

January 01, 2011

## Monetary policy in less developed economies: a cross-country analysis

Ludmilla Buteau  
*Northeastern University*

---

### Recommended Citation

Buteau, Ludmilla, "Monetary policy in less developed economies: a cross-country analysis" (2011). *Economics Master's Theses*. Paper 2.  
<http://hdl.handle.net/2047/d20001153>

This work is available open access, hosted by Northeastern University.

MONETARY POLICY EFFECTIVENESS IN LESS  
DEVELOPED ECONOMIES:  
A CROSS – COUNTRY ANALYSIS

A thesis presented  
by

Ludmilla Buteau

To

The Department of Economics

In partial fulfillment of the requirements for the degree of  
Masters of Arts

in the field of

Economics

Northeastern University  
Boston, Massachusetts  
August, 2011

MONETARY POLICY EFFECTIVENESS IN LESS  
DEVELOPED ECONOMIES:  
A CROSS – COUNTRY ANALYSIS

by

Ludmilla Buteau

Submitted in partial fulfillment of the requirements  
for the degree of Masters of Arts in Economics  
in the Graduate School of  
Northeastern University, August, 2011

## ABSTRACT

Monetary policy's weight in macroeconomic policy has increased over the past years, especially with the liberalization of financial markets and development of new financial instruments. With this new global economy, the gap between countries has become wider, and the less developed are unsuccessfully (for the most part) trying to catch up with the short list of industrialized economies. Less developed countries consists of small open economies that are more exposed to international shocks with a very low level of financial development and other factors such as remittances or dollarization that are affecting implementation of policies. The aim of this thesis is to test for monetary policy effectiveness of less developed economies using a panel of underdeveloped and developing countries. Using the International Financial Statistics dataset published by the IMF, I test for the impact of the monetary policy instrument, the central bank's nominal interest rate, on the economic growth, inflation and also the channel through which the outcome is more significant. The results show that in all of these countries, show that monetary policy through interest rate isn't as efficient as it should be. The exchange rate channel has a more significant impact when trying to impact growth particularly in countries with very low levels of financial development.

## ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor Professor Laura Christina Steiger for her incredible patient guidance, encouragement and excellent advice throughout this research. I would also like to express my gratitude to my Fulbright Advisor Silja Sistok for her help and assistance. I would like to thank my Scholarship sponsors from the Fulbright Program and the International Institute of Education for this great opportunity. My sincere thanks go to Professor Osborne Jackson for his help and advice throughout the course of the thesis. I am thankful to Tess Forssell, Shaun O'Brien and Professor Maria Luango-Prado for their generous assistance during this time, to Rémy Montas from the Board of the Central Bank of Haiti for his help by sending documents related to my thesis for the literature review. I also thank my friends from the class of 2011 for sharing experiences and knowledge during the time of study. Finally, I take this opportunity to express my most profound gratitude to my husband, Nicolas, my beloved parents and family and my family in law for their moral support and patience during my master's program at Northeastern University.

## TABLE OF CONTENTS

|  |    |
|--|----|
| Abstract   | 3  |
| Acknowledgements   | 4  |
| Table of Contents  | 5  |
| Chapter 1: Introduction  | 7  |
| Chapter 2: Literature Review                                       | 8  |
| 2.1 - Monetary Policy in Less Developed Economies                  | 8  |
| 2.2 - The Interest Rate in Monetary Policy                         | 9  |
| 2.3- The Exchange rate and the less developed economy              | 12 |
| Chapter 3: Case Study Of Monetary Policy in LDCs: Example of Haiti | 16 |
| 3.1- Monetary Policy and Preliminary Estimation                    | 18 |
| Chapter 4: Model Specification and Estimation                      | 27 |
| 4.1 – Data   | 28 |
| 4.2 - Methodology  | 28 |
| 4.2.1 – Country Group Specifics and Financial Development Level    | 29 |
| 4.2.2 – Panel regression analysis                                  | 29 |
| 4.2.3 - Vector Auto-Regressive Model (VAR)                         | 31 |
| 4.3 - Results of Estimation  | 33 |
| 4.3.1 – General Results  | 33 |
| 4.3.2 - VAR Results by Country Group                               | 36 |
| 4.3.3- Variance Decomposition                                      | 37 |
| Chapter 5: Conclusion and Policy Recommendation                    | 41 |
| Appendix A   | 43 |
| Appendix B   | 44 |
| References   | 58 |

## Chapter I: INTRODUCTION

According to Weisbrot and Several (2011), “*there has been a long period of time in the 20<sup>th</sup> century during which most low and middle income economies experienced economic policy failure*”. Weak public institutions, including high levels of corruption, characterize many developing countries, but should not be considered as the only cause of their “failure”. Indeed, finding the proper monetary policy for a country with a low level of capital is very challenging, considering the importance of this factor to economic growth. And according to Froyen (1999), as more countries have left the fixed exchange rate, monetary policy became a more important tool with the adoption of the flexible exchange rate regime. As of 2009, the developing or less developed countries (LDCs) lacked both physical and human capital (low stock and investment). They currently hold the highest level of illiteracy and unemployment rate, paired with a lack of infrastructure. Among their limitations, we can count the banking system, mainly the central bank, often limited in its ability to regulate the money supply to influence output and prices in developed economies. The financial market is very dependent on the world economy, poorly organized, discontinuous and with oligopolistic banks.

An optimal economic policy in a less developed economy should seek to decrease price volatility and increase long-term economic growth measured by the change in the Gross Domestic Product. Most international organizations such as the World Bank and the International Monetary Fund have sought to find different strategies to improve economic performances in less developed countries. Policies such as inflation-targeting are suggested in order to reduce the gap between these countries and more advanced economies since it would lead to a lower volatility in inflation and economic growth. In order to control price fluctuations, the interest rate is an important instrument and its popular use comes from its impact on financing conditions on the economy, the availability of credit and expectations regarding direction of economic activity.

The monetary policy decisions affect the economies through several channels including the interest rate and the exchange rate. The focus on those two channels relates to the recent increase in literature on comparing both interest rate targeting and exchange rate targeting for developed economies, especially with the introduction of the euro.

This study investigates the impact of a change in the central bank's interest rate versus that of the exchange rate on growth in less developed economies. Knowing how most of the conditions for inflation - targeting such as central bank independence, and the existence of a predictable relationship between monetary instruments and inflation are lacking in many of these countries, the purpose of this thesis is to show how the exchange rate channel has a stronger impact on economic growth in the small less developed economies than the interest rate channel. My hypothesis rests on the fact that the low financial development in these countries impedes the effectiveness of monetary policy since the primary instrument is interest rate.

In the case of less developed economies, considering their increased openness, the relationships between inflation and monetary aggregates, as well as between monetary aggregates and interest rate weakened as the financial market became more liberalized. On the other hand, in most cases, the decrease in the level of development comes with an increase in emigration, in remittances and also in the existence of dual currency in the economy. This co-circulation of both the national and a stronger foreign currency increases the importance of the exchange rate and its impact on financial and non-financial sectors of the economy as well as on expectations. The exchange rate should then be considered when determining an effective monetary policy.

In order to verify this statement I have reviewed the literature regarding both the exchange rate and the interest rate channels. Through a case study, preliminary estimation was conducted in order to show the importance and relevance of the exchange rate to the economy and this has been done for

Haiti. Haiti is a small open economy and the only less developed country of the Caribbean region. Its characteristics combine increasing inflation rate, high exchange rate relative to the US dollar, low growth, weak public institutions, and important level of dollarization of both deposits and loans as well as a low level of financial development.

This thesis is divided into five sections. In section two, the existing literature on monetary policies in less developed countries is reviewed, specifically regarding the two channels previously discussed. In the third section, the effectiveness of monetary policy channels in Haiti is evaluated using a series of Ordinary Least Squares (OLS) regressions. In the fourth section, the effectiveness of monetary policy in certain LDCs is estimated through a panel data approach and a Vector Auto-Regressive model. The final section concludes.

## **Chapter 2: LITERATURE REVIEW**

In this chapter, the different monetary policies applied are discussed as well as the two main channels through which the instruments affect inflation and economic growth.

### **2.1 - MONETARY POLICY IN LESS DEVELOPED ECONOMIES**

In LDCs, in the context of development, monetary policy has an active role and is considered quite relevant. Just like the industrialized countries, they face different constraints and therefore have different policies. The most common policies used are the monetary targeting which most industrialized economies have transitioned from to move to inflation targeting, and exchange rate targeting. However, the impacts of the interest rate and the exchange rate have been discussed quite

often in the economic literature<sup>1</sup> for the past years and several research papers have been focusing on the possibility of using the exchange rate targeting as an alternative policy because of the strength of this policy variable and the channel through which it affects economic activity.

## 2.2- THE INTEREST RATE CHANNEL

Monetary policy in less developed economies is generally constrained by the small size of the economy itself as well as its financial markets compared to the level of openness<sup>2</sup>, the lack of financial market infrastructure and competition in the banking sector which impacts the transmission of monetary policy to the economy. Although Romer<sup>3</sup> (1991) finds that openness and the inflation rate are not positively correlated, the cross-sectional analysis this conclusion is based on involves only OECD countries, a club of rich countries. His paper also concludes that most of these countries have found the proper equilibrium under dynamic consistency and an independent central bank. In general, for policy to affect the whole economy the instrument must have an impact on the credit market; the nature of this effect will depend on how developed are the financial and the credit markets.

The interest rate performs several functions in an economy. It has been known as the most common instrument for achieving monetary policy, for its influence on expectations, investment, consumption and other important macroeconomic variables in the economy, but also for its influence on financial markets. The use of the interest rate in LDCs often seems inadequate. In these economies, the use of the interest rate doesn't seem relevant considering the absence of a secondary

---

<sup>1</sup> Thórarinn G. Pétursson (2010), David Parsley and Popper (2009), Rusike (2009), M. Uribe (2009), Amos C Peters (2009)

<sup>2</sup> Usually measured by the sum of Exports and Imports over GDP

<sup>3</sup> "Openness and Inflation: Theory and Evidence", MIT Press, Quarterly Journal of Economics, 1993, Volume 108, pages 869-903

market for financial instruments such as bonds and the lack of involvement of most financial institutions. This makes it difficult for commercial banks to follow or react to a signal from the interest rate, which limits the transmission mechanism.

A basic source of the difference in the macroeconomic analysis between less developed and advanced economies lies in the low level of development in LDC's financial markets. The efficiency of monetary policy in LDCs has been questioned, especially when the structure of the financial system constrains the effectiveness of instruments as well as central bank credibility<sup>4</sup>. In many developing countries, the political pressure put on the important institutions constrains the effectiveness of economic policy. In the case of a central bank, its independence can lead to a more effective and consistent policy. Alesina et al (1993) and Cukierman et al (1992) found a negative correlation between the central bank's independence and a country's long – run inflation.

The interest rate, together with the rate of return on financial assets, also influences public allocations of the government's wealth among domestic and foreign assets and goods. As a response, economists such as McKinnon (1973) have promoted the increase of savings through the rise of interest rates to attain economic growth<sup>5</sup>. According to these authors, an increase in interest rates will help stimulate savings and the flow of resources for development, while raising the stock of financial assets, especially those available for investment, thus allowing better market allocation. The basic objective of McKinnon's theory was to analyze the stabilization policies in economies with a small financial market. His findings relied on effective gain in real output that can be obtained through an increase in deposit rates while focusing on price level stabilization. One of the variables interest rate should affect is investment. In less developed countries, investment is not as sensitive to

---

<sup>4</sup> Credibility is a very important issue in monetary policy since the late 1970s, and Rogoff, Walsh and Svensson showed/brought attention to its implications for designing monetary institutions.

<sup>5</sup> Shaw, Edward (1973). *Financial Deepening in Economic Development* (New York: Oxford University Press).

interest rate as it is in developed economies. The interest rate charged by the commercial banks is often too high and therefore, more small investors or consumers turn to money lenders, landlords, relatives and others outside the banks.

At different stages of capital markets, different instruments are used. Even though the financial repression through controlled interest rates and credit rationing is said to impede economic growth<sup>6</sup> by discouraging savings and fostering low and inefficient investment, some form of direct regulation is still used in LDCs. Reserve requirements are a form of direct regulation. It also involves establishing a floor rate for the commercial banks and is often used as it has been proven to be a relevant tool since financial markets aren't developed enough to replicate the efficient market functioning. Even with its own limitations, it is seen as an effective instrument, especially suitable for LDCs' money market. The role and use of interest rates are more obvious with the evolution of financial markets and with more instruments and assets. Indeed, several instruments used in developed countries can be introduced in LDCs only after the market has been established. When banks are performing their intermediation task, they increase the rate of capital accumulation as well as the productivity, thereby stimulating the economy's steady-state growth (Bencivenga and Smith, 1991). The problem with banks in LDCs however, lies in their holding of excess liquidity, most of which is non-remunerated (Saxegard 2006). The banking sector is the most important source of financing in these economies. Thus the investment choice of banks will either slow down the financial system's role in growth or help increase it.

Even with an important lag, the central banks manage the excess bank reserves with an indirect monetary policy through open market operations, often with central bank or Government bonds. The ineffectiveness of indirect monetary policy is due to the transmission mechanism that involves

---

<sup>6</sup> McKinnon and Shaw (1973)

the commercial banks. One of the difficulties faced by the commercial banks is the fact that the liquidity preference curve is perfectly elastic, and the high interest rate on loan is likely to occur as soon as the loan market becomes liberalized. Banks are observed to be private oligopolists and free to set the loan rate at any level desired, and will use it to compensate for their transaction costs risks. This high loan rate is detrimental to output and employment creation in economies since the banking sector accounts for most business financing, and also the banking interest rates rarely adjust to the changes made by the central bank.

### 2.3- THE EXCHANGE RATE CHANNEL

The exchange rate is currently considered a second instrument of monetary policy and is known for the significance of its channel. It plays an important part in policy making, especially in LDCs that are small open economies. In most cases, the real exchange rate is one of the main transmission mechanisms through which policy can affect economic performance. According to Cottani et al<sup>7</sup> (1990), the relationship between real exchange rate (RER) and policy goes both ways. The decisions affect the RER through their impact on the price level and the nominal exchange rate. For example, a policy leading to higher economic growth would appreciate the RER, especially if resulting from improvements in tradable sectors. This study about real exchange rate and economic performance was conducted with a sample of 24 developing countries from 1960 to 1983, with a model combining time-series and cross-sectional data. The authors strongly believe that a high correlation between the real exchange rate and growth may be because the exchange rate is an important link between policy and performance in that economy, therefore if policies are aiming to stabilize the real exchange rate around its optimal level; it will certainly help enhance growth in the process. One other explanation mentioned is the fact that policymakers' decisions affect both rates at the same

---

<sup>7</sup> Cottani and al (1990), Real Exchange Rate and economic performance; Optimal policy in LDCs

time, thus increasing the correlation between the variables, but not necessarily the causality condition.

However, it must be acknowledged that when this study was conducted the main determinants for linking the real exchange rate and economic growth rate was not remittances as it is nowadays, since they did not represent such a significant amount compared to other international funds. Indeed in the late 90s, in most LDCs, governments controlled the nominal exchange rate using pre-fixed parities. For the past decades, they have been using the floating exchange rate, but most have been reported to have a “fear of floating” since they frequently use foreign market interventions.

The importance of the exchange rate has been emphasized with the increasing level of co-circulation and the existence of dual currencies that followed the migration of the population from their home countries to more industrialized economies. Indeed, the conventional wisdom regarding remittances is that it is the result of a low level of development; most remitters are immigrants looking to improve their conditions of life.

Remittances are then seen as a stable and reliable source for foreign exchange; they can help insure consumption against bad shocks, therefore reducing poverty and macroeconomic volatility and enhance investments while alleviating credit constraints. Remittances are then considered as a potential cure to many economic challenges that less developed countries are facing. From this point of view policymakers may try to encourage remittances, which may lead to certain macroeconomic consequences.

For example, if the economy receives a negative productivity shock, the decrease in output would normally imply that households will increase their labor supply. With the presence of remittances, this results in higher remittances, thus in no increase of the labor supply. As remittances increase, the labor effect of remittances boosts compared to the effect from production. By increasing

correlation between labor and output, remittances cause labor supply to become more procyclical. However, by allowing to smooth consumption and credit for the country receiving the flows, it also helps decrease GDP volatility.

Remittances also contribute to greater counter cyclicity in government policy, by forcing it to use instruments leading to the violation of the Friedman rule<sup>8</sup> and use its remaining instrument: the inflation tax on money balances. Remittances, the contemporaneous tax on labor income and money growth are all considered determinants of optimal household supply in equilibrium.

Concerning monetary policy and remittances and their direct impact, it was studied using the example of Mexico by Ruiz and al (2009). In this country, which has the most important inflow of remittances among Latin American countries, the interaction between remittances and macroeconomic policy is studied by Ruiz and al, by Chami and al (IMF 2008), and Cosimano and al (2005). According to the authors, responding actively to the remittances' flow depends on the current policy and also on the effect of the remittances on the monetary policy variables. For example, in the case of Mexico, the authors showed how the monetary policy wasn't as affected by remittances shocks as much as they initially assumed. This can be explained by the fact that the monetary authorities of the country included these flows in their policy decisions. Inflation targeting and keeping a flexible exchange rate are the main emphasis of the monetary policy in the Mexican economy. Remittances may also affect the monetary policy through currency substitution. In fact, when a significant amount of another currency is circulating in a country while local inflation is high, it causes the national money to be replaced by the foreign one. More commonly, this process is called dollarization or co-circulation.

---

<sup>8</sup> The Friedman rule consists of setting net nominal interest rates to zero; it is optimal under commitment when the Government has a sufficient number of independent policy instruments.

According to the literature mentioned previously, most of the high-dollarized economies have adopted inflation-targeting<sup>9</sup>. Indeed, for certain countries such as Peru, Argentina and Bolivia, Leiderman and al (2006) concluded that it can be an effective policy. A lower exchange rate pass-through to domestic prices has resulted from inflation targeting, while a higher impact from central bank's nominal interest rate to bank rates, leading to a better financial intermediation. Karl Driessen<sup>10</sup> (2006) in his paper researched the effectiveness of monetary policy in reversing dollarization<sup>11</sup>, which is according to the author a simple result of significant fiscal deficits and financial crises, both leading to a lack of confidence in the country's denomination. The study was conducted using data from 1991 to 2004, with a total of 23 countries of which 16 transition economies and 7 from the Latin American region. The author calculated monetary tightness over the period as the average real return on deposits using the CPI as a deflator and divided the countries and their data in quadrants. The study revealed that monetary policy had an important effect on the exchange rate, but restrictive measures do not translate into a reduction in dollarization. The inflation targeting is again mentioned as one of the best policies to be used, considering it will lower (and stabilize) inflation and in the long run restore Central Bank's credibility and confidence in the local denomination. Driessen also mentioned using a more sophisticated model would give better results, instead of looking at the impact of de-dollarization on real returns, because monetary policy effectiveness (especially in those economies), does vary over time.

A typical less developed economy does not always combine all of the above mentioned constraints. However should this be the case, the country would have a managed exchange regime, a narrow domestic financial system, a lack of market instruments and all of these combined with a fear of

---

<sup>9</sup> Peru, Bolivia and for references see Mishkin and Schmidt-Hebbel (2005), and Batini and Laxton (2005).

<sup>10</sup> Karl Driessen, "*monetary policy in dollarized economies*", International Monetary Fund, published by the Bank of Albania, 2006

<sup>11</sup> See appendix

floating, a high level of dollarization (over 50 %) and increasing flow of workers' remittances that represents a higher share of GDP than investment. By examining these aspects of such LDCs, it will be better illustrated how the efficacy of monetary policy in these countries can indeed be weakened by those factors. Haiti meets all of these requirements, which is why I chose to look at the monetary policy from its Central bank over the past years along with the stress factors it has been facing.

### **Chapter 3: CASE STUDY OF MONETARY POLICY IN LDCS: EXAMPLE OF HAITI**

Effective monetary policy in a less developed country is difficult to achieve. Various studies have sought to identify the optimal policy or instrument. In the case of a low-income country, complications arise since the economy is not as productive as it should be, more dependent on imports therefore allowing it to be more affected by external fluctuations. With the increasing dollarization and the importance of remittances in the economy, the policy mix used by the Haitian policymakers has not been as effective as expected and this situation hasn't improved since the early 1990's.

As the poorest country of the Caribbean, Haiti's economy is well known for its particular combination of characteristics. Although it was not as affected as the Latin countries by different financial and oil crises, the country's economy is highly dollarized, with a significant level of remittances in the economy and high volatility of prices. Most of the important economic disturbances to which it is subject come from internal shocks, rather than external ones. My purpose throughout this section is to understand the economic framework of policy making in Haiti during the past 20 years, given the constraints on effectiveness of monetary policy.

Like any small open economy, it is a price taker, and not a price setter, and is too small for its own policy or decisions to affect the rest of the world. The economy is also very dependent on imports, as the productive industry became less competitive since the late 1980's and 1990's. The instability coming from political disturbances such as changes of regime, the embargo (1991-1994) period during which the country was basically not trading with the US and most of its partners, has contributed to several period of significant declines in economic activity, due to very low investments, increase in the level of country risk including political, exchange rate, economic and sovereign risk. As a result, depreciation and inflation grew significantly. Even though Haiti has never been through an important period of hyper-inflation, the previous cited events contributed largely to increase negative expectations regarding inflation and enhance the search for another currency as a new store of value, which is how the country started facing increased co-circulation in the economy.

The partial dollarization of the Haitian economy became significant, especially with that of deposits and loans. The ratio such as foreign currency deposits on total deposits and loans in foreign currency over the total loans by the banking sector were then taken into account. Despite an important change in their instruments and in the orientation of their policy, the Central Bank has played its role of lender of last resort, monitor of the banking system and has tried to maintain the inflation and the exchange rate at their most viable level. Like most countries, the Central Bank in Haiti does not solely rely on maintaining inflation and exchange rate but also takes decisions that can help promote economic growth. In fact, one of the main roles of the central bank is to contribute to economic growth.

The period from 1986 to 1994 with its violence and political changes, led to emigration, which has had an important impact on the magnitude of the remittances. The transfers contributed importantly to the dollarization process, initiated with the increase in political shocks, high inflation rates and the

shift from prices in the national currency to the use of the dollar that happened in 1994-1995 with the change to a dollar valuation of real estate.

### 3.1- MONETARY POLICY AND ESTIMATION

The conduct of monetary policy in Haiti has been subject to lack of regime consistency, incorrect choice of instruments, poor market conditions and most importantly high dollarization. From the early 1970's to 2008, the monetary policy was a mix of monetary aggregate targeting and inflation targeting, during the change in exchange rate regime which went from fixed to floating in the mid 1980's.

From its creation in 1976 to the late 1990s, the central bank of Haiti was assumed to have as a primary role to keep inflation low, to be a lender of last resort and to help promote growth. The main instruments used were credit ceiling, reserve requirements, interest rate controls by setting the maximum and/or the minimum rate the commercial banks could apply on loans or deposits. These measures were determined only by the central bank. Like most low income countries and those with conflicts, Haiti has a history of fiscal deficits. Indeed, the policy was oriented depending on what the central government wanted, and the Central bank primarily played its role of lender of last resort.

The introduction of the BRH bonds was intended to lead to a sharp increase in private credit, and to indirectly finance the fiscal deficit. On the other hand, it served for the commercial banks as an attractive and risk-free alternative to credit, especially with the liquidity impacts of the government's deficits. The BRH bonds were temporarily created to sterilize excess liquidity and money created from financing the Government deficit. The instrument used was the interest rate on the 91-day BRH bond, while the money supply was determined by the volume of BRH bonds. The interest rate was not determined by the market since it was very primary and there were very few interbank

transactions. This led to an important delay in the effect of monetary policy instrument on the levels of interest rates in the economy.

The increasing level of dollarization (graph 2) also hampered the monetary policy effects, especially on prices in sectors such as real estate and consumer durables. Prior to 2004, the importance of fiscal deficit affected the central bank's losses which amounted to 2 % of GDP, a result of the sterilization process from 2001 to 2004. Most of its losses came from the outstanding stock of bonds for sterilization purposes. When BRH tried stopping sterilization during 2003, high liquidity occurred as well as currency depreciation and an increase in dollarization which went from 30% in early 2000 to 50 % in the beginning of 2004.

The monetary policy since the regime change in 2004 has been conducted in line with the objective of macroeconomic stabilization and the strengthening of economic governance. Inflation has decreased from 40 % in the end of 2003 to 8 % in September of 2007. At the same time, the interest rate was cut by 5 % from the end of 2006 to mid-2007, to increase credit growth.

According to IMF economists in a country report on Haiti's selected issues<sup>12</sup>, the analysis of the framework for monetary policy relied on econometric techniques applied to analyze factors influencing the main target which is inflation. Data from 1996 to April 2007 were used to test the cointegration between money supply, inflation and output while a VEC model was used to test the quantity theory. The results implied that despite Haiti's high level of dollarization, when the model includes world oil prices and the exchange rate, there was proof of cointegration between money, prices and real income in line with theory.

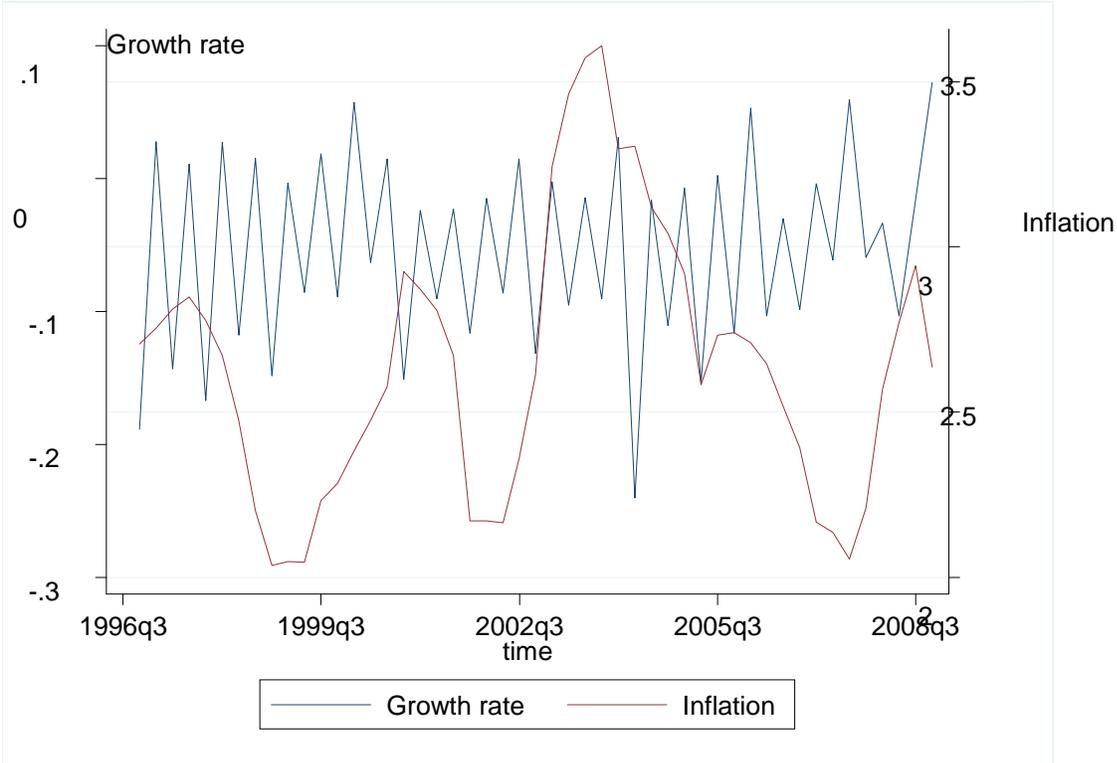
According to the graph, inflation is negatively correlated with output variation as economic theory would predict since important inflation variability would impede growth. Indeed, high inflation

---

<sup>12</sup> IMF – Selected Issues: Haiti country report – 2007, Washington, DC.

volatility would lead to unstable prices and raise uncertainty regarding expectations over future prices. In this case, the standard deviation of the inflation rate is 0.41 whereas for growth it is around 0.07.

Graph 1: Inflation and Growth rate



Since the graph and the data are in line with theory, I will also test for the relationship between the different monetary aggregates and inflation. Monetary targeting has been used in Haiti even long before the 1996 central bank bonds were first issued and is still currently in effect. A strong correlation between monetary aggregates and inflation can help explain better the effectiveness of monetary policy through interest rates. If the inflation and the monetary aggregates have a weak correlation, this would impede the effectiveness of the interest rate on the economy, since the monetary policy cannot properly impact inflation which is one of the important constraints on its effectiveness.

The correlation between monetary aggregates M1, M2 and M3 were tested through a linear regression involving inflation and each of them individually. According to economics, inflation is dependent on the changes in monetary aggregates, because if the money supply grows faster than the economy, than it leads to higher demand of goods and services which in short-term cannot be provided by the corresponding increase of supply, leading to inflation. Monetary aggregates are often best modeled by using an autoregressive process; therefore I use one lag to accompany to estimate the correlation. The one lag is also because of the dataset, which is 49 in total, using more than one would cause significant loss of data and of degree of freedom. This would hinder the significance of the test. The model specification is as follows:

$$Inflation = \beta_0 + \beta M1_t + \beta M1_{t-1} + \varepsilon_t$$

t: time variable

I expect the coefficients accompanying the independent variables to be positive and less than 0.5 since the hypothesis from the beginning of this study is the lack of effectiveness of interest rate policy versus exchange rate policy. The estimation is done using the robust option on stata for better results.

---

Table 2: Results of estimation – dependent variable : Inflation

Independent variables : M1 and L.M1

---

| Series            | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) |
|-------------------|---------------------------------|---------------------------------|---------------------------------|
| C                 | 0.991<br>(1.07)                 | 1.117<br>(1.27)                 | 0.996<br>(1.08)                 |
| M1                | 0.119<br>(0.07)                 | 0.163<br>(1.71)                 |                                 |
| M1 (L1)           | 0.056<br>(0.03)                 |                                 | 0.176<br>(1.77)                 |
| R-square          | 0.045                           | 0.040                           | 0.045                           |
| Number of Obs.    | 48                              | 49                              | 48                              |
| F-statistic       | 1.55                            | 2.92                            | 3.12                            |
| Prob. F-statistic | 0.223                           | 0.094                           | 0.084                           |

---

The results in the previous table show no strong correlation between the monetary aggregate M1 or its lagged value and inflation. The coefficients have the expected signs, are less than 0.50 and are not statistically significant. The model overall isn't statistically significant, although this can be explained by omitted variables, this states a very low correlation between the two variables. To account for possible multicollinearity I tested for each variable individually and the results barely improved.

Tables 3 and 4 give the results for the same estimation for M2 and M3.

---

Table 3: Results of estimation – dependent variable : Inflation

Independent variables : M2 and L.M2

---

| Series            | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) |
|-------------------|---------------------------------|---------------------------------|---------------------------------|
| C                 | 0.474<br>(0.42)                 | 0.978<br>(0.93)                 | 0.947<br>(0.87)                 |
| M2                | 5.319<br>(1.85)                 | 0.163<br>(1.56)                 |                                 |
| M2 (L1)           | -5.122<br>(-1.79)               |                                 | 0.167<br>(1.54)                 |
| R-square          | 0.108                           | 0.035                           | 0.035                           |
| Number of Obs.    | 48                              | 49                              | 48                              |
| F-statistic       | 2.90                            | 2.44                            | 2.36                            |
| Prob. F-statistic | 0.066                           | 0.125                           | 0.132                           |

---

In the case of M2, the coefficients associated with M2 and the first lagged value of M2 are higher than expected but still not statistically significant, and neither is the model. The problem with this is that all three monetary aggregates cannot be added since each is a combination of the previous. The aggregates are composed as follows:

$M1 = \text{Demand Deposits} + \text{Currency in circulation } (M_0)$

$M2 = M1 + \text{Quasi – Money (time and savings deposits)}$

$M3 = M2 + \text{Foreign Currency Deposits}$

In the case of M3 however, I expect statistical significance of the coefficients considering the foreign currency deposits are added when calculating M3. The dollarization indicators have increased over the past years as shown in graph 2, both of deposits and loans as a result of the decrease of confidence in the national currency linked to the political and economic instability throughout the years as mentioned earlier in the text. According to the results in table 4, the coefficients are not all positive. The effect of the exchange rate is implicit in this model and therefore the negative sign of the coefficient associated with the first lagged value of M3 can be expected. It can be explained by the fact that an increase in exchange rate will cause the deposits in dollar to decrease, which will lead to less incentive to save, causing co-circulation and the prices in the economy to rise. The model is better specified than the previous ones (table 4), meaning that when foreign currency in the economy is added to the monetary aggregates, inflation is more sensitive.

---

Table 4: Results of estimation – dependent variable : Inflation

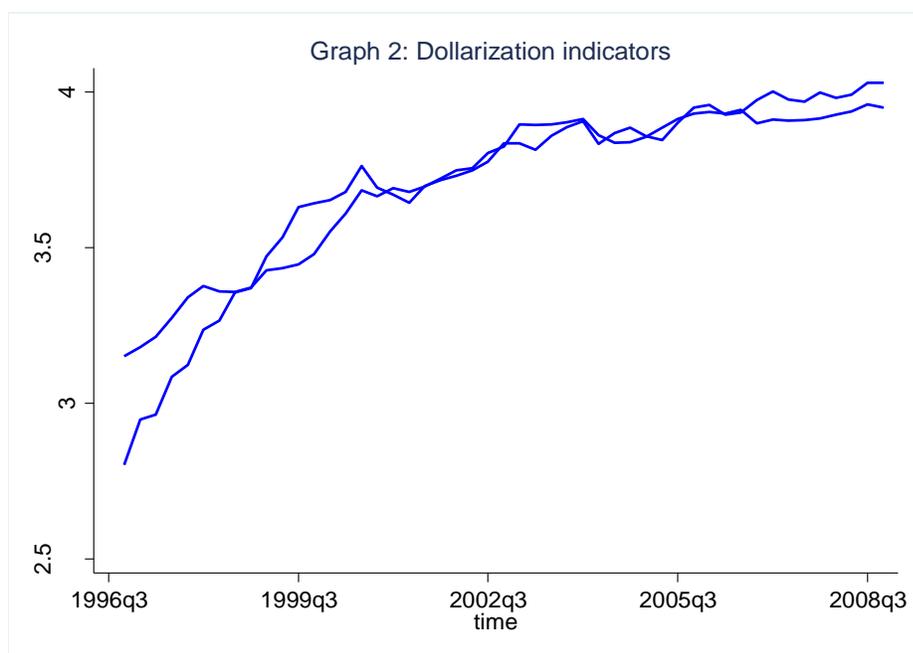
Independent variables : M3 and L.M3

---

| Series            | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) | Coefficients<br>(t –statistics) |
|-------------------|---------------------------------|---------------------------------|---------------------------------|
| C                 | 0.661<br>(0.71)                 | 1.150<br>(1.31)                 | 0.996<br>(1.08)                 |
| M3                | 3.173<br>(1.40)                 | 0.14<br>(1.67)                  |                                 |
| M3 (L1)           | -2.998<br>(-1.33)               |                                 | 0.145<br>(1.66)                 |
| R-square          | 0.095                           | 0.041                           | 0.042                           |
| Number of Obs.    | 48                              | 49                              | 48                              |
| F-statistic       | 2.70                            | 2.80                            | 2.74                            |
| Prob. F-statistic | 0.078                           | 0.100                           | 0.105                           |

---

The strongest relationship is noted to be between M3<sup>13</sup> and M2, thus allowing us to conclude that the prices in the economy may be very sensitive to foreign currency in circulation. This remark is in line with my hypothesis, and because of the importance of the foreign currency in circulation it is also showing that the exchange rate has a strong influence in the economy. Dollarization is a very important consequence of the high inflation, and it became slowly part of the structure of the Haitian economy.



Haiti is a small open economy and a less developed country, this combination often leads to domestic prices being particularly exposed to external shocks which affect the economy through the exchange rate. Several studies regarding the importance of the exchange rate pass-through to domestic prices were conducted at the central bank to find the significance of this assumption. Indeed in a work done by two economists at the research department at the Central bank in 2002,

<sup>13</sup> The monetary base could also be used since in the last empirical paper in the IMF report, it was shown to be very stable which means it could be a very good instrument for controlling money supply in the Haitian economy.

and cited as a reference in the Central bank's Annual report, the pass-through of the exchange rate on domestic prices is close to 50 %.

Aside from its important impact and its predictive power when it comes to the variation of inflation, the exchange rate is also one of the most available information in Haiti. Transactions are documented every day on both the formal and the parallel market. Selling and buying dollars has become a developed sector and most banks rely on the spreads for their profits. This increases the significance of the exchange rate and the sensitivity of a possible response that can come from the economy when a signal or shock is from the rate itself. The last row of the following table shows the correlation between the exchange rate and most of the variables mentioned throughout this section and the line before the correlation with the inflation rate. The numbers for the inflation are significantly lower than that of the exchange rate, whether it is with growth, monetary aggregates, and most importantly with the central bank interest rate.

|                   | M1     | M2     | M3     | growth | inflation | exchange | $\Delta$ BRH rate <sup>14</sup> |
|-------------------|--------|--------|--------|--------|-----------|----------|---------------------------------|
| M1                | 1.000  |        |        |        |           |          |                                 |
| M2                | 0.998  | 1.000  |        |        |           |          |                                 |
| M3                | 0.997  | 0.999  | 1.000  |        |           |          |                                 |
| Growth            | 0.125  | 0.123  | 0.126  | 1.000  |           |          |                                 |
| Inflation         | 0.201  | 0.187  | 0.203  | -0.121 | 1.000     |          |                                 |
| Exchange rate     | 0.942  | 0.935  | 0.946  | 0.079  | 0.407     | 1.000    |                                 |
| $\Delta$ BRH rate | -0.430 | -0.414 | -0.394 | 0.032  | 0.151     | -0.262   | 1.000                           |

Another aspect of the exchange rate is the parallel market. According to the literature<sup>15</sup>, the parallel

<sup>14</sup>  $\Delta$ BRH rate: the change in the interest rate is used instead of the level because what matters is the policy induced by the change in the interest rate.

foreign exchange market arises as a consequence of the adoption of exchange rate controls in many less developed economies facing substantial macroeconomic imbalances. This market, developed in the early 1980's, has continued to evolve for the past 10 years. It consists of people on the streets exchanging gourdes and dollars at a rate determined by bargaining. The informal exchange rate is collected by the Central Bank's international affairs department by a brief census.

The lack of effectiveness of monetary policy has been said to be a result of the weakness of the interest rate channel that the Central bank has been trying to improve. Different methods were used such as in 2008 when the BRH bonds started to include other financial institutions like insurance companies as buyers in their bidding process. This is a characteristic of an under-developed financial system. Opening the bonds to other financial institutions was considered the beginning of a more transparent policy and to create a secondary market, which would eventually lead to a financial market. The commercial banks would no longer be the sole ones informed of the orientation of monetary policy.

The macroeconomic review and the preliminary estimation helped strengthen the assumption that the exchange rate is a more relevant instrument when it comes to achieving growth and price stability in a less developed economy. However, to increase the significance of the results, in the following section this hypothesis is tested using a panel dataset of developing countries with both a panel regression and a Vector Auto-Regressive model by country in order to evaluate and compare the impact of a change in interest rate and in exchange rate on both growth and inflation, knowing the financial development level of these countries.

---

<sup>15</sup> Derrese Degefa, "The Parallel Foreign Exchange Market and Macroeconomic Performance In Ethiopia", 2001

## Chapter 4: MODEL SPECIFICATION AND ESTIMATION

### 4.1 – DATA

The methodology involves both time series and panel data analysis at the country level. The data from Haiti was not sufficient enough for a more in-depth investigation; therefore I decided to test for the impact of both the interest rate and the exchange rate using a panel of less developed and developing countries according to the criterion listed by the World Bank. This analysis is done using a mixed panel of both types of economies because of the lack of data noted in most of the less advanced ones. From over 45 countries, the selection of countries was reduced to 14, including Argentina, Botswana, Brazil, India, Haiti, and Bolivia among others for which available data goes back to the early or mid-1990s<sup>16</sup>. The main database used for this study is the International Financial Statistics' website (IFS). In the case of Haiti, I had the opportunity to have access to the quarterly data for the GDP which was transformed from annual to quarterly data using the Chow-Lin methodology by an economist<sup>17</sup> at the Central Bank and approved by the department of Money and Economic Analysis<sup>18</sup>.

To test for the impact of monetary policy on economic growth through the interest rate channel and the exchange rate channel, I used the quarterly gross domestic product, central bank nominal interest rate, inflation and exchange rates, and financial development level measured by the ratio of the sum of deposits and the central bank's total assets.

### 4.2 - METHODOLOGY

#### 4.2.1 –Country group specifics and financial development level

---

<sup>16</sup> See appendix I for the list of countries

<sup>17</sup> Jean-Marie Cayemitte

<sup>18</sup> Jean Marie Cayemitte, "Transforming the annual GDP into quarterly data", Bank of the Republic of Haiti

The literature on the monetary policy transmission specifies that an increase in interest rates is likely to be more effective in reducing inflation or stimulating growth where the financial sector is developed which justifies the inclusion of the financial development level in the model as an interaction term in the following models. A more developed financial system enhances the monetary policy transmission, as banks not only interpret the signals sent by the central bank, but also act appropriately to alter their balance sheets to adequately mirror the current stance of monetary policy. These statements in literature explain the ratio of financial development level and its impact on monetary policy transmission.

This states a positive relationship between the financial development level and the transmission of monetary policy in the economy. As a monetary policy instrument or MPI, the first difference of the Central bank's interest rate is used since it is the variation that illustrates the direction of the policy, and the economic growth is calculated as the year-to-year variation of the GDP. The financial development level varies importantly with each country, and this will be the case especially in this dataset since there are countries from different development level according to the classification of the World Bank.

The financial development ratio calculated for this study is the one used by Carranza and al (2010) in their paper relating the financial development level and monetary policy effectiveness. It is the ratio of the total deposits and the central bank assets. Using this criterion, the first group comprises: Argentina, Bolivia, Chile, Malaysia and Peru for which the FD ratio averaged 2.45. The second set of countries is composed of South Africa, Brazil and Jordan and the indicator was around 1 and higher than 0.5. The third group includes Haiti, Colombia, Cyprus and Botswana and the level of the ratio was lower than 0.5, with Colombia and Haiti having the lowest indicator.

#### 4.2.2 - Panel regression analysis

The basic model used throughout this section is a linear panel regression. The basic linear panel models used in econometrics can be described as the following:

$$y_{it} = \alpha_{it} + \beta_{it}^T x_{it} + \mu_i + u_{it};$$

Where  $i = 1 \dots n$  is the individual group index,  $t = 1 \dots T$  is the time index and  $u_{it}$  a random disturbance term of mean 0, and  $\mu$  is the individual unobserved effects or fixed effects.

In the case of our estimates, I chose the first difference estimator since I want to show how the effects of a change in interest rate and exchange rate account for a change in economic growth. In the case of the FD estimator, the errors are strongly persistent since the difference decreases the possibility of the errors being correlated. This method also allows to remove time-invariant country components. All of the data is then lagged and first differenced. The panel analysis allows me to see if the results would change across countries concerning the relevance of the interest rate compared to that of the exchange rate. The financial development is added as an interactive term considering that it ranges between 0 and 2 then it is similar to adding a dummy variable.

My first assumption is that most low and middle income countries use the interest rate and the exchange rate as monetary policy instrument and variable, and as small open economies, the exchange rate should be more relevant since they are more vulnerable to external shocks.

Increased volatility in prices affect economic growth, according to theory and evidence was found in the case of Haiti that growth was negatively correlated with inflation. This led me to believe that by reducing inflation, the monetary authorities are also influencing and stimulating economic growth. I also compare the financial development level on average for all of the countries and found that I could separate them in three categories using a range for the average financial development level. All

of the estimation done below takes into account the financial development level since it relates directly to the effectiveness of the interest rate on economic growth.

I started by testing for the correlation by country with inflation. The reason behind this estimation is because even when the instrument chosen may not have any direct impact on economic growth, the impact on inflation can in the long run influence economic growth. How effective are the interest rate and the exchange rate is what I will test for further down in the study for a policy recommendation.

$$\text{Growth}_{it} = \beta_0 + \beta_1 \text{Growth}_{it-1} + \beta_2 \text{lintrate}_{it} + \beta_3 \text{lintrate}_{it-1} + \beta_4 \text{lintrate}_{it} * \text{lfd}_{it} + \beta_5 \text{lfd}_{it} + \mu_i + \varepsilon_{it}$$

Where  $i = 1::n$  cross-sectional observations of countries and  $t = 1::64$  quarters.

I expect the coefficients related to growth to be positive, whereas the coefficients related to inflation to be of the opposite sign since a negative correlation is expected between the two variables. According to the descriptive statistics table below, inflation across developing countries is highly volatile and negatively correlated with growth<sup>19</sup>.

Table 7: Key statistics of Inflation and Growth

| <b>Variable</b>       | <b>Obs.</b> | <b>Mean</b> | <b>Std. Dev.</b> | <b>Min.</b> | <b>Max.</b> |
|-----------------------|-------------|-------------|------------------|-------------|-------------|
| <b>Inflation</b>      | 992         | 26.055      | 226.431          | -3.324      | 4452.97     |
| <b>Growth</b>         | 905         | 7.421       | 3.425            | -.732       | 14.018      |
| <b>Interest rate</b>  | 877         | 2.246       | .692             | -.7317696   | 4.254       |
| <b>Exch. rate</b>     | 994         | 2.130       | 2.292            | -4.847      | 7.986       |
| <b>Financial dev.</b> | 813         | 0.614       | 1.042            | -2.510      | 3.127       |

<sup>19</sup> Except for Argentine, Chile, Jordan and South Africa where the correlation was positive.

#### 4.2.2 – Vector Auto-Regressive Model (VAR)

Monetary policy is often associated with the use of the interest rate of the central bank. In macroeconomics, a change in the interest rate will cause the aggregate expenditure to shift. With the open market operations, the central bank impacts the money supply, which causes the interest rates in the economy to change, thus leading to more (less) investment and/or consumption, to get to the real GDP.

In order to test for the effectiveness of the interest rate on economic growth and inflation, a Vector Auto-Regressive model is used and estimated by country. The advantage of using a VAR model is that it is used for forecasting and specially in analyzing policy implications and through the impulse response functions you can best evaluate the impact of a change. Before the model is estimated the value of the lag must be calculated using different lag – length criteria such as Akaike Schwartz Criterion, BIC and Hannan and Quinn and in this case will be two.

There has been a growing interest in using panel models for applied macroeconomic analysis in the economic literature. This interest is due, in part, to the availability of better quality data for a larger number of countries but for a limited time period. In the case of less developed economies, exchange rates and interest rates may have different impacts on economic growth given different country characteristics, particularly given variation in the level of financial development, consumer price index computation along with other variables across countries. To account for those differences, I estimated a VAR model by country using the following specifications but only with two lags considering that the results from the lag criteria test. When estimating by country, “i” is then fixed and different per country name.

$$X_{it} = C_0 + C_1X_{it-1} + C_2X_{it-2} + U_{it}$$

Where

- $X_t$  is a vector time series of growth, interest rate and of inflation rate and exchange rate, and the financial development as an exogenous variable;
- $C_0$  is a vector of intercept parameters,
- the  $C_j$  are parameter matrices, and
- $U_t$  is the error vector, which is assumed to be Independently and Identically Distributed (i.i.d.)
- $i$  refers to the country

In a VAR model, none of the variables is exogenous, that is, each variable potentially influences all other variables, considering each is expressed as a function of the lagged values of the selected variables. The economic importance of a variable in the VAR model is measured by looking at its impact on the other variables using the variance decomposition and by the impulse response function table and graph.

## 4.3 - RESULTS OF ESTIMATION

### 4.3.1 – General Results

The Panel results were estimated with fixed (or country) effects to account for differences in structural changes of policy in each country. With  $\mu_i$  ( $i=1\dots 14$ ) is the unknown intercept for each country (14 entity-specific intercepts).

The regression was overall well specified and all of the coefficients were statistically significant when estimating growth using interest rate except for the lagged value of the interest rate that doesn't

seem to have an impact on a change in growth. For a one point change in the interest rate there will be a 0.37 change in economic growth but this is at a 10 % level of confidence. For inflation, none of the coefficients are statistically significant meaning that the interest rate doesn't seem to cause much variation in the inflation rate.

When growth is estimated with the exchange rate using the interactive term and the financial development as additional explanatory variables, only the exchange rate and its lagged value are statistically significant and a one percent increase in the exchange rate will cause the economic growth to slow down by 0.33 % on average. When the effect of the interest rate is removed by not including the I term, the exchange rate seems to only have a lagged effect of causing a positive response from growth of 0.81 %.

When the inflation is estimated with the exchange rate, the coefficient of the lagged value however is significant along with that of the financial development and the I term. Meaning that when a country has an increase of 1 % in its financial development level, it leads to a better responsiveness of inflation to monetary policy and consequently to a decrease of 1.42 % in inflation. The tables below summarize the results of all of the above mentioned estimation.

**Table 8: Summary of the regression Growth and interest rate**

| Fixed-effects (within) regression | Number of obs.   | 801                       |              |                 |
|-----------------------------------|------------------|---------------------------|--------------|-----------------|
| Group variable: countryid         | Number of groups | 14                        |              |                 |
| Growth                            | Coef.            | Std. Err.                 | T- statistic | P>t             |
| Growth(L1)                        | .905             | .0164                     | 55.05        | 0.000           |
| Lintrate                          | -.005            | .002                      | -2.56        | 0.011           |
| Lintrate (L1)                     | .004             | .002                      | 1.770        | 0.077           |
| cons                              | .751             | .129                      | 5.840        | 0.000           |
| Avg. ob                           | 57.2             | F test that all $u_i=0$ : |              | F(13, 784) 3.29 |
| F(3,784)                          | 1117.48          | Prob > F                  |              | 0.000           |
| R-sq: within                      | 0.8105           | R-sq: overall             |              | 0.997           |

**Table 8: Results of Panel regression between growth and exchange rate**

| Fixed-effects (within) regression | Number of obs    | =                  | 891     |                |
|-----------------------------------|------------------|--------------------|---------|----------------|
| Group variable: countryid         | Number of groups | =                  | 14      |                |
| Growth                            | Coef.            | Std. Err.          | t       | P>t            |
| Growth L1.                        | .860             | .013               | 65.17   | 0.000          |
| lexch                             | .070             | .025               | 2.81    | 0.005          |
| cons                              | .901             | .089               | 0.50    | 0.000          |
| F test that all $u_i=0$ :         |                  | F(13, 875)         | 10.57   | Prob > F 0.000 |
| R-sq: within                      | 0.8696           | Obs. per group avg | 63.6    |                |
| R-sq: overall                     | 0.9930           | F(2,875)           | 2918.28 | Prob > F 0.000 |

Even when structural or cultural differences across countries are taken into consideration by including fixed effects. Assuming a lag in monetary policy transmission in most low and middle income countries is more than 3 quarters<sup>20</sup>. I tested for the interest rate the lag that has the most effect on the economic growth and found that the instrument after the 4<sup>th</sup> quarter accounts for 31 %

<sup>20</sup> According to a study conducted by Klaus Schmidt-Hebbel and Matías Tapia (2002) from the Central Bank of Chile. “..As for horizons, most central banks focus in the next 2 years, a horizon that is consistent with the estimated lags in monetary policy effectiveness.”

of the change in the economic growth, meaning that the effect of the interest rate on GDP is strongest for that period. The coefficient associated with the fourth lag of the interest rate also has the correct sign, indicating that the expansion (tightening) of monetary policy indicated by a decrease (increase) of the interest rate leads to positive (negative) variation of GDP.

Meanwhile the results of a panel regression with fixed effects show that the interest rate accounts for only 11.9 % of the changes in the financial development level, with an evidence of a low correlation for most of the countries between the two variables. This then helps confirm the choice of the financial development variable as a control. This low R-square noted in most of these countries indicates that the relationship between those variables contribute to slowing down the monetary policy transmission mechanism and the effectiveness of its impact on growth or inflation or on both.

#### 4.3.2 - VAR Results by Country Group

In the case of Argentina for example, the growth rate has an immediate negative response to the exchange rate shock, for the first two periods, which can be explained by the fact that a decrease of its exchange rate affects the level of competitiveness of their exports.

On the other hand, even though the exchange rate seems to be very important in Columbia, along with Chile and most latin American countries, its interest rate channel is more precise than that of most countries in the panel. The IRF coefficients confirmed that when it comes to more developing countries with an important export sector such as India, Argentina and Chile, a decrease in the exchange rate would imply a valuation of their local currency, which would hurt their exports and therefore production. When it comes to less developed economies such as Haiti and South Africa, the response is immediate and positive. The difference in the sign lies within the fact that these countries are very dependent on remittances. Therefore, the increase of the exchange rate, inflates

consumption by giving local residents a higher purchasing power than before, and therefore increasing consumption of both local and imported goods, and sometimes even savings.

For countries with a very high level of dollarization and important flows of remittances such as Argentina, Bolivia, Colombia, Chile and Jordan, the exchange rate seems to have a stronger impact on economic growth and financial development. Results from the impulse response show a definite positive effect from the exchange rate on growth for most of these countries<sup>21</sup>. A high response is also observed from the financial development when a change in the exchange rate occurs. VAR results from both variables show that there is a relationship between the two variables, expressing therefore the importance of using this channel in the case of countries where the interest rate demonstrates very low effectiveness. The impact from an increase on the exchange rate in these countries is very important for the change in GDP.

#### 4.3.3 – Variance Decomposition<sup>22</sup>

In Argentina, a change in the interest rate accounts less for an increase in inflation than in economic growth. According to the results, the interest rate is responsible after the second quarter for 5 % of the changes in growth and at 3 % of the variation in prices. Up to the 8<sup>th</sup> quarter, it increases to 12 % for growth and 7 % for inflation. Nonetheless, this is a much higher impact than the exchange rate seems to have on both variables. It accounts for 1.73 % for a change in growth and 0.7 % in the case of inflation. However the importance in the variance decomposition of inflation seems to increase whereas it relatively stays the same for growth.

In the case of Bolivia, the interest rate accounts for a change in inflation more than growth at 2 % for growth and 5% for inflation. The interest rate including the effect of the financial development

---

<sup>21</sup> Appendix II

<sup>22</sup> See Appendix B for impulse response graphs

however does account for changes in both inflation and growth but more significantly for inflation up to 14 %. The exchange rate has its most significant impact on the inflation, thus showing a likely high exchange rate pass-through in this economy. This is also reflected in the variance decomposition, while after the 8<sup>th</sup> quarter the exchange rate accounts for 14 % of changes in economic growth, it actually accounts for more than 20 % in inflation. By looking at the relationship between inflation and growth in this country, I verified to what extent does inflation account for changes in growth, if it was significant this would lead to the conclusion that monetary policy can affect growth by reducing volatility in inflation, however, this relationship isn't significant and this can lead to believe that the exchange rate pass-through is indeed high in this economy. The inflation is mainly affected not by changes in the monetary aggregates or by production but by imports and the exchange rate. For Peru, the results are similar than in Bolivia, with a low contribution of interest rate of both but a higher impact on inflation, and the inflation accounts for a very small percentage in a change in growth as well with a high contribution of exchange rate to a change in inflation.

Results for Malaysia are a little bit different since both interest rate and exchange rate account for changes in growth at a significant level, but with a more precise impact coming from the interest rate. This is the same for Chile where the interest rate accounts for around 67 % of the changes in growth, and for 7 % in inflation, and reaches 59 % and 14 % respectively for each of these macroeconomic variables after the 8<sup>th</sup> quarter. The response of growth and inflation are very low when a shock is coming from the exchange rate than when it's coming from the central bank interest rate. In this case, I doubt there is high ineffectiveness of monetary policy considering they have been increasing the size of the financial market which

When  $FD = 1$

The results from South Africa seem very close to that of Peru and Bolivia. With a financial development level around 1, South Africa's interest rate doesn't account for much of changes in the economic growth (around 3 %), however, the interest rate seems to have a significant impact on inflation (32 % after the 8<sup>th</sup> quarter) and so does the exchange rate. In the case of Brazil the results are similar but with a wider gap. The interest rate accounts for 34 % of a change in inflation but for 0.5 % of a change in GDP growth. The results do not change when it comes to the exchange rate. Jordan also shows the same pattern in its estimation results, however with a narrower gap between the two impacts of the interest rate on inflation and growth.

When FD is close to 0

Columbia has the lowest level of financial development ratio but falls into a different category since its interest rate has an important impact on inflation, even though it doesn't really account for much change in growth, and it is the same for the exchange rate. This difference in the results found in the case of Columbia can lead me to the fact that the region is as an important factor when estimating models using data from different countries.

The results are significantly different when the financial development is low, especially when it comes to the effectiveness of the interest rate. In the case of Botswana, the interest rate accounts for around 8 % in the variation of growth but for 6 % for inflation and the same is the case when measuring the impact of the exchange rate. The response of growth and inflation are also very low in Cyprus and Haiti when a shock is coming from the interest rate, but with a little more significant response from inflation when the shock is coming from the exchange rate.

### *The case of India*

Because the ratio of India was the highest and the only one that was 4, I tested for the hypothesis separately. I found through the estimation that both the interest rate and the exchange rate have a strong impact in the economic activity. However, the effects noted are not as strong as I would predict, meaning although the financial development ratio is very important to the impact of an instrument there are also other variables that should be taken into account when choosing a monetary policy instrument to impact the economy. However, considering the impact of inflation on growth is higher for this country, by stabilizing inflation, monetary authorities are also affecting economic growth.

## **Chapter 5: Conclusion and Policy Recommendation**

This paper is an initial attempt to understand the monetary policy effectiveness in less advanced economies in stimulating economic growth. The basic limitation is the lack of quarterly data that would allow testing for less developed countries versus what is going on in developing or emerging economies. The primary focus of this thesis was to show that due to several constraints, monetary policy in developing and less developed economies could not be efficient if it doesn't directly include the exchange rate, considering they are for the most part small open economies. The macroeconomic analysis of the Haitian economy led me to believe that a monetary policy focused on the exchange rate should be the best alternative for a less developed economy for a more effective policy.

Through the VAR estimations, similarities and differences among these economies became more important when testing for the effectiveness of monetary policy. The results prove that the exchange

rate and the interest rate both have a very important role in the economy; however their impact on growth depends on the link between inflation and growth but more importantly on the degree of openness and the financial development. With most of the countries that have a high level of financial development the interest rate has a greater impact on both growth and inflation, except in the case of a much opened economy such as Bolivia. The first sub-groups were 3 because of the difference in the financial development level, but the results lead to believe that there isn't a huge gap between the financial development levels 1 and 2. My hypothesis was partly verified with the countries having a financial development ratio close to 0, but even in these cases, the impact of the exchange rate is still small, whereas throughout all the panel, the most consistent observation was that the impact of both interest rate and exchange rate on the financial development level (or the Inter term) was significant.

The lack of success of macroeconomic policies in LDCs resides in the lack of adequate policies and proper market structure. The need for financing and less access to credit combined leads to high private interest rates in the private sector of these countries for which the commercial banks are the sole resort for credit.

By examining various aspects of the cross country analysis, it became clear that a new variable should be calculated in order to implicate and measure both the impact of the exchange rate and the interest rate in order to have a more efficient monetary policy instrument. The monetary conditions index<sup>23</sup> is an indicator that combines both and has been calculated for Uganda is an example of such instrument. The purpose of this indicator is to respond to the need to include alternative variables as information and target for a better conduct and effectiveness of monetary policy. Since the relationship between interest rate and economic growth has weakened, the monetary condition

---

<sup>23</sup> This index has been initially is the result of a linear combination of a number of economic variables that affect monetary policy which include interest rate and exchange rate, by economists of the Bank of Canada, used by several central banks of developed economies such as New Zealand, Sweden and Norway.

index would be able to measure both the influence of exchange rate and interest rate developments on macroeconomic variables. However, considering the relationship between the exchange rate and the financial development level<sup>24</sup> was also found to be significant, the choice of this instrument can help develop the financial market which can in return help create better conditions for implementation of other policies, and therefore would probably need to include the variables that are pertaining to the financial development of these economies, as they do vary from one country to another.

---

<sup>24</sup> See Appendix II

## **Appendix A**

### **List of countries**

The countries what I primarily gathered data for are Argentina, Botswana, Bolivia, Brazil, Chile, Colombia, Costa Rica, Brunei, Cyprus, India, Jordan, Peru, Malaysia, South Africa, Haiti, Latvia, Estonia, Uganda, Ivory Coast, Jordan, Jamaica, Israel, India, Georgia, Egypt, Mauritius, Morocco, Philippines, Thailand, Romania, Lithuania.

### **Definition – the term dollarization**

The term Dollarization is used in cases where foreign currency is held in a domestic economy.

Another term used is Euroization, in European countries when the euro is used instead of the dollar.

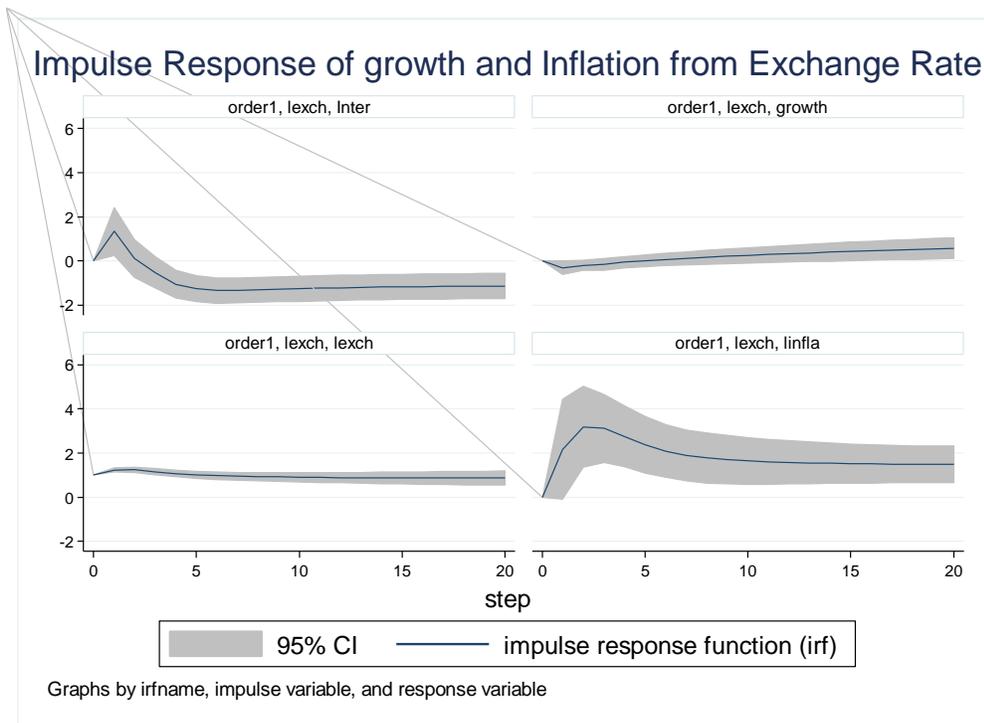
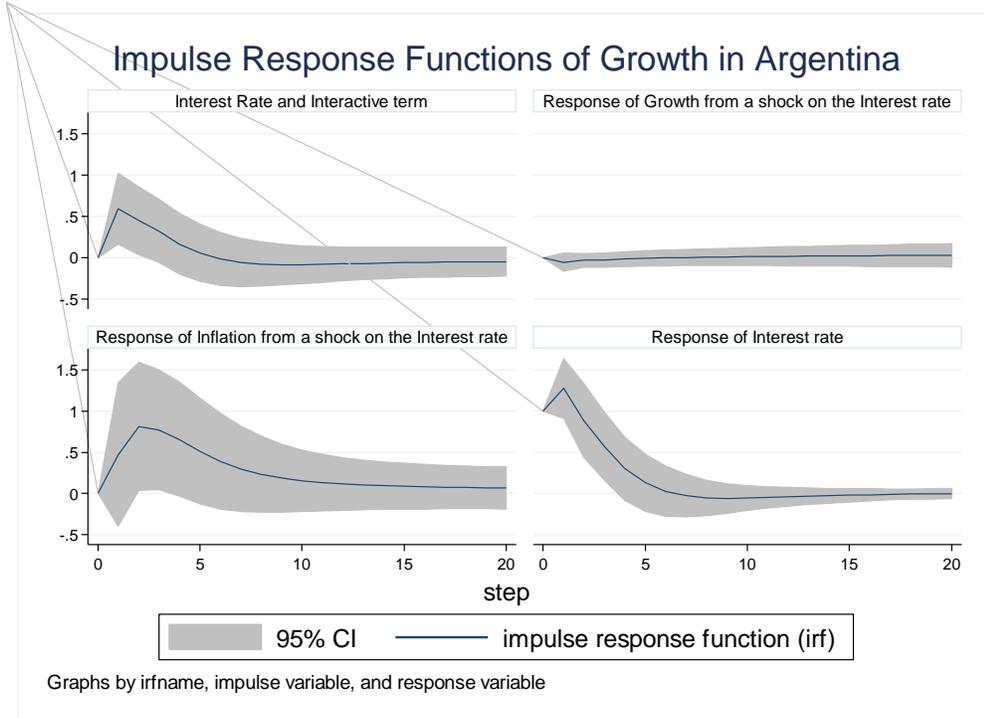
The most important reason for a central bank to worry about dollarization is the concern with stability of the financial system. If significant parts of the financial system are dollarized, this leads to both liquidity risk and solvency risk. In the case of this study, the liquidity risk is more relevant. The importance of the liquidity risk can be explained by the fact that, the central bank can step in as lender of last resort, since it can create domestic currency in case of emergency, with possible inflationary consequences. However, for foreign currency deposits, strictly limited international reserves are the only way the central bank can intervene in case of a liquidity crisis<sup>25</sup>.

---

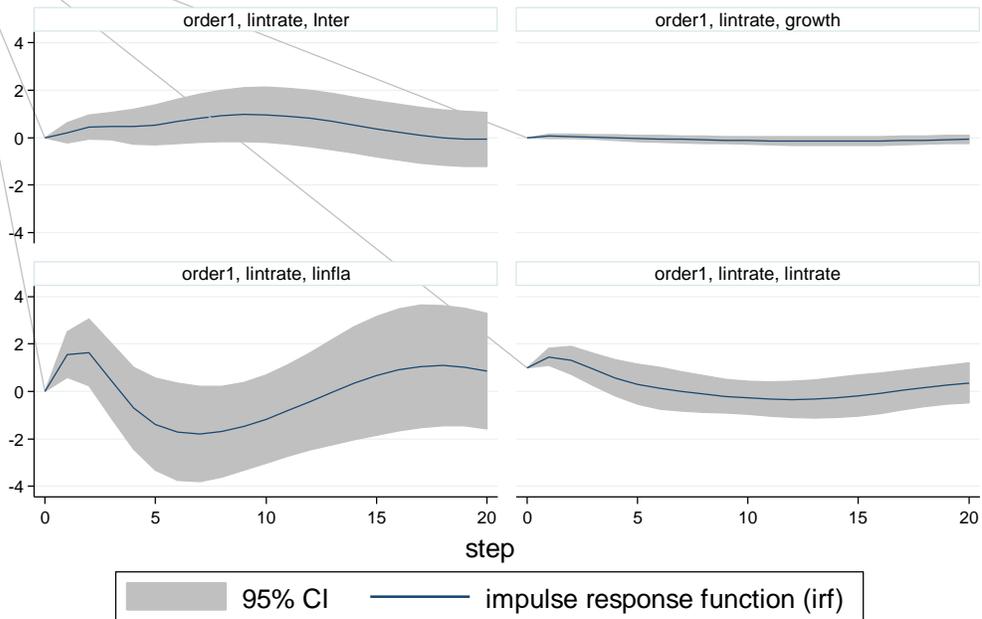
<sup>25</sup> See "MONETARY POLICY IN DOLLARIZED ECONOMIES", by Karl Driessen

## Appendix B - Impulse Response Functions

### High Level of Financial Development

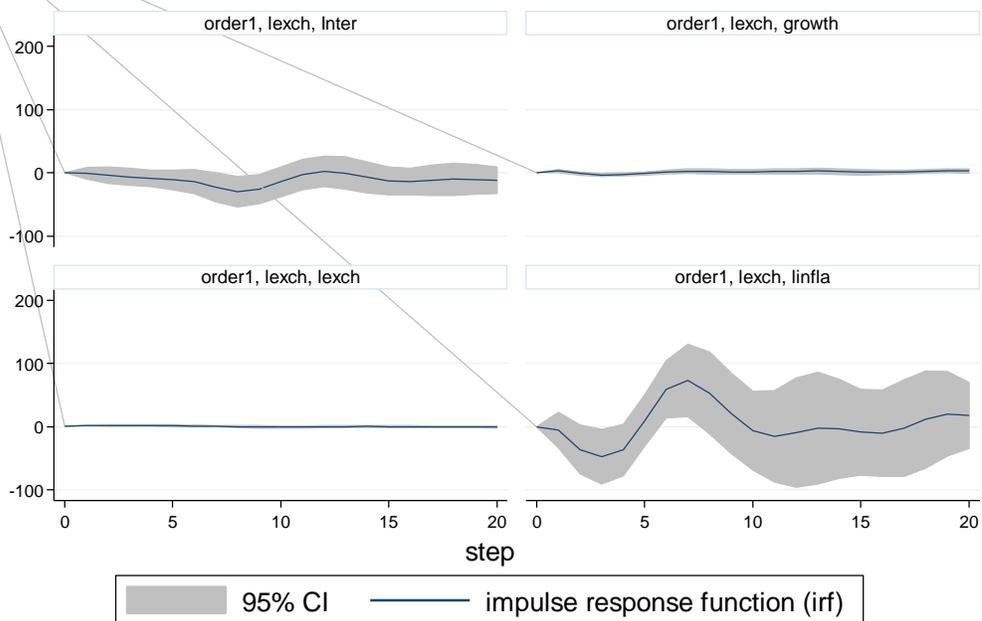


### Impulse response of Interest Rate in Bolivia

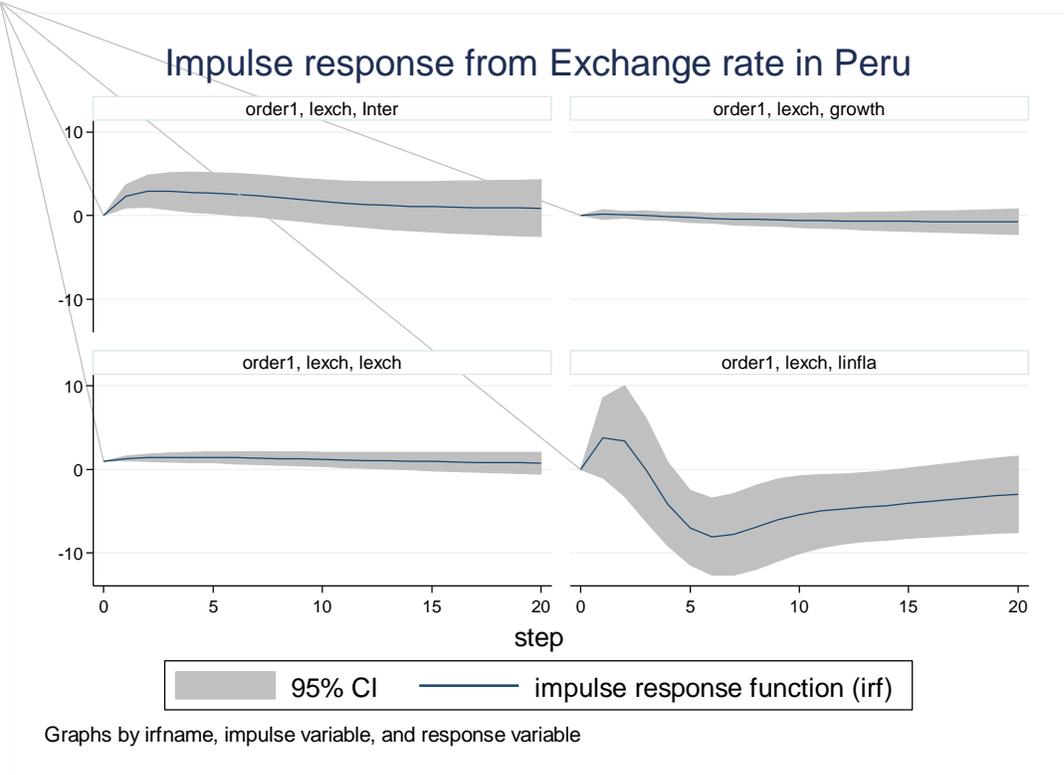
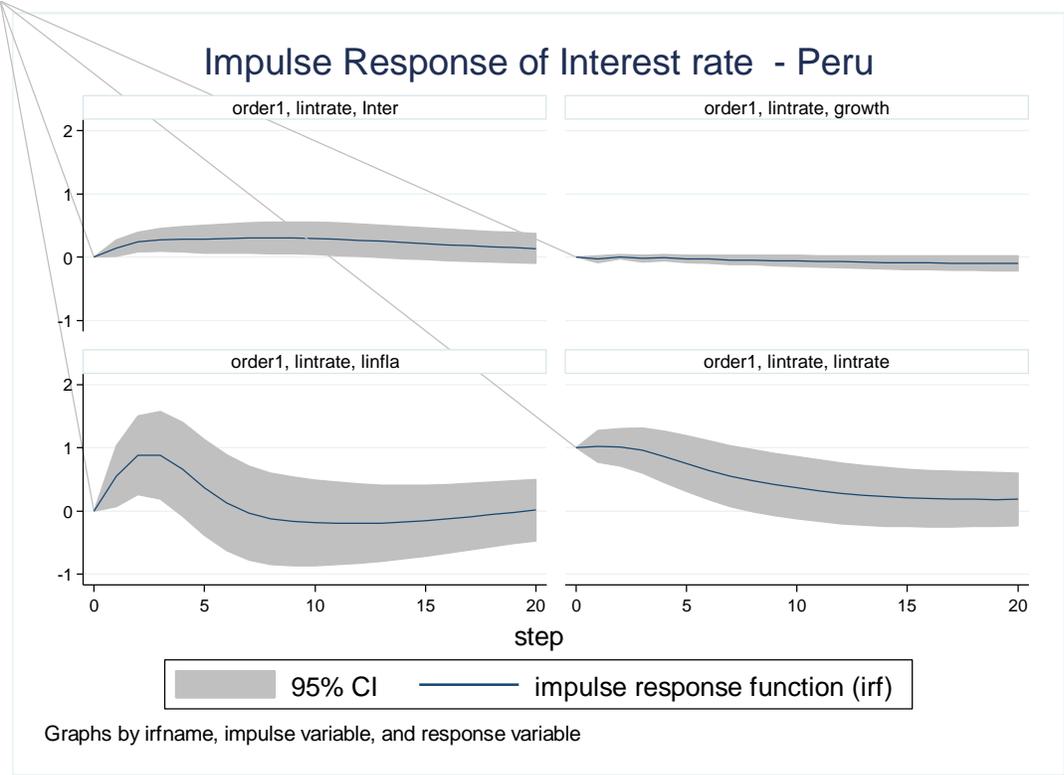


Graphs by irfname, impulse variable, and response variable

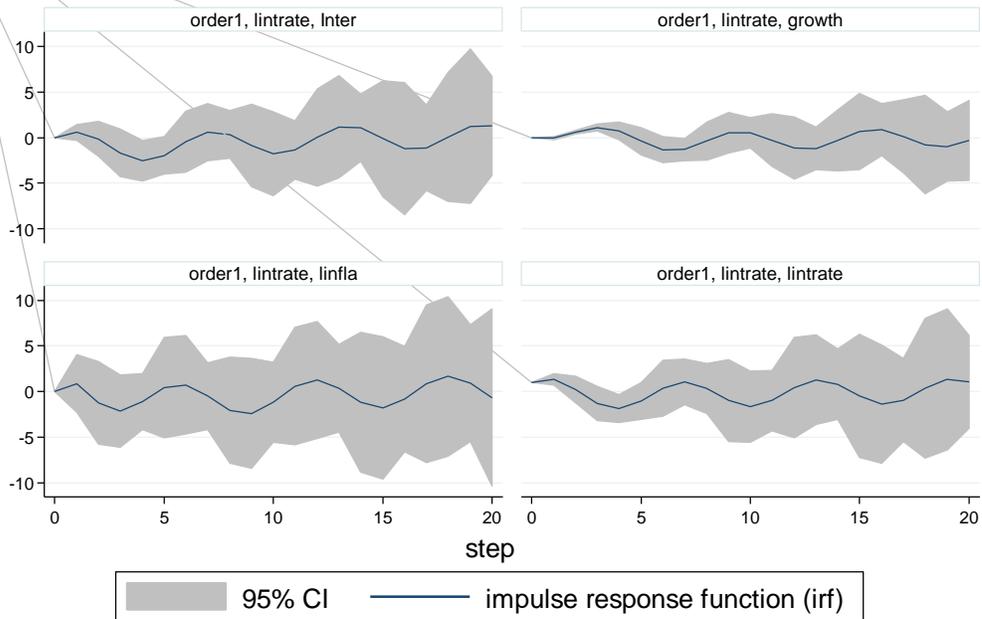
### Impulse Response from Exchange Rate in Bolivia



Graphs by irfname, impulse variable, and response variable

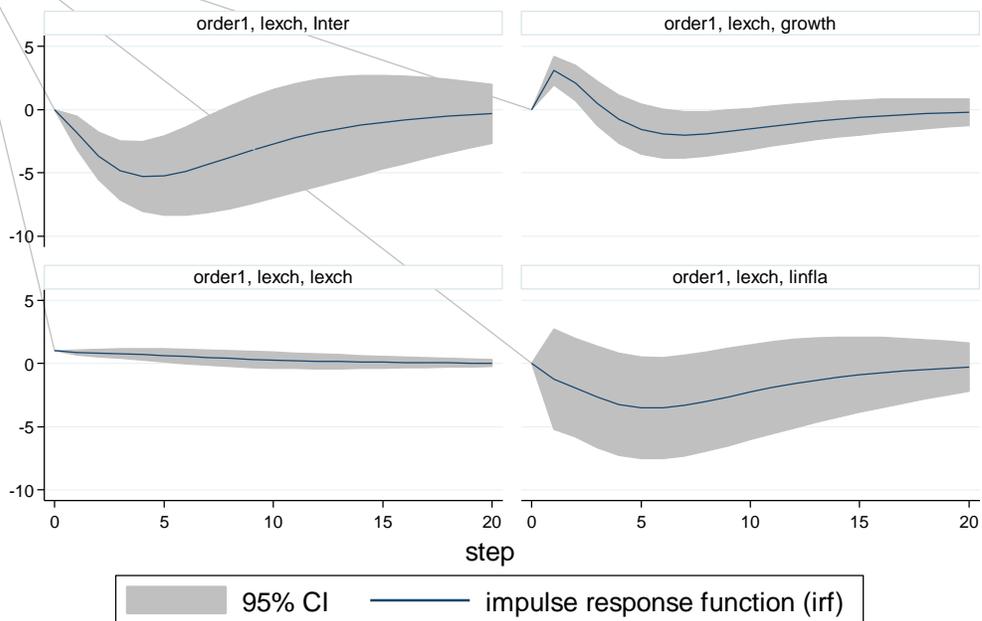


### Impulse response from the interest rate of Chile



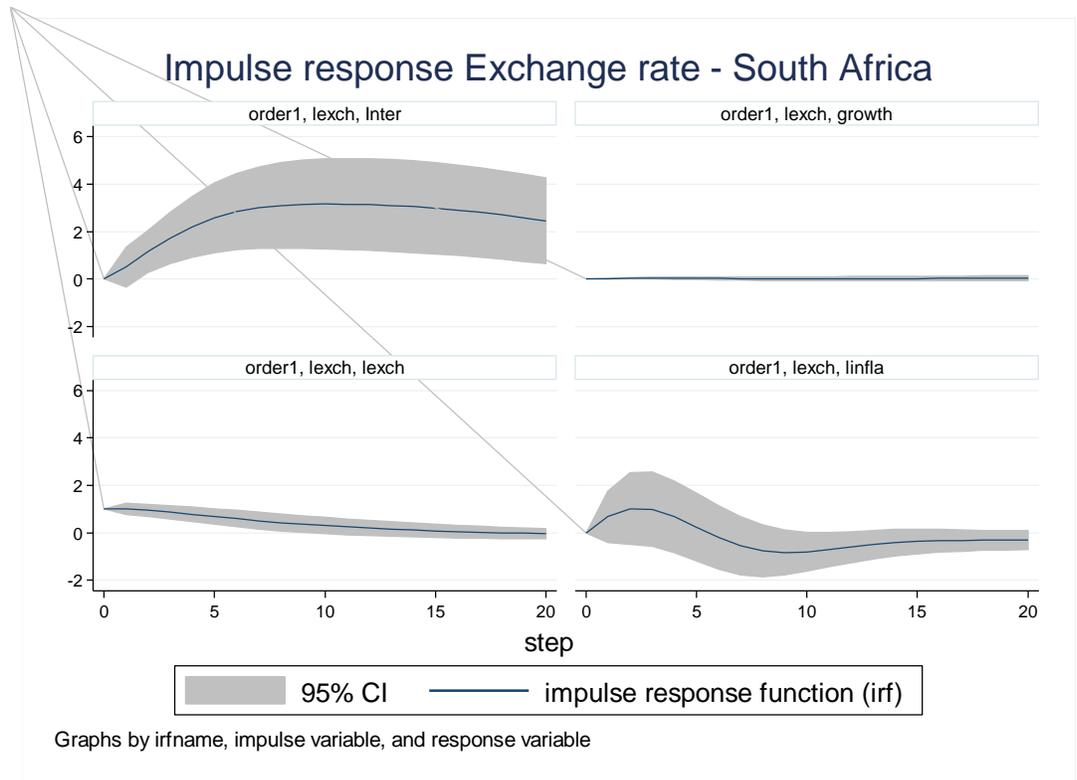
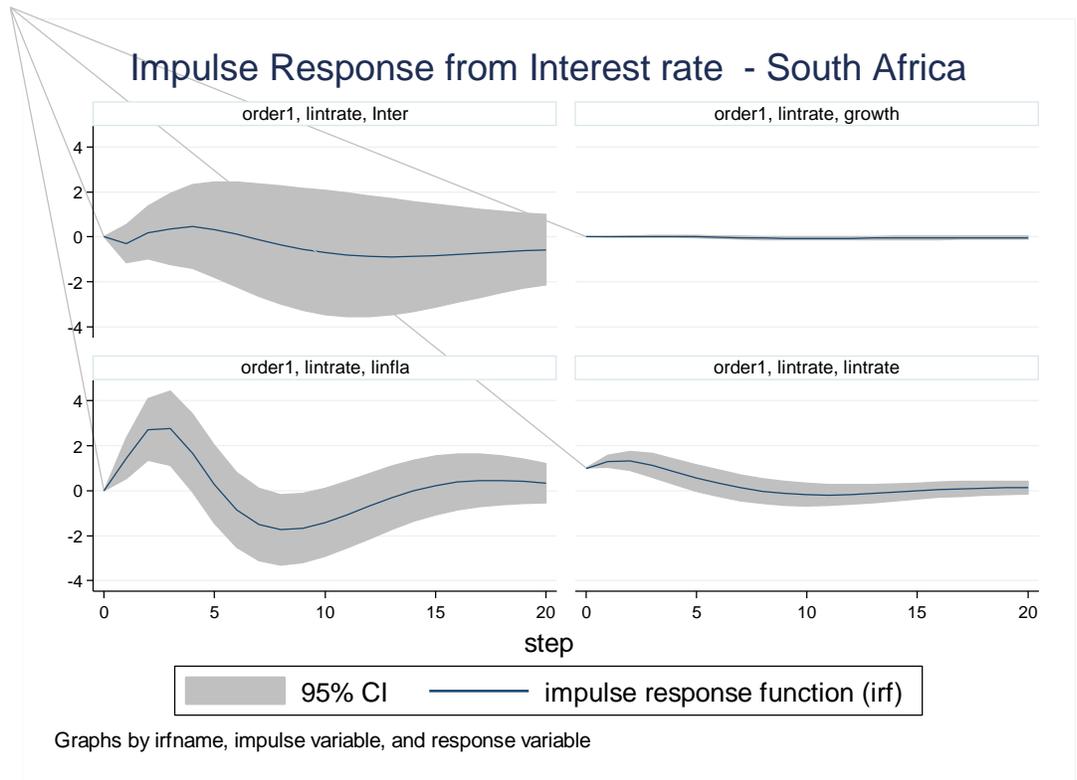
Graphs by irfname, impulse variable, and response variable

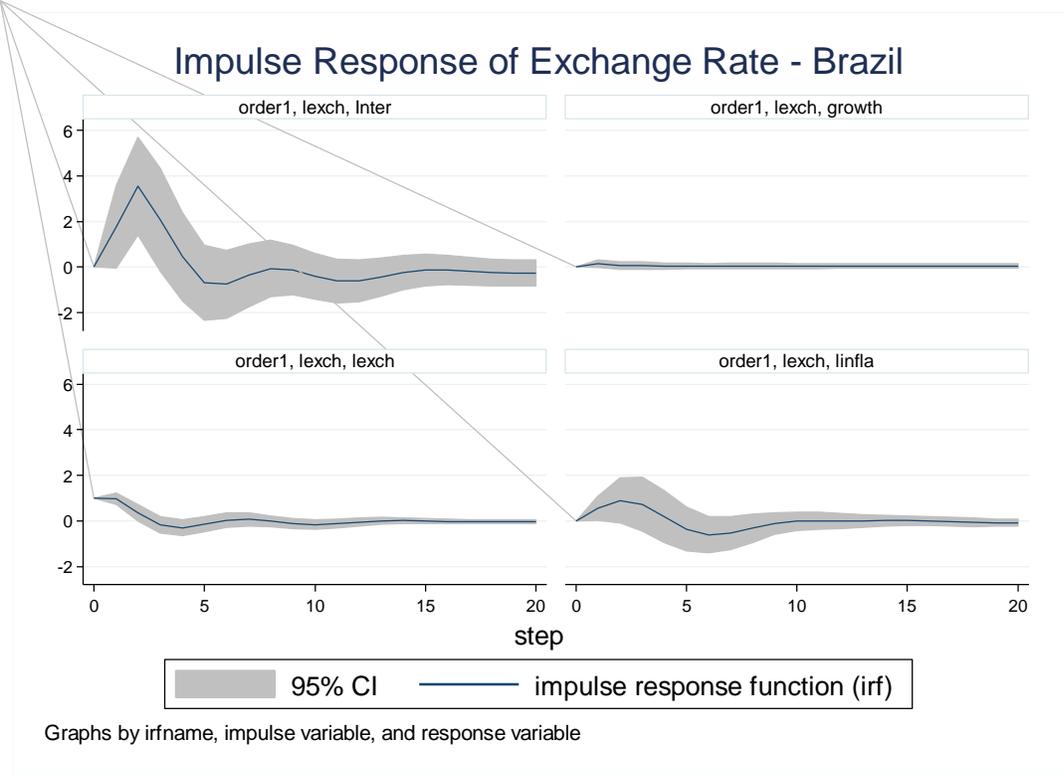
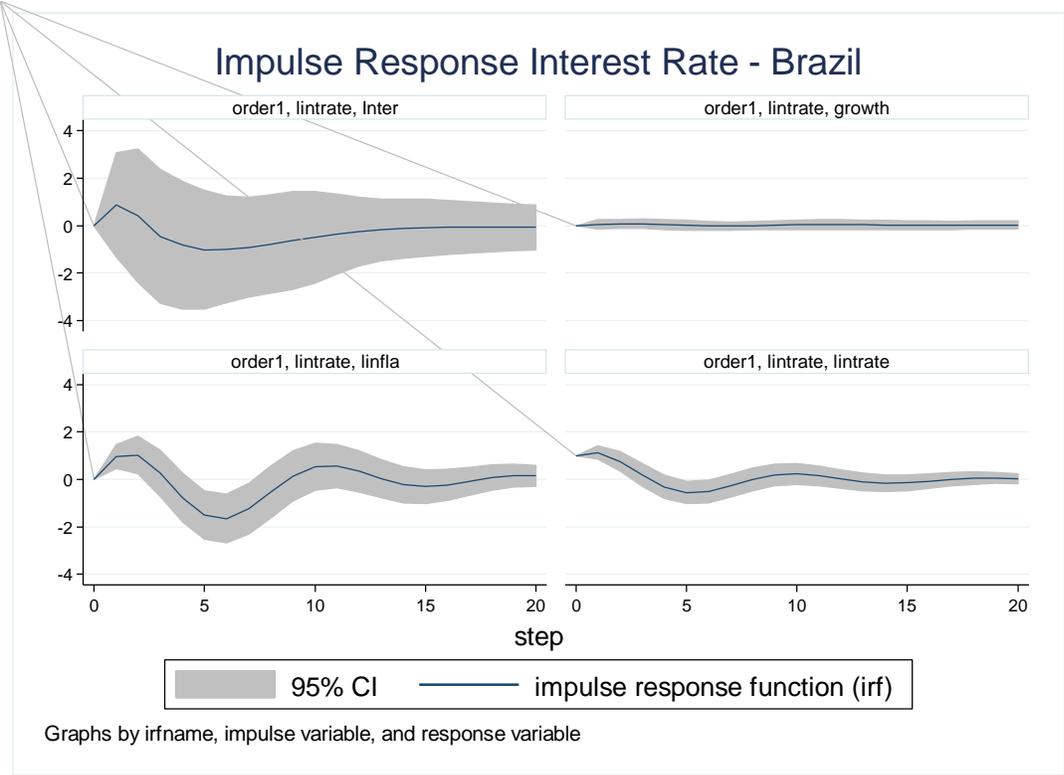
### Impulse response from exchange rate in Chile

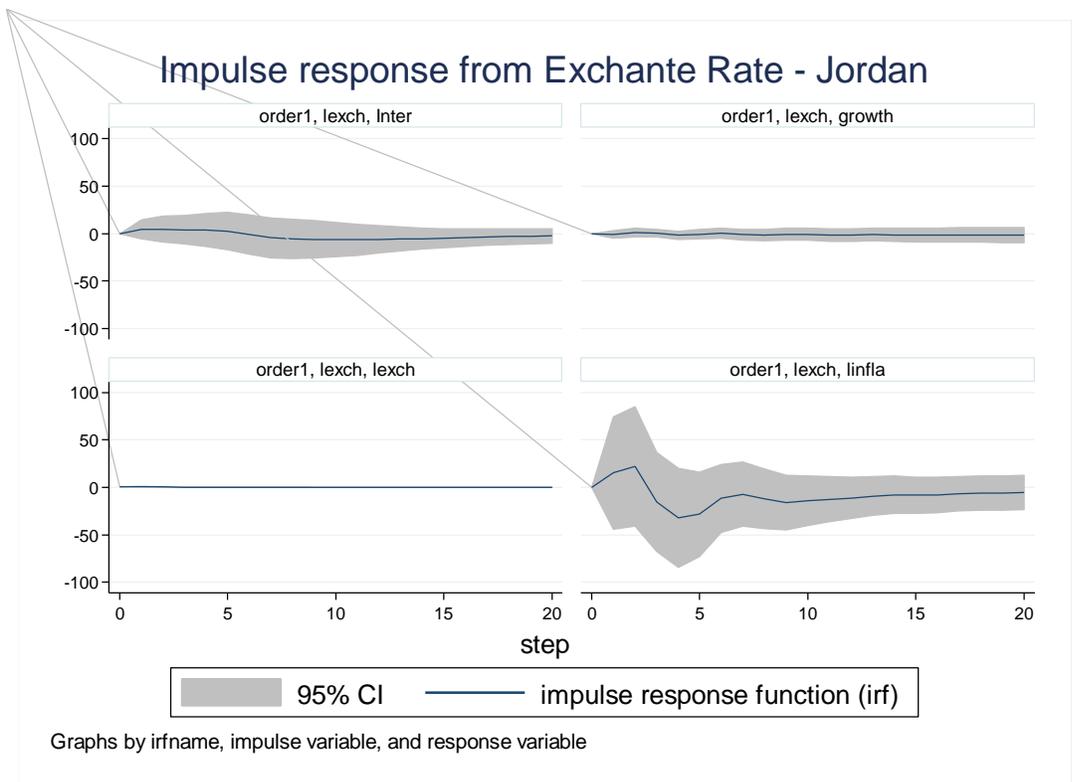
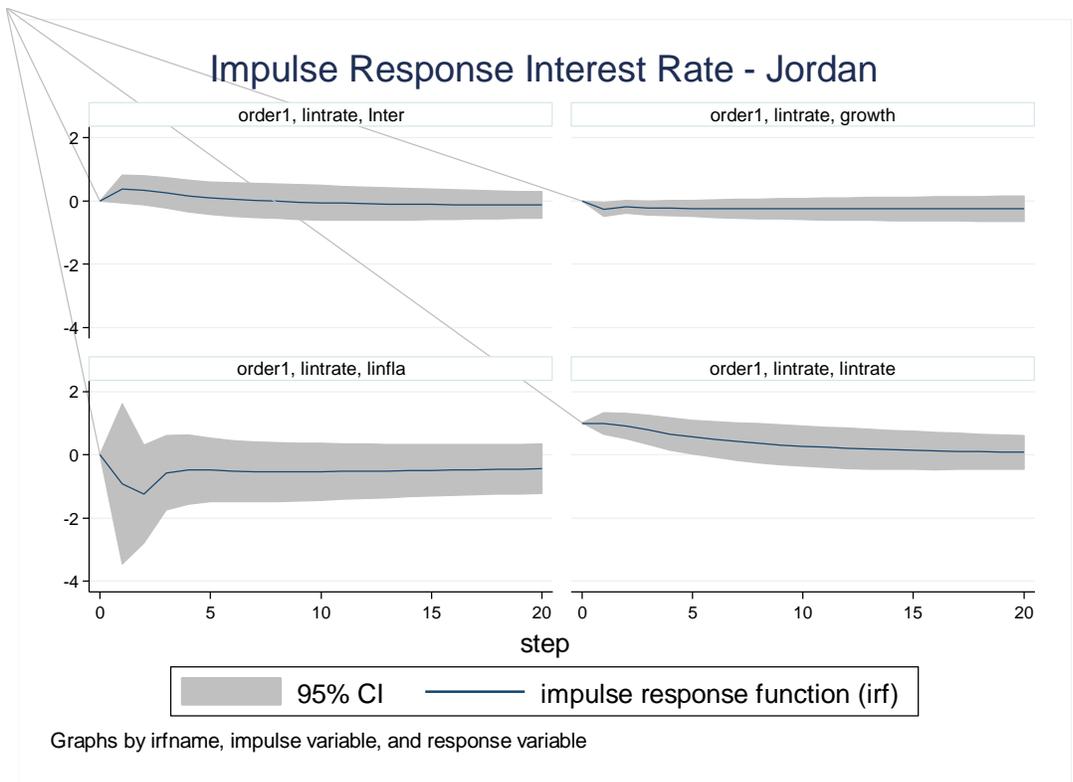


Graphs by irfname, impulse variable, and response variable

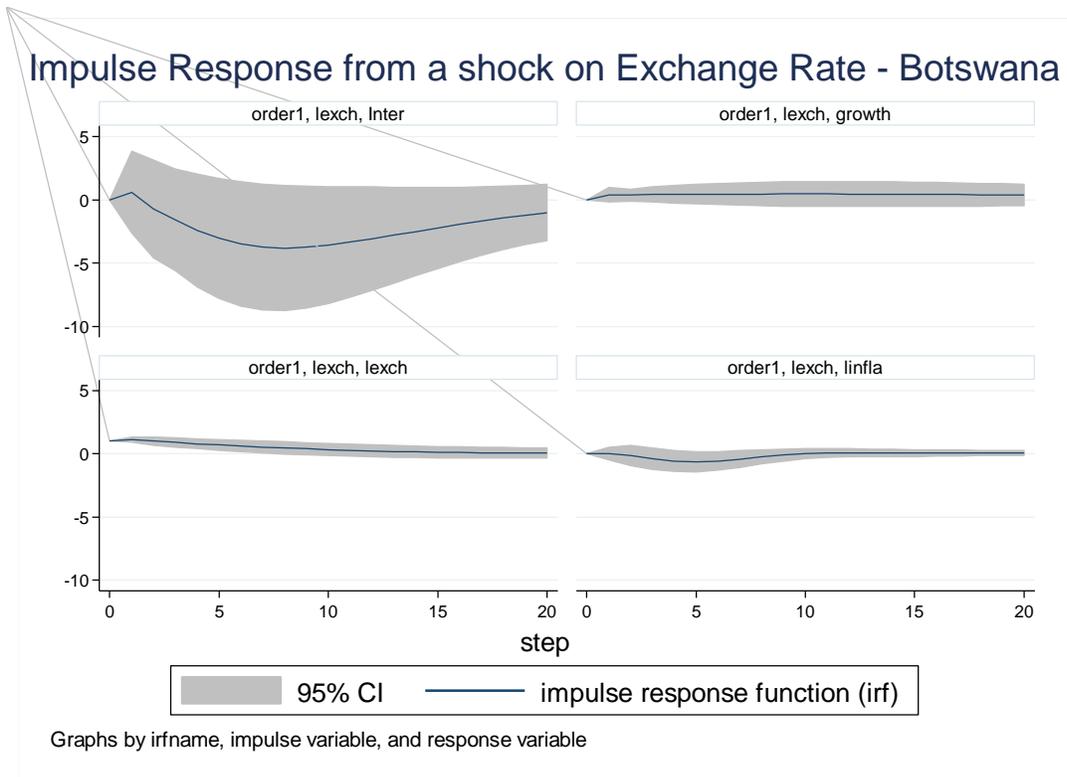
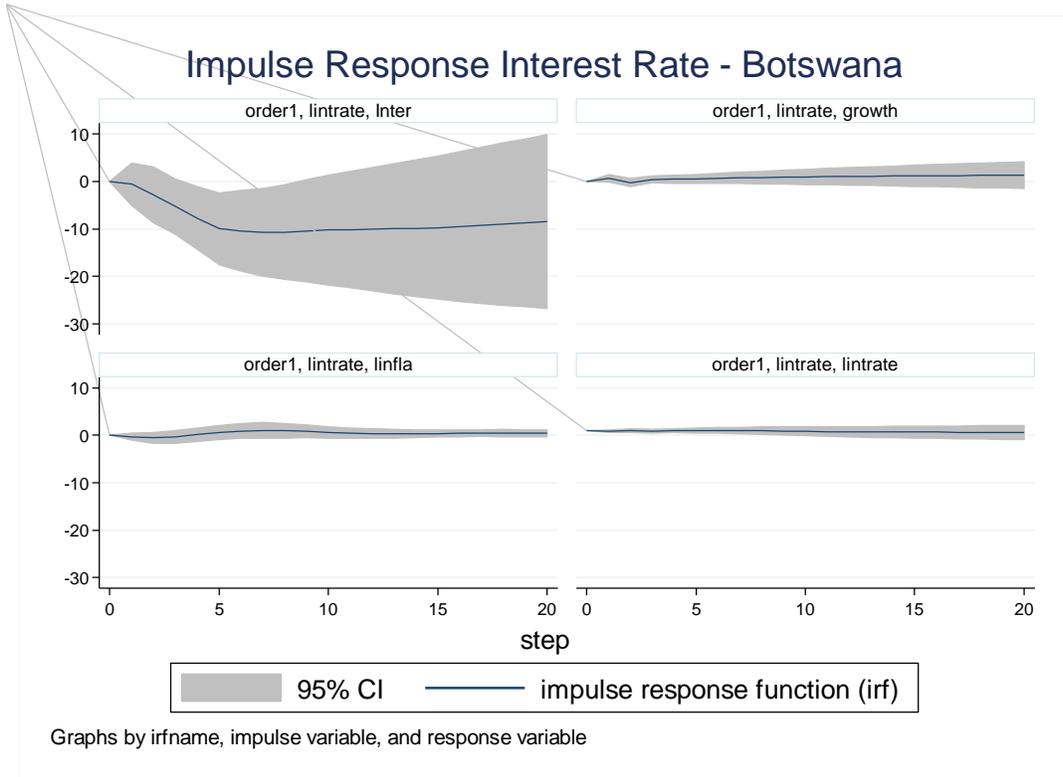
Medium Level of Financial Development



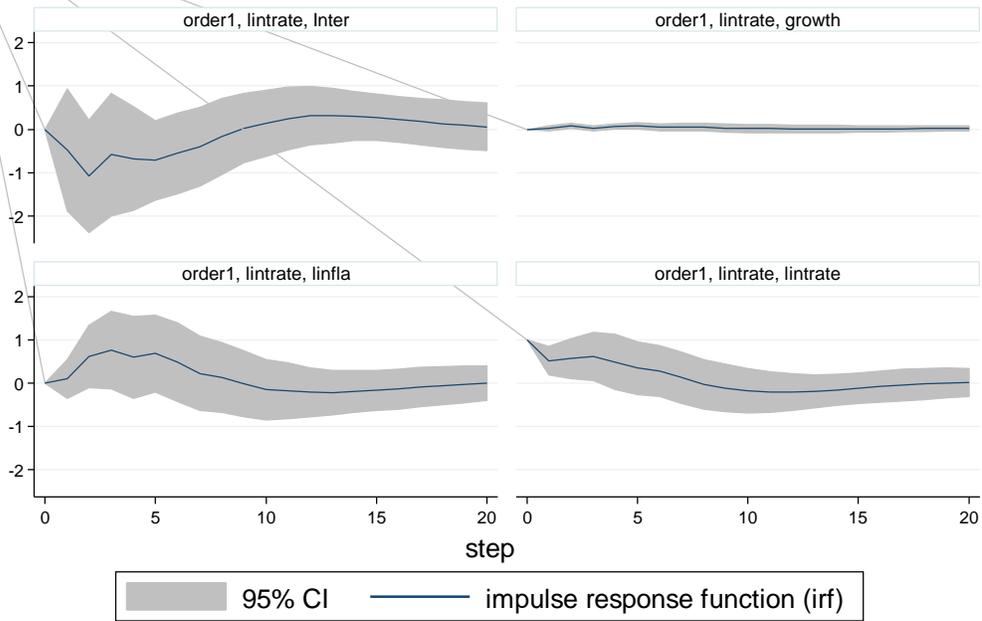




## Low level of Financial Development

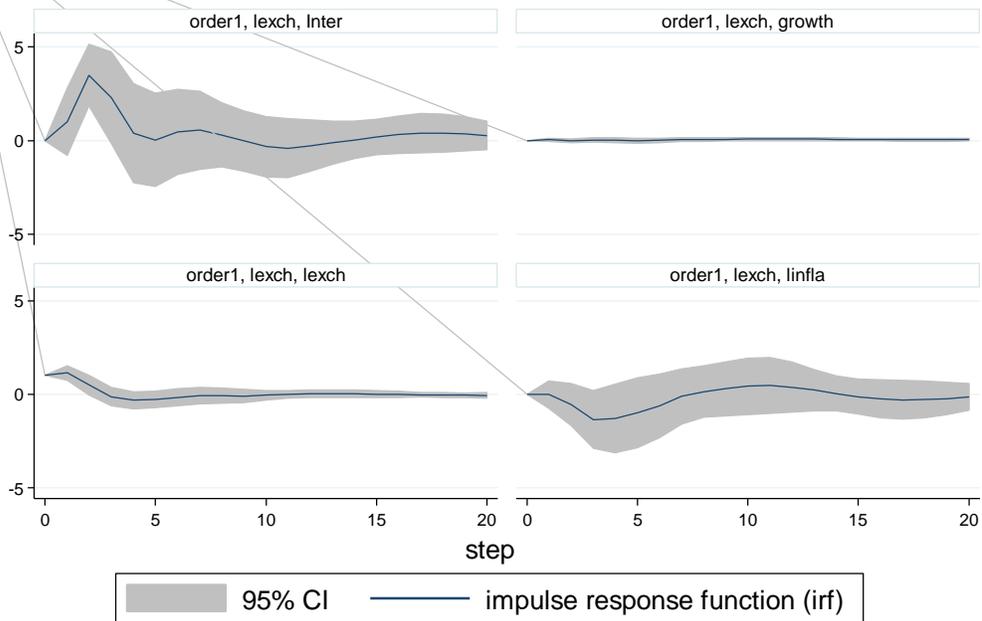


### Impulse Response Interest Rate - Columbia

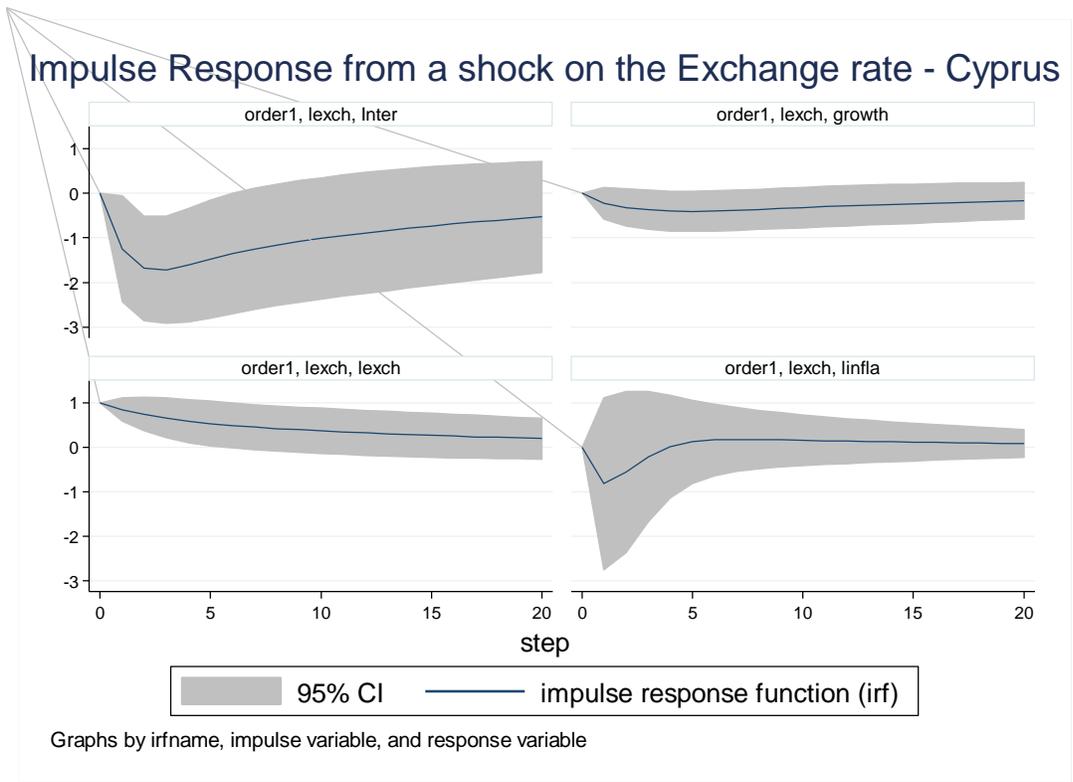
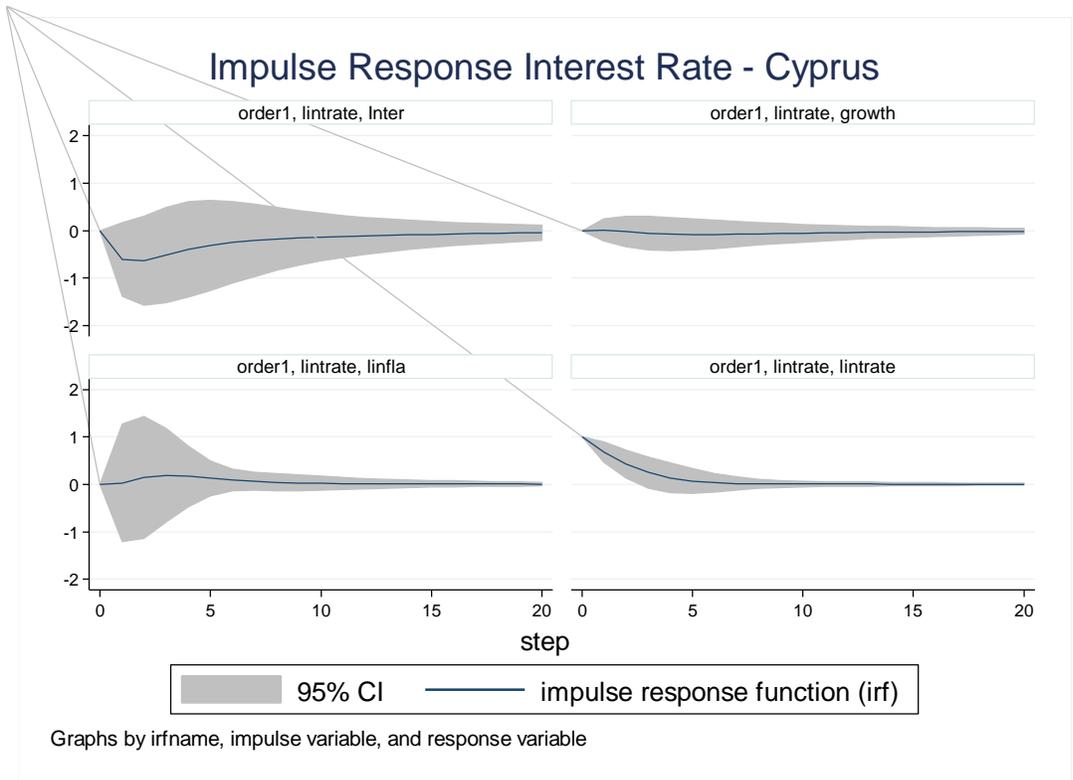


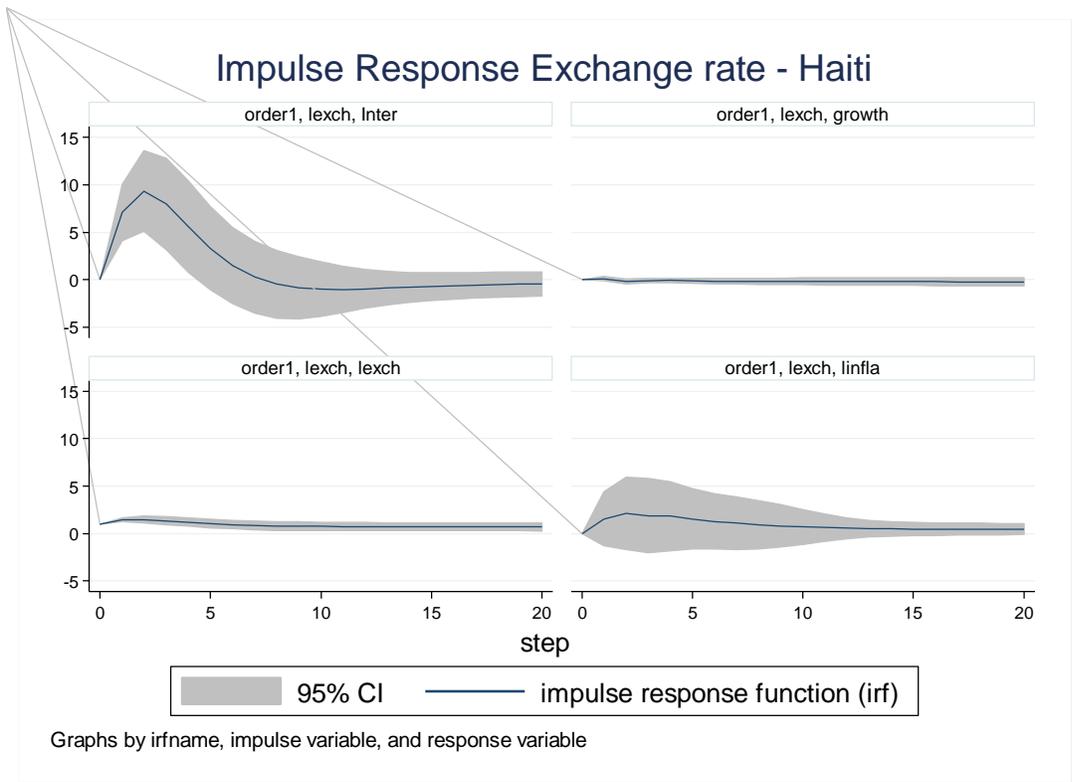
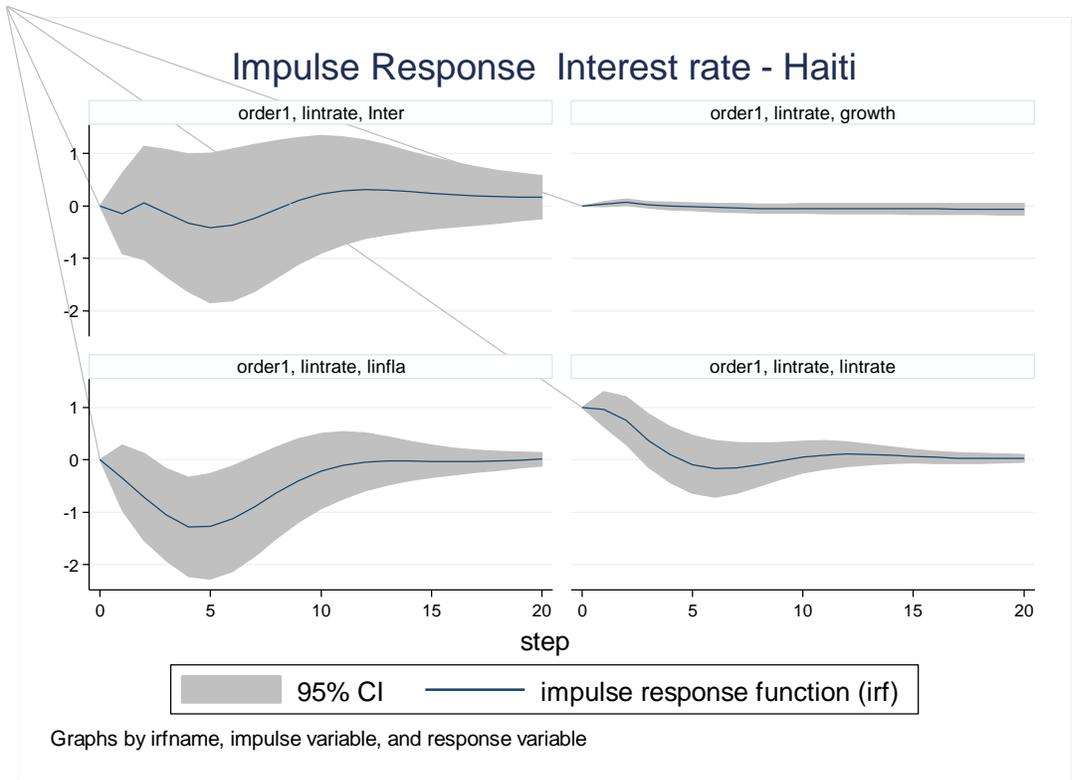
Graphs by irfname, impulse variable, and response variable

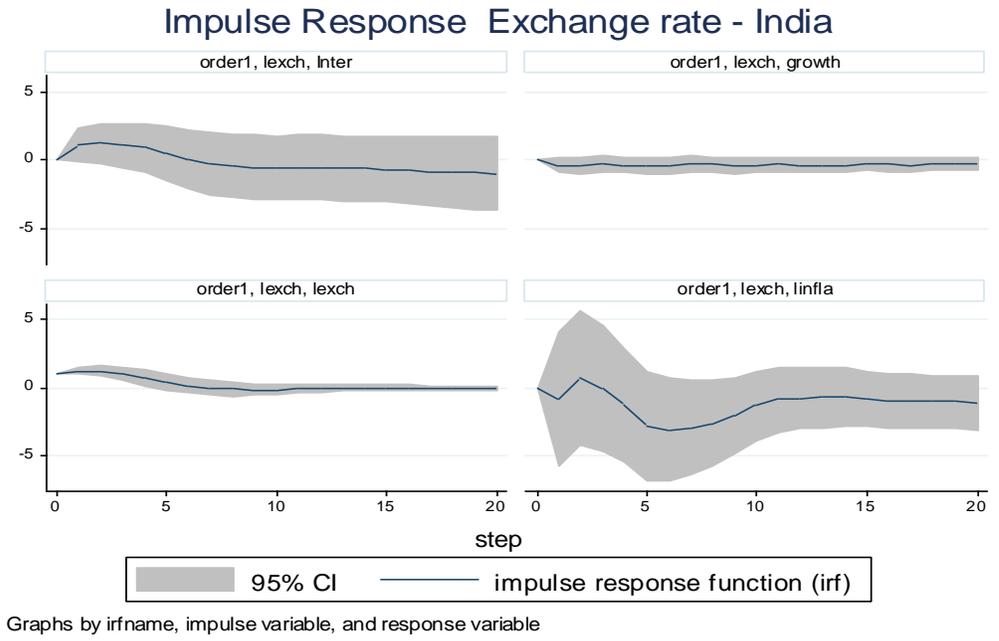
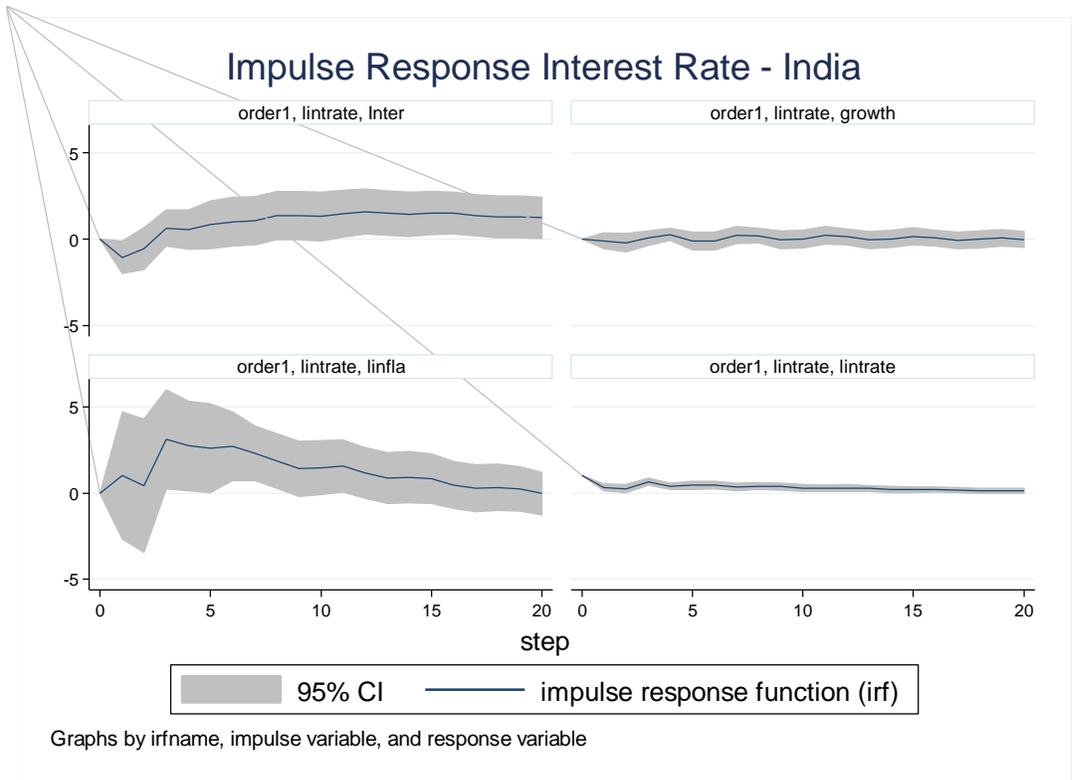
### Impulse Response from Exchange Rate - Columbia



Graphs by irfname, impulse variable, and response variable







## IRF tables for estimating interest rate and exchange rate with growth

| Table 7: Impulse response from interest rate |          |          |          |          |         |          |         |         |          |          |         |        |         |          |         |
|--|----------|----------|----------|----------|---------|----------|---------|---------|----------|----------|---------|--------|---------|----------|---------|
| Argentina                                    |          |          |          | Botswana |         |          |         | Bolivia |          |          |         | Brazil |         |          |         |
| step   | irf      | Lower    | Upper    | step     | irf     | Lower    | Upper   | step    | irf      | Lower    | Upper   | step   | irf     | Lower    | Upper   |
| 0  | 0        | 0        | 0        | 0        | 0       | 0        | 0       | 0       | 0        | 0        | 0       | 0      | 0       | 0        | 0       |
| 1  | -.05623  | -.109423 | -.003036 | 1        | .281802 | -.438772 | 1.00238 | 1       | .025804  | -.055916 | .107523 | 1      | .105263 | -.069822 | .280348 |
| 2  | -.042762 | -.087474 | .001949  | 2        | .218541 | -.356439 | .793522 | 2       | -.000534 | -.076744 | .075676 | 2      | .087737 | -.105287 | .28076  |
| 3  | -.045124 | -.099947 | .009698  | 3        | .284473 | -.501196 | 1.07014 | 3       | -.030351 | -.112512 | .051811 | 3      | .095559 | -.134476 | .325594 |
| 4  | -.036911 | -.09966  | .025838  | 4        | .279825 | -.623912 | 1.18356 | 4       | -.058452 | -.150191 | .033288 | 4      | .069064 | -.163239 | .301368 |
| 5  | -.033134 | -.104268 | .038     | 5        | .307479 | -.741724 | 1.35668 | 5       | -.080061 | -.181268 | .021146 | 5      | .053546 | -.159248 | .26634  |
| 6  | -.02849  | -.106966 | .049987  | 6        | .318389 | -.855738 | 1.49252 | 6       | -.094517 | -.203179 | .014144 | 6      | .040575 | -.137282 | .218433 |
| 7  | -.025496 | -.110959 | .059966  | 7        | .336504 | -.956701 | 1.62971 | 7       | -.102608 | -.217973 | .012758 | 7      | .039818 | -.105045 | .184682 |
| 8  | -.023001 | -.114891 | .068889  | 8        | .350141 | -1.05365 | 1.75393 | 8       | -.105811 | -.226717 | .015095 | 8      | .044585 | -.083957 | .173126 |
| 9  | -.021321 | -.119097 | .076456  | 9        | .364939 | -1.14335 | 1.87323 | 9       | -.105702 | -.229631 | .018226 | 9      | .051897 | -.080995 | .18479  |
| 10   | -.020127 | -.123104 | .08285   | 10       | .378133 | -1.22927 | 1.98553 | 10      | -.103664 | -.227347 | .020019 | 10     | .056888 | -.089118 | .202894 |

| Table 8: Exchange RATE - Growth - IRFs |          |          |          |          |         |          |         |         |          |          |         |        |         |          |         |
|--|----------|----------|----------|----------|---------|----------|---------|---------|----------|----------|---------|--------|---------|----------|---------|
| Argentina                              |          |          |          | Botswana |         |          |         | Bolivia |          |          |         | Brazil |         |          |         |
| step                                   | irf      | Lower    | Upper    | step     | irf     | Lower    | Upper   | step    | irf      | Lower    | Upper   | step   | irf     | Lower    | Upper   |
| 0                                      | 0        | 0        | 0        | 0        | 0       | 0        | 0       | 0       | 0        | 0        | 0       | 0      | 0       | 0        | 0       |
| 1                                      | -.295157 | -.499504 | -.090809 | 1        | .409965 | -.182724 | 1.00265 | 1       | -.304714 | -2.12167 | 1.51224 | 1      | .134509 | -.031166 | .300185 |
| 2                                      | -.231784 | -.440556 | -.023011 | 2        | .359665 | -.140695 | .860026 | 2       | -.235305 | -2.42137 | 1.95075 | 2      | .054859 | -.11222  | .221938 |
| 3                                      | -.216297 | -.475887 | .043293  | 3        | .428989 | -.187637 | 1.04562 | 3       | -.357109 | -2.69505 | 1.98083 | 3      | .047548 | -.134244 | .229341 |
| 4                                      | -.092706 | -.376701 | .191289  | 4        | .438109 | -.256531 | 1.13275 | 4       | -.384383 | -2.76708 | 1.99832 | 4      | .022129 | -.150962 | .19522  |
| 5                                      | .019179  | -.302894 | .341252  | 5        | .464287 | -.310939 | 1.23951 | 5       | -.303712 | -2.8211  | 2.21367 | 5      | .028159 | -.126577 | .182895 |
| 6                                      | .144804  | -.218381 | .507989  | 6        | .47504  | -.3679   | 1.31798 | 6       | -.095313 | -2.77015 | 2.57952 | 6      | .035184 | -.103872 | .17424  |
| 7                                      | .25367   | -.153097 | .660436  | 7        | .484305 | -.412759 | 1.38137 | 7       | .206584  | -2.60898 | 3.02215 | 7      | .04448  | -.086489 | .17545  |
| 8                                      | .350928  | -.099654 | .80151   | 8        | .487318 | -.451254 | 1.42589 | 8       | .566535  | -2.35667 | 3.48974 | 8      | .047902 | -.081978 | .177782 |
| 9                                      | .432048  | -.062643 | .926738  | 9        | .487026 | -.480848 | 1.4549  | 9       | .949847  | -2.04788 | 3.94758 | 9      | .047688 | -.083338 | .178714 |
| 10                                     | .500656  | -.038311 | 1.03962  | 10       | .483162 | -.503553 | 1.46988 | 10      | 1.32895  | -1.71422 | 4.37212 | 10     | .045217 | -.086639 | .177073 |

| Table 9: Impulse response table results Exchange rate - growth |         |          |         |          |         |         |         |        |          |          |         |       |          |          |         |
|--|---------|----------|---------|----------|---------|---------|---------|--------|----------|----------|---------|-------|----------|----------|---------|
| Chile  |         |          |         | Colombia |         |         |         | Cyprus |          |          |         | India |          |          |         |
| step   | irf     | Lower    | Upper   | step     | irf     | Lower   | Upper   | step   | irf      | Lower    | Upper   | step  | irf      | Lower    | Upper   |
| 0  | 0       | 0        | 0       | 0        | 0       | 0       | 0       | 0      | 0        | 0        | 0       | 0     | 0        | 0        | 0       |
| 1  | 1.66314 | -.834383 | 4.16067 | 1        | .135336 | .036508 | .234163 | 1      | .148821  | -.298818 | .59646  | 1     | -.572467 | -1.57967 | .43474  |
| 2  | 2.71131 | -1.34549 | 6.76811 | 2        | .166017 | .030406 | .301629 | 2      | .090898  | -.240145 | .421942 | 2     | -.679626 | -1.99587 | .636615 |
| 3  | 2.42584 | -1.93571 | 6.78739 | 3        | .184892 | .019419 | .350364 | 3      | -.01256  | -.309954 | .284834 | 3     | -.568354 | -1.89802 | .761308 |
| 4  | 1.61384 | -1.95544 | 5.18313 | 4        | .193645 | .008282 | .379008 | 4      | .035923  | -.351242 | .423088 | 4     | -.386583 | -1.68005 | .906887 |
| 5  | 1.14467 | -1.46327 | 3.7526  | 5        | .197664 | .002592 | .392737 | 5      | -.016724 | -.437091 | .403644 | 5     | -.206019 | -1.4566  | 1.04456 |
| 6  | 1.13207 | -1.14787 | 3.41201 | 6        | .19838  | .001814 | .394946 | 6      | -.031194 | -.512015 | .449628 | 6     | -.055567 | -1.23436 | 1.12322 |
| 7  | 1.21971 | -1.17707 | 3.6165  | 7        | .1971   | .004205 | .389995 | 7      | -.043951 | -.587544 | .499642 | 7     | .057902  | -1.02054 | 1.13634 |
| 8  | 1.14861 | -1.3312  | 3.62842 | 8        | .194932 | .00742  | .382445 | 8      | -.063216 | -.6656   | .539168 | 8     | .137505  | -.832329 | 1.10734 |
| 9  | .945025 | -1.4401  | 3.33015 | 9        | .192663 | .009724 | .375602 | 9      | -.077499 | -.738787 | .58379  | 9     | .189844  | -.685838 | 1.06553 |
| 10   | .751158 | -1.44529 | 2.9476  | 10       | .19066  | .010644 | .370677 | 10     | -.09106  | -.809285 | .627165 | 10    | .221826  | -.588388 | 1.03204 |

Table 10: Impulse response table results Exchange rate - growth

| Jordan |         |          |         | Peru |          |          |         | Malaysia |          |          |         |
|--------|---------|----------|---------|------|----------|----------|---------|----------|----------|----------|---------|
| step   | irf     | Lower    | Upper   | step | irf      | Lower    | Upper   | step     | irf      | Lower    | Upper   |
| 0      | 0       | 0        | 0       | 0    | 0        | 0        | 0       | 0        | 0        | 0        | 0       |
| 1      | 1.18573 | -3.84918 | 6.22063 | 1    | .007714  | -.529581 | .545009 | 1        | .031639  | -.185848 | .249127 |
| 2      | 2.51346 | -3.10652 | 8.13344 | 2    | .061246  | -.252784 | .375276 | 2        | .036046  | -.273839 | .34593  |
| 3      | 2.94316 | -3.88617 | 9.77249 | 3    | -.075376 | -.603912 | .45316  | 3        | .014746  | -.339443 | .368934 |
| 4      | 3.18141 | -4.47826 | 10.8411 | 4    | -.118403 | -.551911 | .315106 | 4        | -.018433 | -.410899 | .374033 |
| 5      | 3.3017  | -4.86468 | 11.4681 | 5    | -.223456 | -.789219 | .342307 | 5        | -.054907 | -.490449 | .380635 |
| 6      | 3.3569  | -5.09802 | 11.8118 | 6    | -.25954  | -.807311 | .288232 | 6        | -.090914 | -.573822 | .391994 |
| 7      | 3.37321 | -5.23285 | 11.9793 | 7    | -.320443 | -.952612 | .311725 | 7        | -.125054 | -.657046 | .406938 |
| 8      | 3.36638 | -5.30543 | 12.0382 | 8    | -.34286  | -.992452 | .306732 | 8        | -.156903 | -.737766 | .423961 |
| 9      | 3.34561 | -5.33892 | 12.0302 | 9    | -.378987 | -1.09236 | .334384 | 9        | -.186424 | -.814915 | .442066 |
| 10     | 3.3164  | -5.34784 | 11.9806 | 10   | -.396072 | -1.14585 | .353702 | 10       | -.213731 | -.888197 | .460736 |

## References

- "Haiti: Selected Issues and Statistical Appendix"*, IMF Country Report No. 07/292, August 2007;
- "Journal of Economics and International Finance"*, Vol. 3(5), pp. 328-336, May 2011, Available online at <http://www.academicjournals.org/JEIF>, ISSN 2006-9812, Academic Journals.
- A. G. CHANDAVARKAR, *"Government Balances as a Monetary Policy Instrument in the Less Developed Countries"*, Economic and Political Weekly (Vols. 1-40);
- Alleyne DILLON, Kirton CLAREMONT and Figueroa MARK, 2008, *"Macroeconomic Determinants of Migrant Remittances to Caribbean Countries: Panel Unit Roots and Cointegration"*, The Journal of Developing Areas, Volume 41, Number 2, pp. 137-153;
- Amos C. PETERS, 2009, *"Exchange Rate Targeting in an Estimated Small Open Economy"*, University of North Carolina at Chapel Hill, Job Market Paper;
- Anton PARLOW, Lab session Econ710, 2010, *"Panel Data Analysis in Stata"*, UWM Econ Department, Berlin;
- B. Gabriela MUNDACA, 2009, *"Remittances, Financial Market Development, and Economic Growth: The Case of Latin America and the Caribbean"*, Review of Development Economics, 13(2), pp 288–303;
- Bronwyn H. HALL (UC Berkeley; IFS) and Jacques MAIRESSE (CREST-INSEE; EHESS), 2002, *"Testing for Unit Roots in Panel Data: An Exploration Using Real and Simulated Data"*, NBER;
- Deena R. KHATKHATE, 1988, *"Assessing the impact of interest rates in less developed countries"*, World Development Volume 16, Issue 5, pp 577-588;
- Derrese DEGEFA, 2001, *"The parallel foreign exchange market and macroeconomic performance in Ethiopia"*, AERC Research Paper 107, African Economic Research Consortium, Nairobi;
- Evans JADOTTE, 2009, *"International Migration, Remittances and Labor Supply: The Case of the Republic of Haiti"*, Research Paper No. 2009/28, UNU;

Fabio CANOVA and al, 2001, “*Forecasting and Turning Point in a Bayesian Panel VAR Model*”, CEPR;

Gyan PRADHANA, Mukti UPADHYAYB and Kamal UPADYYAYAC, 2008, “Remittances and economic growth in developing countries”, *The European Journal of Development Research* Vol. 20, No. 3, pp 497–506;

Isabel RUIZ and Carlos VARGAS-SILVA, 2009, “*Monetary policy and international remittances*”, *The journal of developing area*;

Isabel RUIZ, Elias SHUKRALLA, and Carlos VARGAS-SILVA, 2009, “*Remittances, Institutions and Growth: A Panel Semi-Parametric Approach*”, *International Economic Journal* 23.1, pp. 111-119;

James STOCK and Mark WATSON, 2007, “*Introduction to econometrics*”, 2<sup>nd</sup> Edition, Pearson Education;

Joel Hinaunye EITA and Andre C. JORDAAN, “*A Causality Analysis Between Financial Development and Economic Growth for Botswana*”, *The African Finance Journal*, Africa growth Institute, vol. 12(1), pp 72-89. (Investment and Trade Policy Centre, University of Pretoria);

Karl DRIESSEN, “*MONETARY POLICY IN DOLLARIZED ECONOMIES*”, Bank of Albania

Leonardo LEIDERMAN, Rodolfo MAINO, and Eric PARRADO, 2006, “*Inflation Targeting in Dollarized Economies*”, IMF Working Paper, WP/06/157;

Lester V. CHANDLER, “*The Place of Monetary Policy in the Stabilization Program The Review of Economics and Statistics from 1919-2005*”, the MIT press (Vols. 1-87);

Manuel ARELLANO and Stephen BOND, 1991, “*Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations*”, *The Review of Economic Studies*, Vol. 58, No. 2., pp. 277-297;

Mark R. ROSENZWEIG, 2005, “*Consequences of migration for developing countries*”, United Nations;

Mark WEISBROT and Rebecca RAY, 2011, *“The Scorecard on Development, 1960-2010: Closing the Gap?”*, Center for Economic and Policy Research;

Martín URIBE, 2000, *“Real exchange rate targeting and macroeconomic instability”*, University of Pennsylvania and NBER, Department of Economics;

Mwanza NKUSU, 2003, *“Interest rate, credit rationing and Investment in less developed countries”*, IMF working paper 03/63, IMF;

Ralph CHAMI, Connel FULLENKAMP and Samir JAHJAH, 2005, *“Are Immigrant Remittance Flows a Source of Capital for Development?”*, IMF Staff Papers, Vol. 52, No. 1, pp. 55-81;

Ralph CHAMI, Thomas F. COSAMINO and Michael T. GAPEN, 2006, *“Optimal Fiscal and Monetary Policy in the Presence of Remittances”*, IMF;

Richard T. FROYEN, 1999, *“Macroeconomics: Theories and Policies”*, 6<sup>th</sup> Edition, Prentice Hall, NJ;

Robert E. HALL and Marc LIEBERMAN, 2008, *“Macroeconomics: Principles and Applications”*, 5<sup>th</sup> Edition, South Western Cengage Learning;

Robert J. BARRO, 1995, *“Inflation and economic growth”*, Cambridge USA, WP 5326, NBER;

Ruth A. JUDSON and Ann L. OWEN, 1996, *“Estimating Dynamic Panel Data Models: A Practical Guide for Macroeconomists”*, Federal Reserve Board of Governors;

Samina KHALIL, 1993, *“Monetary and fiscal policy in LDCs: limitations and constraints”* Economic Review;

Samuel Erasmus ALNAA, and Ferdinand AHIKPOR, 2011, *“ARIMA (autoregressive integrated moving average), approach to predicting inflation in Ghana”*, Ghana;

Stefan KRAUSE and Felix RIOJA, 2006, *“Financial Development and Monetary Policy Efficiency”*, Department of Economics, Emory University, and Department of Economics, Georgia State University;

Thomson LEARNING, 2003, “*The Interaction between the Interest Rate and GDP*”, South-Western University;

Walter ENDERS, 2004, “*Applied Econometric Time Series*”, University of Alabama, Second Edition, Wiley;

Yves CROISSANT (Université Lumière Lyon 2), Giovanni MILLO (University of Trieste) and Generali SPA, 2008, “*Panel Data Econometrics in R: The plm Package*”, published in the Journal of Statistical Software, Paris;