</tr>
<tr>
<td>GDP</td>
<td>0.000401</td>
<td>0.000385</td>
<td>1.042937</td>
<td>0.3028</td>
</tr>
<tr>
<td>RINT</td>
<td>-0.005771</td>
<td>0.002315</td>
<td>-2.493356</td>
<td>0.0166</td>
</tr>
<tr>
<td>RFER</td>
<td>-0.13178</td>
<td>0.056005</td>
<td>-2.352999</td>
<td>0.0233</td>
</tr>
<tr>
<td>RTRD</td>
<td>4.77E-05</td>
<td>0.00012</td>
<td>0.397509</td>
<td>0.693</td>
</tr>
<tr>
<td>RGOV</td>
<td>-0.002726</td>
<td>0.003291</td>
<td>-0.828425</td>
<td>0.412</td>
</tr>
<tr>
<td>REF</td>
<td>-0.011865</td>
<td>0.002004</td>
<td>-5.921212</td>
<td>0</td>
</tr>
</tbody>
</table>

| R-squared | Mean dependent var | 0.553229 | -0.005573 |
| Adjusted R-squared | S.D. dependent var | 0.480498 | 0.008949 |
| S.E. of regression | Akaike info criterion | 0.00645 | -7.106346 |
| Sum squared resid | Schwarz criterion | 0.001789 | -6.803315 |
| Log likelihood | F-statistic | 189.2118 | 7.606584 |
| Durbin-Watson stat | Prob(F-statistic) | 1.710143 | 0.000006 |
Appendix B. Breusch-Godfrey Test Results

Breusch-Godfrey Serial Correlation LM Test:

<table>
<thead>
<tr>
<th></th>
<th>F-statistic</th>
<th>Prob. F(4,39)</th>
<th>Obs*R-squared</th>
<th>Prob. Chi-Square(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.883593</td>
<td>0.482711</td>
<td>4.237817</td>
<td>0.374776</td>
</tr>
</tbody>
</table>

Test Equation:
- Dependent Variable: RESID
- Method: Least Squares
- Date: 11/12/13  Time: 19:04
- Sample: 2000Q2 2012Q4
- Included observations: 51
- Presample missing value lagged residuals set to zero.

Variable | Coefficient | Std. Error | t-Statistic | Prob. |
---------|-------------|------------|-------------|-------|
C        | 0.001345    | 0.003878   | 0.346811    | 0.7306|
CPI      | 3.43E-05    | 0.000722   | 0.047427    | 0.9624|
GDP      | -0.000376   | 0.000521   | -0.720511   | 0.4755|
RINT     | 0.001019    | 0.001866   | 0.545949    | 0.5882|
RFER     | 0.027143    | 0.068335   | 0.397209    | 0.6934|
RTRD     | -6.30E-05   | 0.00012    | -0.522976   | 0.6039|
RGOV     | 0.0005      | 0.003407   | 0.146894    | 0.884 |
REF      | 0.001247    | 0.00242    | 0.515197    | 0.6093|
RESID(-1)| 0.16425     | 0.172472   | 0.952325    | 0.3468|
RESID(-2)| -0.165499   | 0.17406    | -0.950817   | 0.3476|
RESID(-3)| -0.236332   | 0.189945   | -1.244211   | 0.2208|
RESID(-4)| 0.006963    | 0.184817   | 0.037674    | 0.9701|

R-squared | 0.083094 | Mean dependent var | 2.28E-18 |
Adjusted R-squared | -0.17552 | S.D. dependent var | 0.005982 |
S.E. of regression | 0.006485 | Akaike info criterion | -7.03623 |
Sum squared resid   | 0.00164  | Schwarz criterion    | -6.58169 |
Log likelihood      | 191.424  | F-statistic          | 0.321306 |
Durbin-Watson stat  | 2.032082 | Prob(F-statistic)    | 0.976392 |