

# **Estimation of Money Demand Function for Selected Countries; A Panel Data Analysis**

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## ABSTRACT

This study evaluates the nature of the demand for broad money ( $M_2$ ) in seven selected countries of Australia, Canada, Hungary, Iceland, Singapore, South Africa, and Switzerland as a panel data analysis. This is important in a sense that money demand function in monetary policies rely on its permanency. A set of expletory researches were conducted regarding quantity of real money demand function in developing and developed countries with similar financial sector in order to well understanding of the nature of modeling. In particular, the thesis uses annual data about real money demand ( $M_2/P$ ), nominal interest rate (INT), real gross domestic product (GDP) and financial development (G) to estimate the income and interest rate elasticity of money demand for this sample of countries. In this study also the relationship of financial development and quantity of real money demand are being investigated. The methodology will be based on panel data regression analysis with fixed effect. The sample period of study will be between 1985-2010 years. The quantity theory of money states that, the long term income elasticity needs to be close to the value one which is consistent with our finding of 0.7739. The coefficients obtained of real income, interest rate, and financial developments are as expected and significant. Consequently, the long run demand for money ( $M_2$ ) in selected countries as a group was positively related to real income and financial development and negatively related to nominal interest rate.

**Keywords:** Money Demand Estimation, Interest Rate, GDP, Panel, Regression Analysis

## ÖZ

Bu çalışma, bir panel veri analizi olarak Avustralya, Kanada, Macaristan, İzlanda, Singapur, Güney Afrika, ve İsviçre yedi belirli ülkelerde geniş para ( $M_2$ ) için talep niteliği değerlendirir. Bu, bir anlamda önemli dirky, para talebi para politikaları fonksiyonunda kalıcılığa dayanmaktadır. Araştırmalar bir dizi modelleme doğanın iyi anlaşılması için, benzer finans sektöründe gelişmiş ve gelişmekte olan ülkelerde gerçek para talebi fonksiyonunun miktarı ile ilgili yapılmıştır. Özellikle, tez gelir ve para talebinin faiz esnekliği tahmin etmek için gerçek para talebi ( $M_2 / P$ ), nominal faiz oranı (INT), reel gayri safi yurtiçi hasıla (GSYİH) ve finansal geliştirme (G) örnek ülkelerin yıllık verilerini kullanır. Bu çalışmada finansal gelişme ve gerçek para talebinin miktarı arasındaki ilişki araştırılmaktadır. Metodoloji panel veri regresyon analize ile sabit etkiye dayalı olacaktır. Örnek Araştırma süresi 1985-2010 yılları arasında olacaktır. para miktar teorisi belirtirky uzun vadede gelir esnekliği değeri, bizim bulduğumuz tutar ile (0.7739) yakın olması gerekir. Reel gelir, faiz oranı, ve finansal gelişmelerin elde edilen katsayıları beklendiği gibi ve önemli edilmektedir. Sonuç olarak, bir grup olarak belirli ülkelerde uzun vadede para için edilen talep ( $M_2$ ) olumlu reel gelir ve finansal gelişme ile ilgili ve olumsuz olarak nominal faiz oranı ile ilgilidir.

**Anahtar Kelimeler:** Para Talep Tahmini, Finansal Gelişme, Faiz, GSYH, Panel, Regresyon Analizi

This study is dedicated to my parents with their support and kindness

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# **Chapter 1**

## **INTRODUCTION**

### **1.1 Background of the Study**

Start date of investigation on the demand for money dates back to the period where it was used as a tool to solve some problem in barter system. The demand for money has an important role in macroeconomic. The relationship between the quantity of real money demand and its key variables is a very crucial subject in macro-economic theory to take action in monetary policies. During the last decade, the Central Banks has been using various monetary policy instruments to control inflation and effective demand to regulate the quantity of money in the economy.

### **1.2 Problem Statement**

Policies such as inflation control to a targeted single digit point, has been the objective of both developed and developing countries. The Key variables for money demand estimation and their relationship to each other is of a great importance. Effectiveness of a monetary policy can be understood from the money demand theory to its variable relationship which gives the policy makers a tool to adjust economy factors in a way that targeted achievement in economy is being materialized.

### **1.3 Research Objectives**

The main goal of this study is to estimate an ideally consistent model of the money demand function of seven selected countries shown in figure 1 from five continents for the period of 1985 to 2010 using annual data. Broad money ( $M_2$ ) as definition of money balances has been employed in the study which includes currency, demand deposits and time deposits. For the model estimation, this study employed the method of least square method with fixed effect. Our variables are GDP, interest rate, financial development and quantity of real money demand. The data will be analyzed in the form of panel data for selected countries and coefficient will be obtained for sample as whole. This will provide answers to important macroeconomic questions such as; do changes in real income affect the demand for money ? What is the relationship between real quantity of money demand and financial development? What is the relationship between real quantity of money demand and GDP? What is the relationship between real quantity of money demand and interest rate? Also we aim to estimate how money demand responds to changes in financial development. Overall, they enable us to provide references that would benefit monetary management systems through central banks in countries.

### **1.4 Significance of the Study**

Central banks need a correct itemized money demand function in order to stabilize the economy by formulating and conducting its monetary policy through supplying optimum amount of money into economy. The paper provides important information on predicting and tracking the interest rates and money supply. This is crucial because it will help in assessing the control of monetary policy in selected

countries. Furthermore, this research is significant because it will add up to the literature study of money demand estimation for selected countries of developed and developing countries as a whole.



Figure 1. Seven Selected Countries on World Map

The specified countries in figure 1 are seven selected countries mentioned. The countries are both developed and developing. The selection of countries was based on fact that we wanted to have an estimation of model that could be generalized to whole world and not to be biased in the sense of having similar economies.

### **1.5 Research Hypotheses**

The employed hypotheses of this study are presented below. Our assumption is going to be in a way that the coefficients are zero otherwise we fail to accept the null hypothesis and we accept the alternative hypothesis which indicate the existence of relationship.

Table 1. The Hypothesis

<b>The null hypothesis</b>	<b>The hypothesis explanation</b>
<b>1</b>	Real income has no effect on money demand
<b>2</b>	Interest rate has no effect on money demand
<b>3</b>	Financial development has no effect on money demand

## **1.6 Scope of the Paper**

The structure of this paper is organized as follows: Chapter 1 starts with introduction. In chapter 2, the model of money demand function is reviewed. Chapter 3 presents the model, methodology, data. Estimation results are in chapter 4 and section 5 is the conclusion.



## Chapter 2

### LITERATURE REVIEW

#### 2.1 Theory

Money is the standard way of exchange where fees and expense are paid. Theory of money demand has advanced over time and in this section we discuss the evolution of these theories from classical to recent theories.

##### 2.1.1 Quantity Theory of Money Demand

Irvin Fisher has exposed one of the most clear classical money demand theories in his work which its main assumption is: the quantity theory of money becomes a theory of the demand for money once one assumes that the money market is in equilibrium so that (Apostolos 2001). He examined the relationship between quantity of money (total  $M$ ) and amount of spending (total  $P \times Y$ ) on final goods and services. In this case  $P$  represents the level of price and  $Y$  is output, Velocity of money are marked by  $V$  which can be mentioned as follows:

$$V = \frac{P \times Y}{M} \quad (1)$$

Multiplying both sides of equation (1) an equation will appear which relates quantity of money demand and velocity and nominal income:

$$M \times V = P \times Y \quad (2)$$

Fisher's view was that velocity movement is very slow overtime in short period; in other word it is constant. Fisher's view that velocity is fairly constant in the short run transforms the equation of exchange into the quantity theory money, which states that nominal income is determined solely by movements in the quantity of money. For the classical economists, the quantity theory of money provided an explanation of movements in the price level.

$$M = \frac{1}{V} P \times Y \quad (3)$$

Rewriting equation (2) in th form of equation (3) we note that in equilibrium form of market quantity of money demand  $M$  will be equal to amount of money people hold  $M^d$ . taking  $k$  as a constant form of  $\frac{1}{V}$  the equation will take the following form:

$$M^d = kP \times Y \quad (4)$$

Fisher came to conclusion that the demand for money is a function of output and interest rate does not have influence on the amount of money people hold. He believed that this demand is influenced in two ways:

1. Transaction level
2. The level of technology or institutions in economy

### **2.1.2 Keynes's Liquidity Preference Theory**

The liquidity preference theory which is a theory of money demand is developed by Keynes. In his view he put emphasis on interest rate and forgot about the constant velocity in classical view of theory.

Keynes discussed three motives behind theory of money demand which are:

1. Transactions motive
2. Precautionary motive
3. Speculative motive.

Transactions motive: That is a need to hold some money between transaction receipts and payment to be able to do the transaction. Keynes in his studies mentioned transaction as one of the motives which is proportional to income level.

Precautionary motive: This motive is about the uncertainty and unexpected expenses that everybody may face and it is proportional to income level as well.

Speculative motive: This motive says that money can be seen as store of wealth which individual can take it as a source that helps them to increase their wealth by speculating the markets such as financial markets.

Keynes discussed that three motives are proportional to income level and interest rate:

$$\frac{M^d}{P} = f(i, Y) \quad (5)$$

We can rewrite the equation (5) in the form of equation (6)

$$\frac{P}{M^d} = \frac{1}{f(i, Y)} \quad (6)$$

Equating  $M$  with  $M^d$  since they are in equilibrium we will come up with following equation:

$$V = \frac{PY}{M} = \frac{Y}{f(i, Y)} \quad (7)$$

Which indicate the fact that velocity is not constant as mentioned in classical view and it fluctuates with changes in interest rate.

Table 2. Dependent and Independent Variables

Variable	Explanation	Abbreviation
Dependent	Quantity of Real Money Demand	$M^d = M_2/P$
Independent	Real Gross Domestic Product	GDP
Independent	Nominal Interest Rate	INT
Independent	Financial Development	G*

\* The values of financial developments were collected as (M2/GDP) from World Bank

## 2.2 Quantity of Real Money Demand

The real demand for money (or the demand for real money balances) is the nominal quantity demanded divided by price level. (Richard 2007). The real money demand of different countries can be seen in logarithmic form dated from 1985 to 2010.

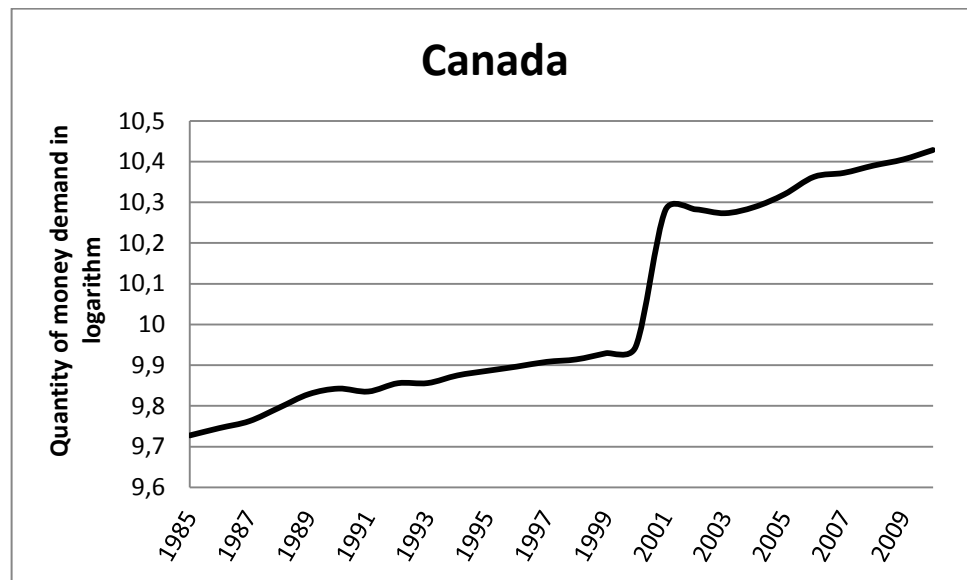


Figure 2. Quantity of Money Demand in Canada

As the figure 2 shows  $M^d$  increase rapidly in 2001 and after that it continues to grow in its smooth way.

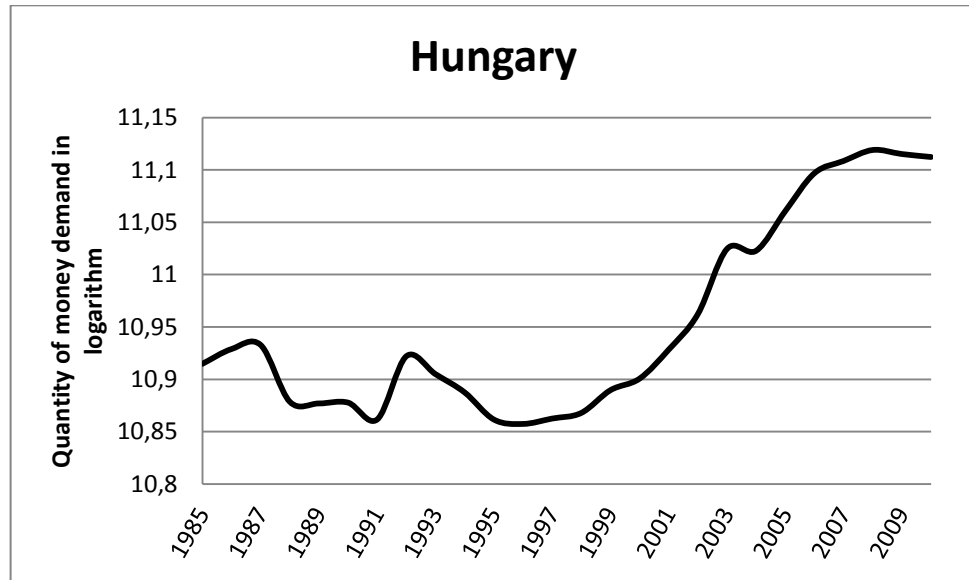


Figure 3. Quantity of Money Demand in Hungary

The fluctuation in Hungary real demand of money can be seen since 1999 when it starts to grow and reach new highs.

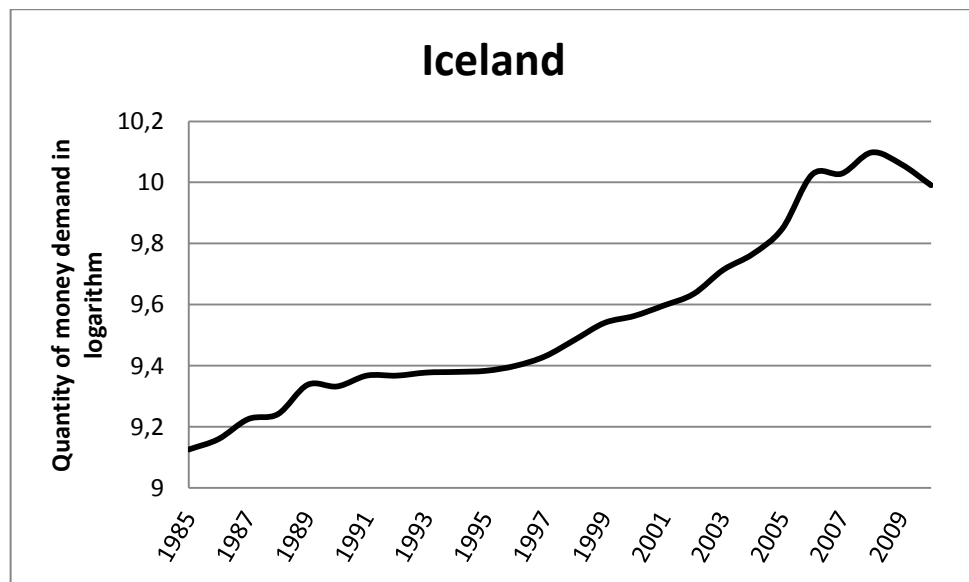


Figure 4. Quantity of Money Demand in Iceland

As figure 4 implies the Iceland economy always has faced increase in demand for its real money demand until 2008 where it sees a decline afterwards.

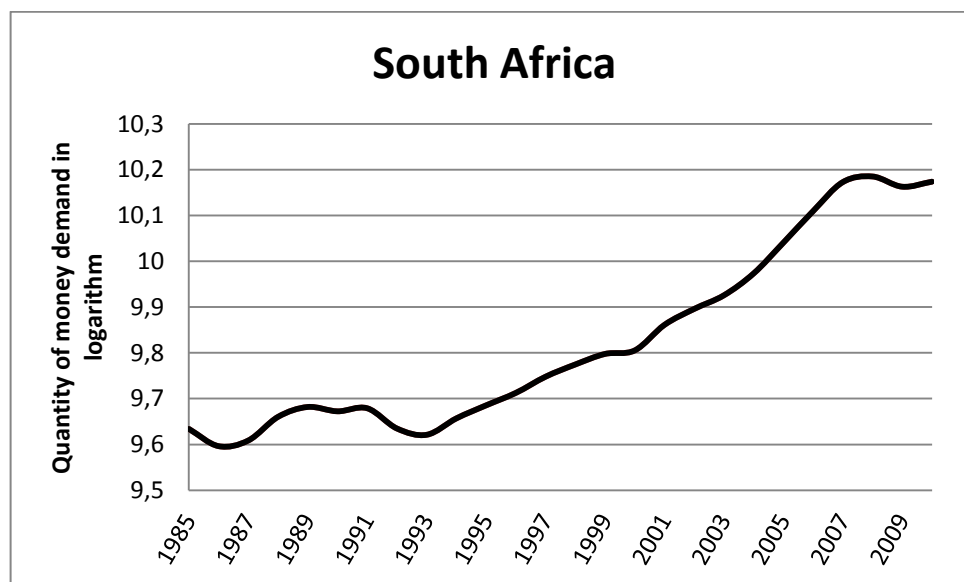


Figure 5. Quantity of Money Demand in South Africa

The figure 5 shows that  $M^d$  in South Africa has started to increase until 2007.

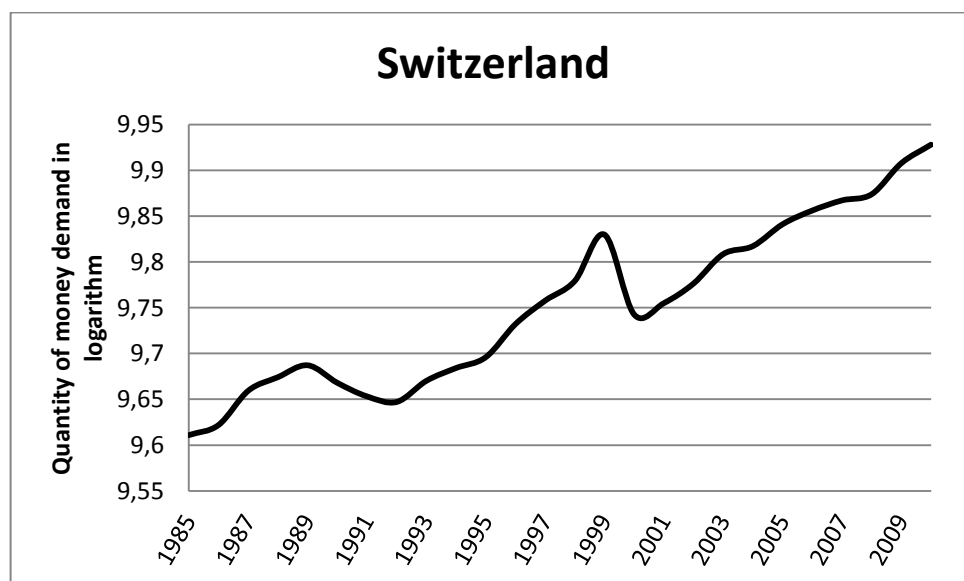


Figure 6. Quantity of Money Demand in Switzerland

Switzerland seems to follow other countries increased trend line facing some decline in 1989 and 2000.

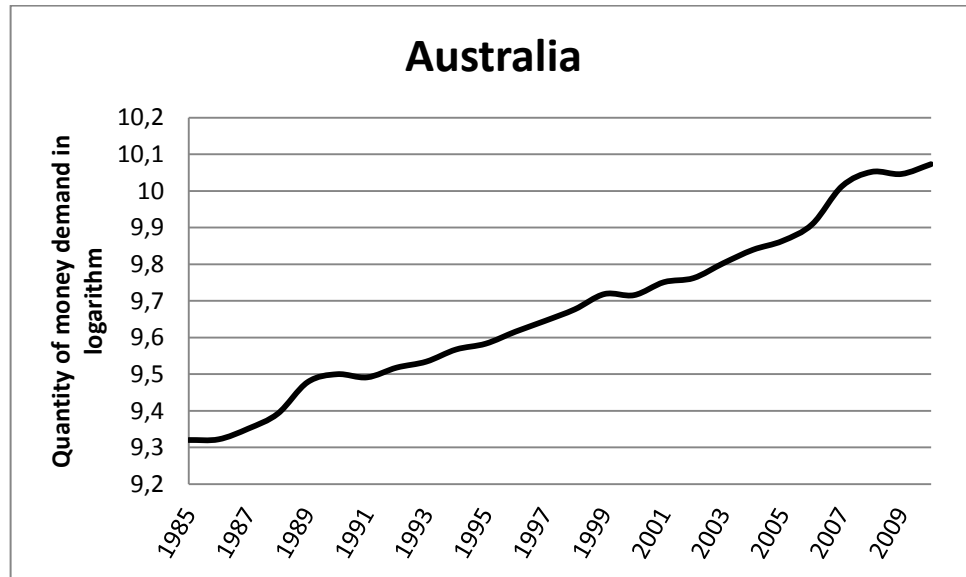


Figure 7. Quantity of Money Demand in Australia

As figure 7 implies Australia have one of the clearest upwards trend line will less fluctuation.

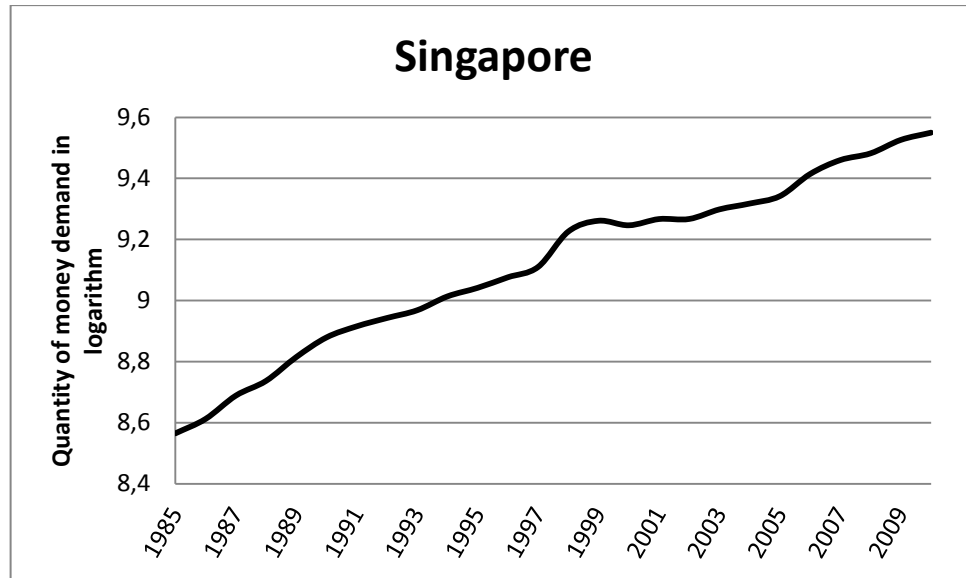


Figure 8. Quantity of Money Demand in Singapore

Singapore's quantity of money demand always have seen a steady growth except the case of 1998 which a small jump could be seen which its reason can be analyzed and found in key variables relationships to  $M^d$ .

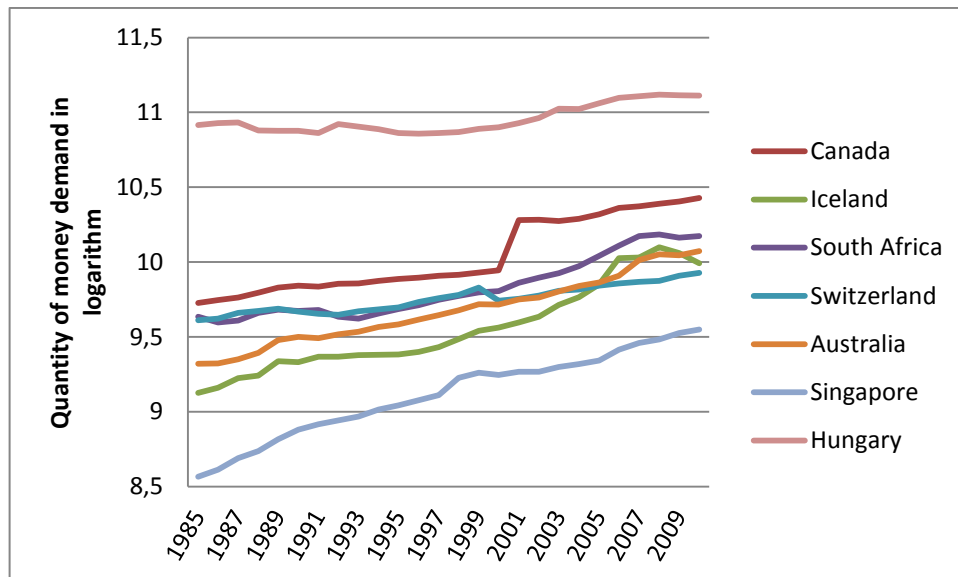


Figure 9. Quantity of Money Demand in Selected Countries



Figure 9 illustrate all the countries quantity of money demand in one graph implying all the demand to be increase and following a steady bullish trend.

### 2.3 Interest Rate

Interest rate is one of the key variables in the quantity of real money demand. We evaluate interest rate not in the in the form of real interest rate since quantity of real money demand continues to depend on the nominal interest rate , because nominal interest rate measure the opportunity cost of holding money rather than bonds (Robert 1998). Rise in interest rate is widely thought to work to depress output (Michael 2007) is our base to evaluate the obtained result.

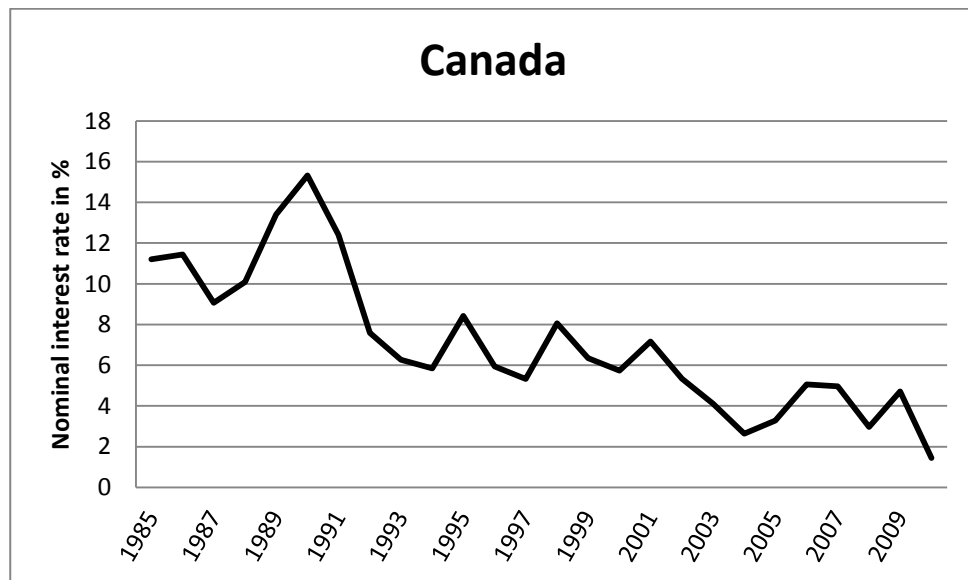


Figure 10. Nominal Interest Rate in Canada

Figure 10 shows the well performance of Canada economy in targeting a single digit inflation rate since 1985.

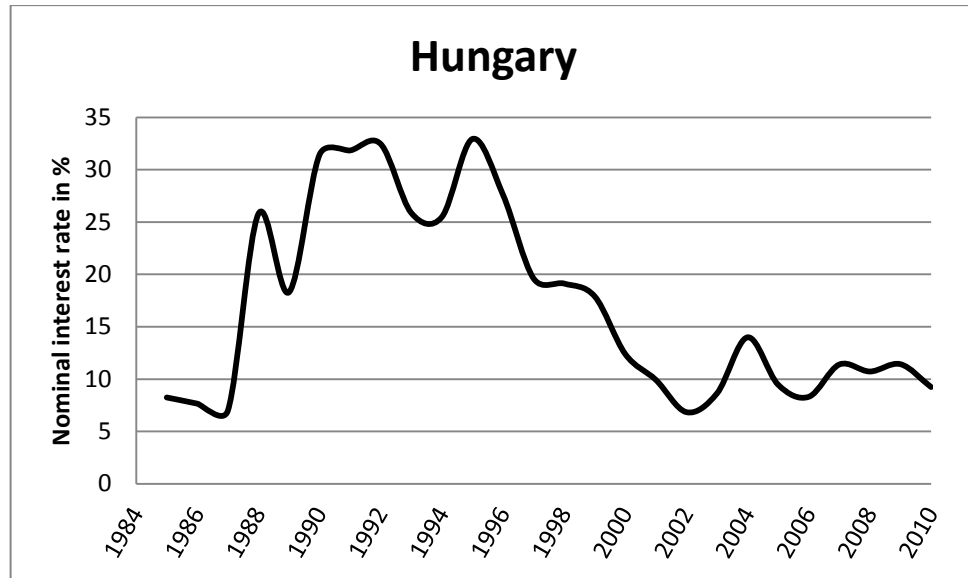


Figure 11. Nominal Interest Rate in Hungary

As the figure 11 shows Hungary experienced unprecedented peaks between years 1990 to 1999 ending it by a recovery in economy afterwards.

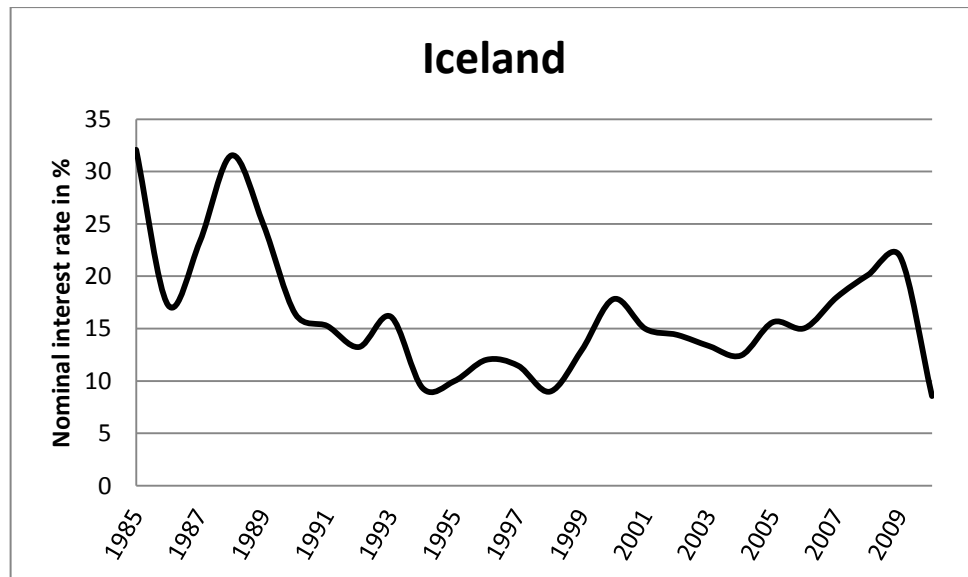


Figure 12. Nominal Interest Rate in Iceland

The minimum inflation rate in Iceland was during 1995, 1999, and 2009 and maximum inflation rate belongs to 1985.

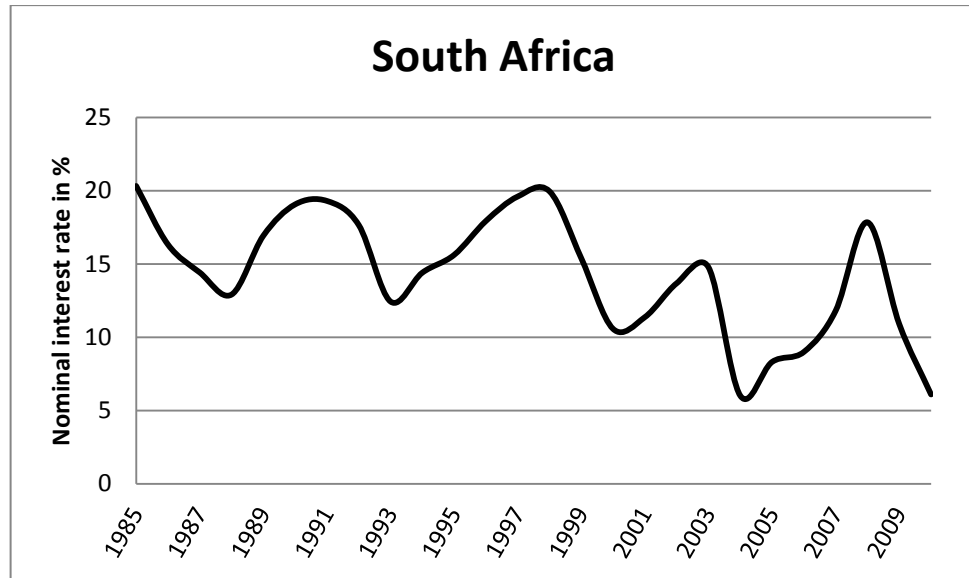


Figure 13. Nominal Interest Rate in South Africa

As the figure 13 shows South Africa was successful in targeting single digit inflation rate by doing some major reforms in its financial sectors leading to decrease in nominal interest rate.

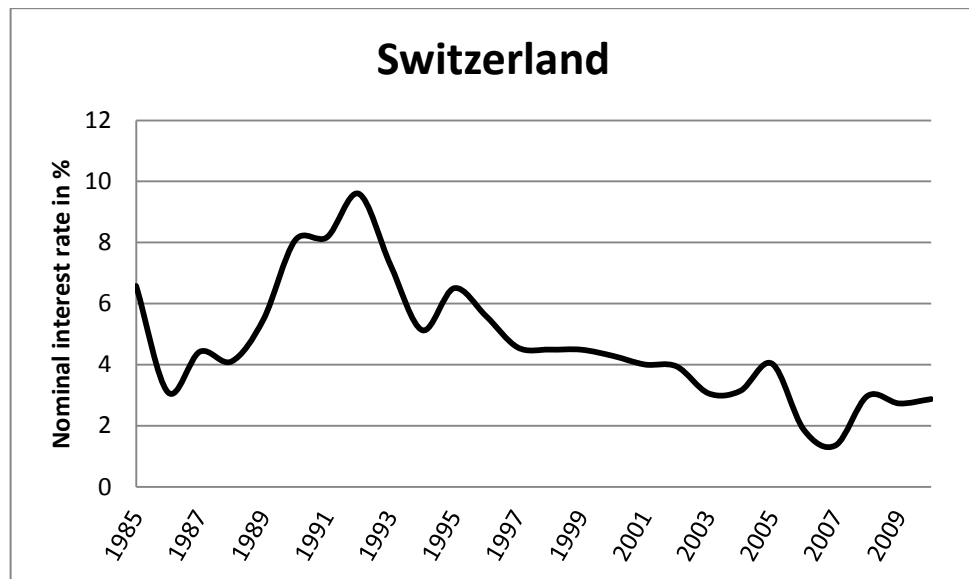


Figure 14. Nominal Interest Rate in Switzerland

In all the period that our study implemented, indicates the nominal interest rate of Switzerland is below 10 percent which it keep steady decline in the years. Switzerland's maximum nominal interest rate has occurred during year 1992.

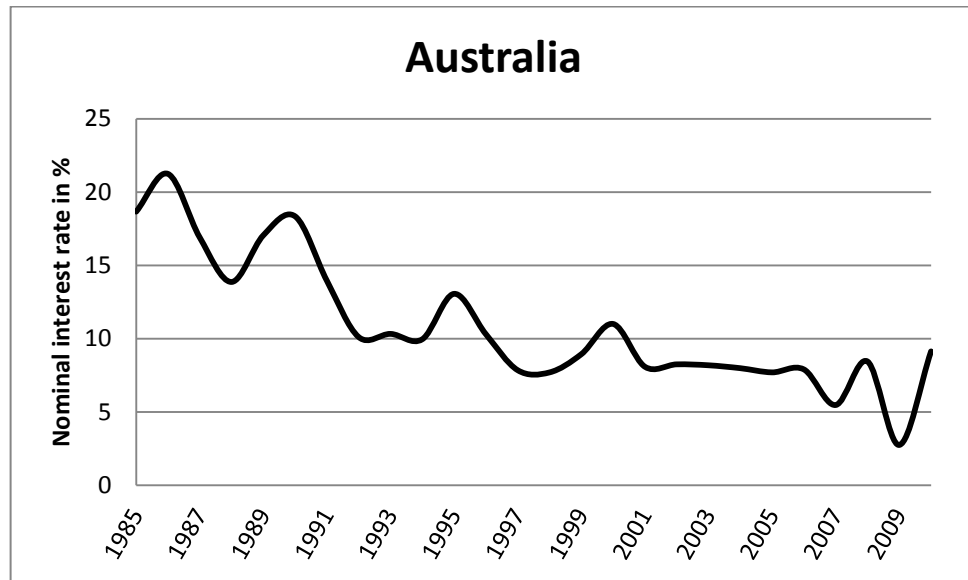


Figure 15. Nominal Interest Rate in Australia

Nominal interest rate in Australia has been able to reach below 5 % in 2009 while this country has seen its rate in rally above 5 % in following year.

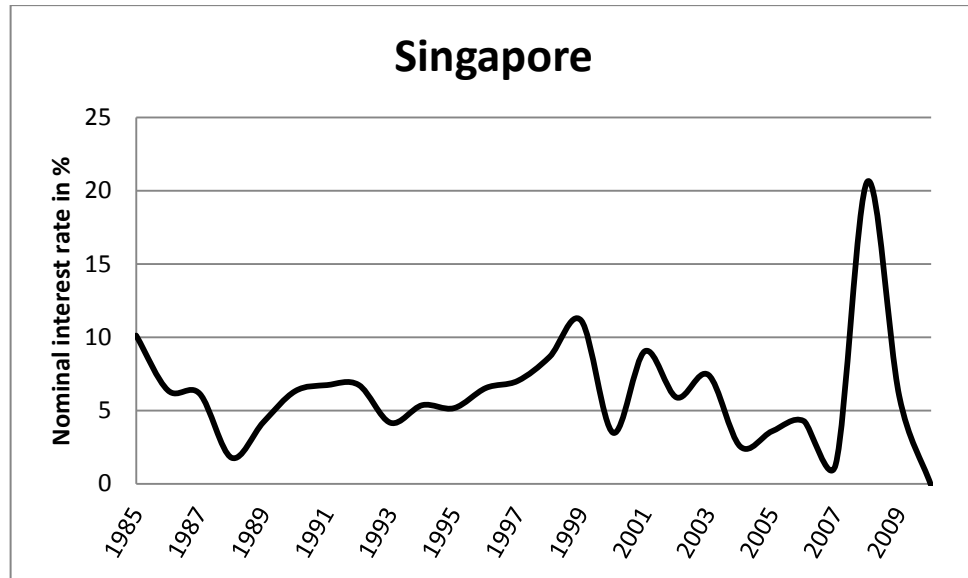


Figure 16. Nominal Interest Rate in Singapore

Singapore case is pretty different in the case of nominal interest rate which this country has faced a huge fluctuation in years. This country has seen a jump in its interest rate in year 2007 to 2008. A recovery has caused this country to have a negative interest rate in year 2010.

Finally we have all countries collected in figure17 having a decline in their interest rate as shown. Nominal interest rate plays a very important role as a key variable determining the quantity of real money demand. That is important to know how much adjustment needed or what the optimum amount of money supply is so imbalances in economy could be offset.

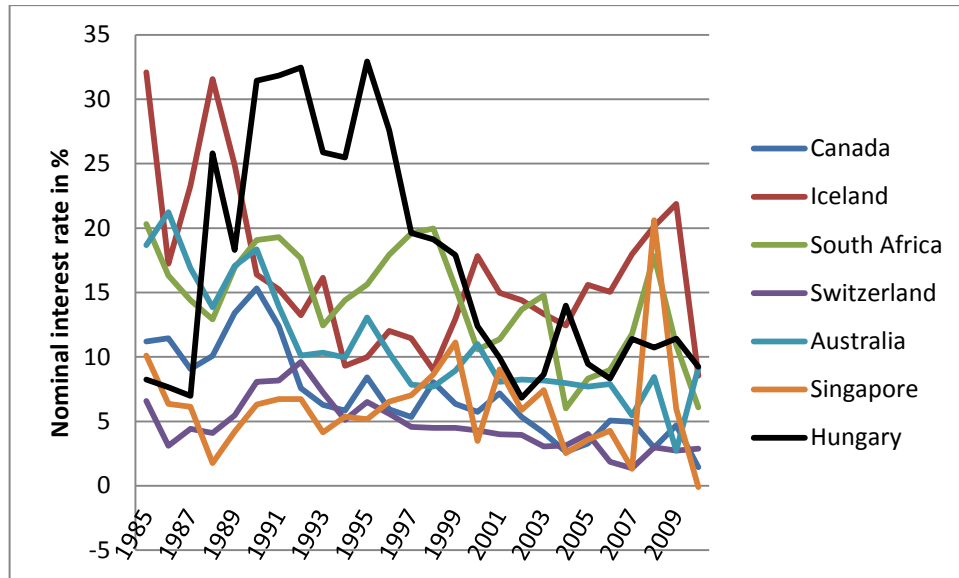


Figure 17. Nominal Interest Rate in Selected Countries

## 2.4 Financial Development

Financial development is a measure which promotes the competition among financial institution which can lead to decrease in the transaction costs, and for sure it will help to have advancement in technology. All of those will lead to increase in money demand. Moreover development In financial sector along with success and achievements will encourage individuals and entities to invest in the financial market which indicate how related can be the influence of financial development, so we take this financial development as a variable to assess its effect on quantity of real money demand. Financial development in our case is calculated as Broad money ( $M_2$ ) over real gross domestic product (GDP),

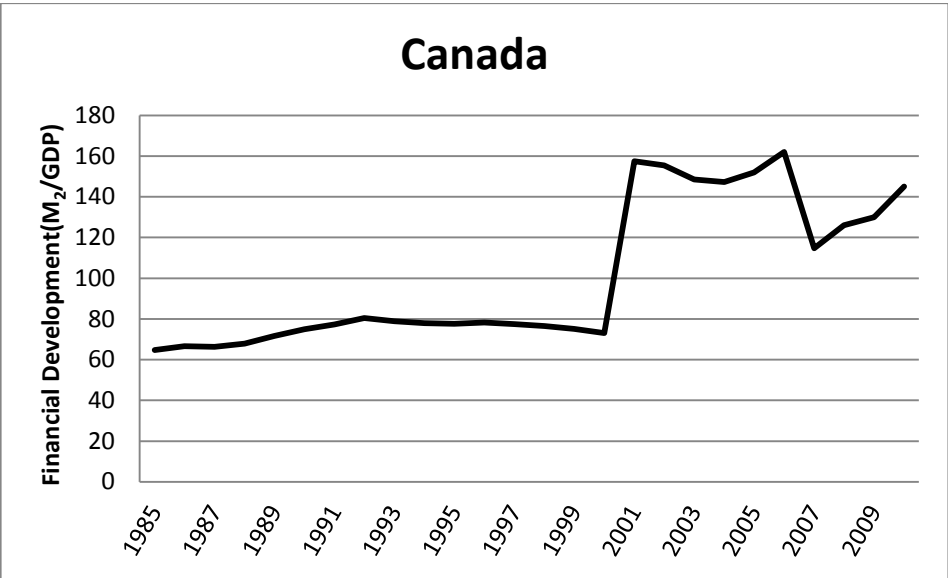


Figure 18. Financial Development in Canada

After economic crisis Canada has faced rapid increase in financial development in year 2001.

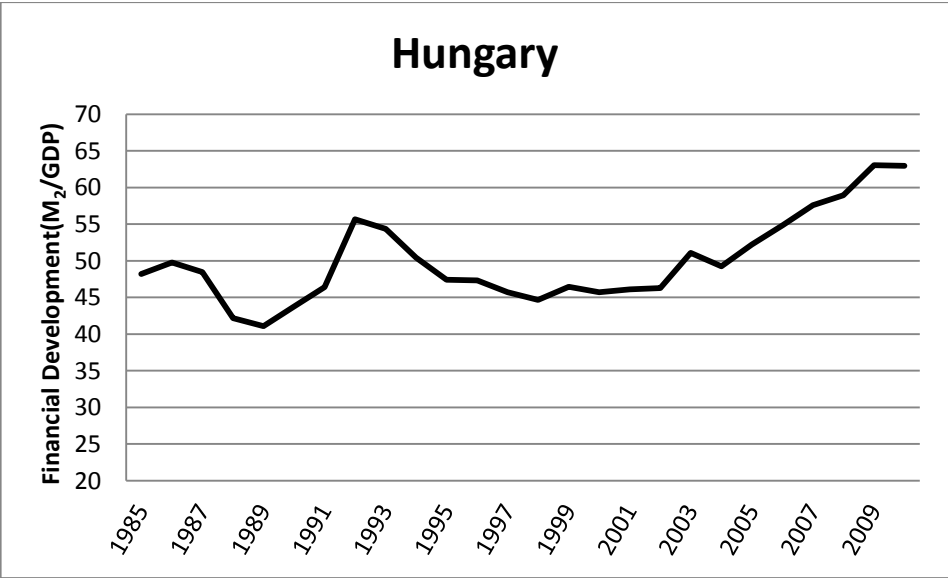


Figure 19. Financial Development in Hungary

In the case of Hungary an obvious smooth uptrend line can be seen after 1997.

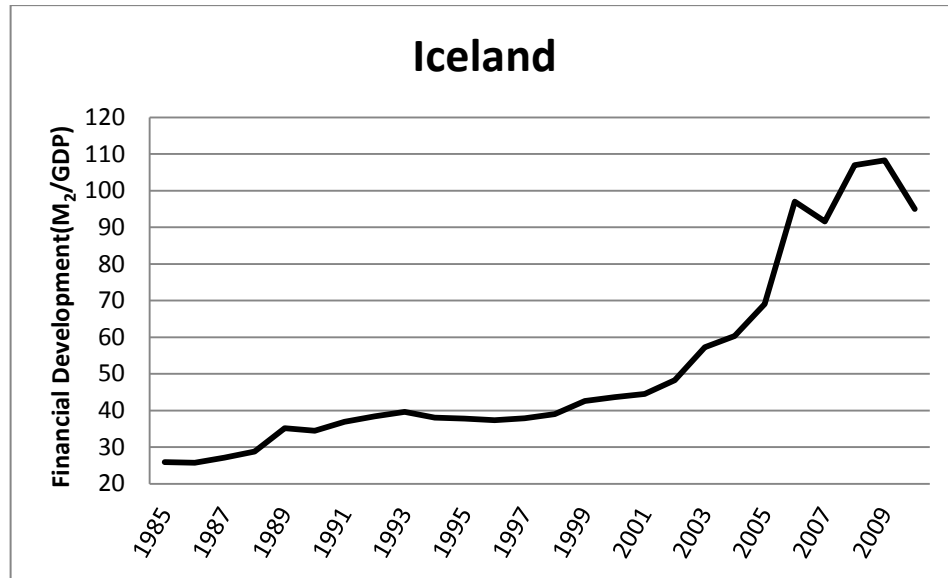


Figure 20. Financial Development in Iceland

The Iceland is facing a very smooth upward trend line after 1995 where prior to that the development seems to be constant growth.

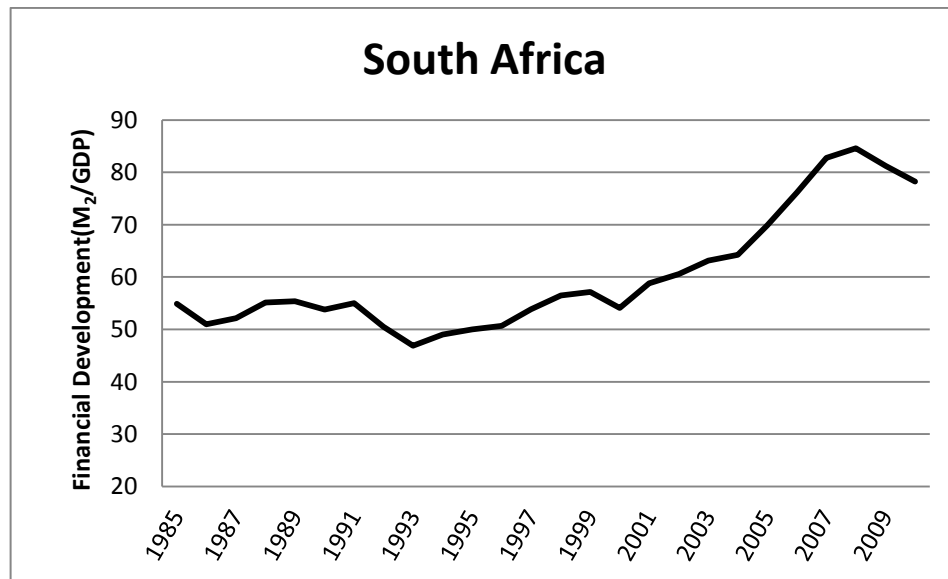


Figure 21. Financial Development in South Africa

Year 1993 is the time which new era started in which the country became market oriented. It was time when some privatization in banks started. The overall reforms helped government to have increase in financial development.



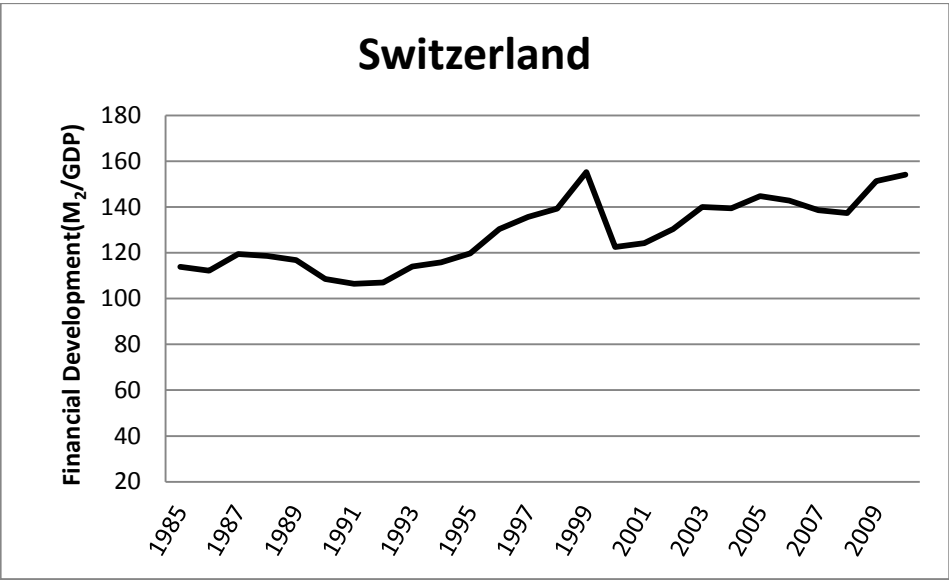


Figure 22. Financial Development in Switzerland

As the figure 22 shows since Switzerland is having a very high constant growth in its financial sector.

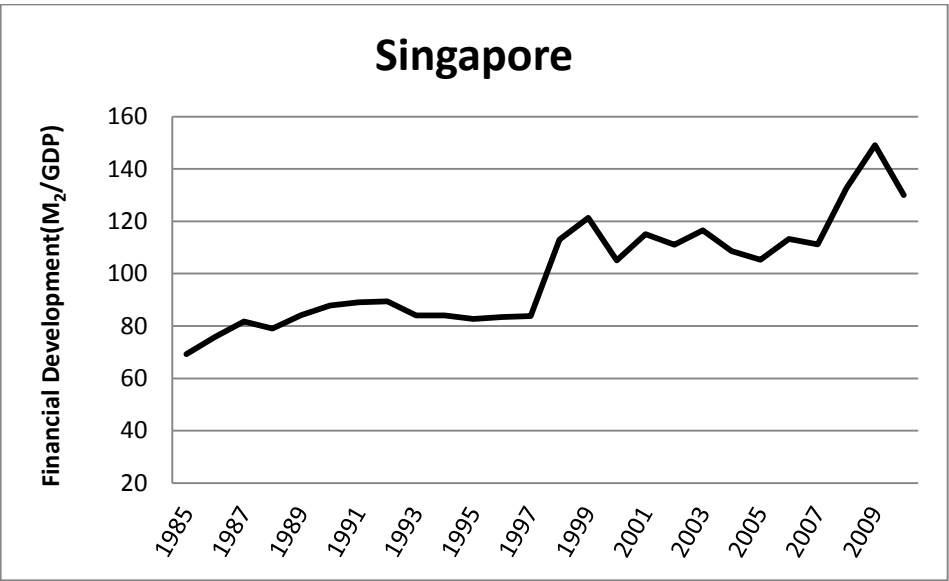


Figure 23. Financial Development in Singapore

Keeping safe the financial sector and going out of crisis successfully helped to have a steady growth in financial sector of Singapore.

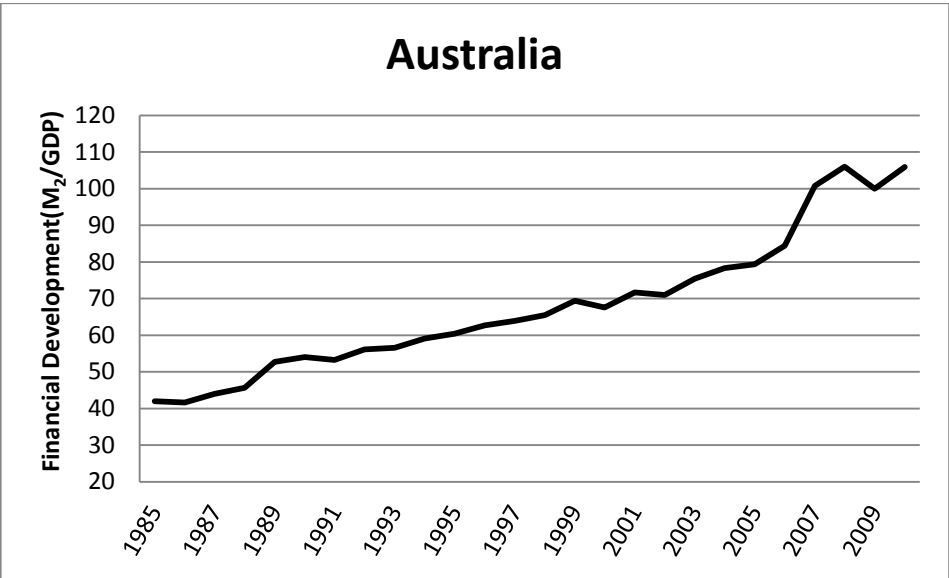


Figure 24. Financial Development in Australia

Australia has faced a smooth uptrend growth in the financial development that can be a sign how this countries has understand this factor's importance

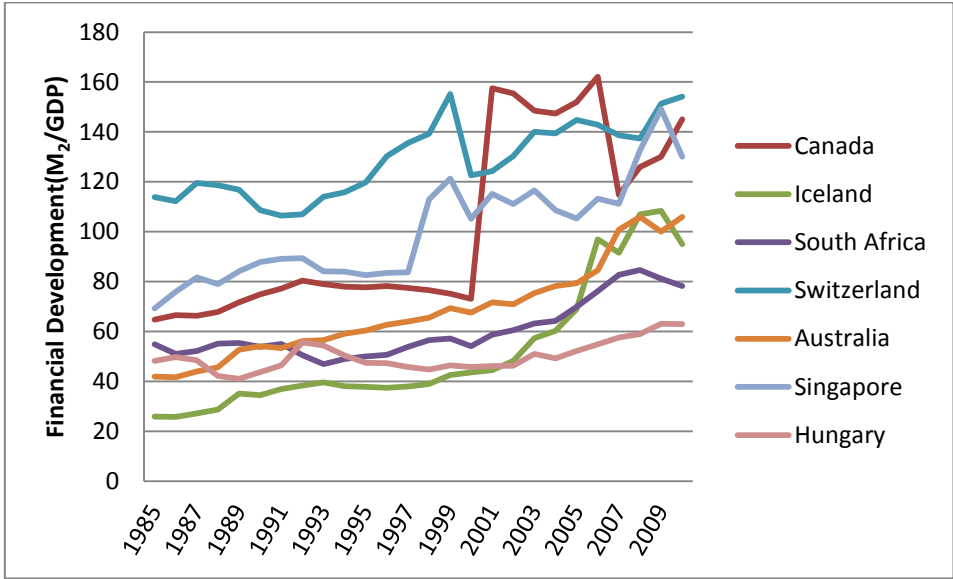


Figure 25. Financial Development in Selected Countries

As shown in figure 25 an overall image of selected countries financial development is obvious. With no exception all countries have development in their financial sector.

## 2.5 Real Gross Domestic Product

Real gross domestic product is a form of Gross domestic form which is adjusted for inflation. The GDP as per definition is the value of goods and services produced in a one given year. Real gross domestic product seems to be proportional to quantity of money demand in direct way meaning that increase in RGDP will lead to increase on amount of money people in their daily life want to hold. The below tables all the amount of GDP has been expressed in logarithmic form meaning that the amount of real GDP which was in Local currency unit has been converted to logarithm.

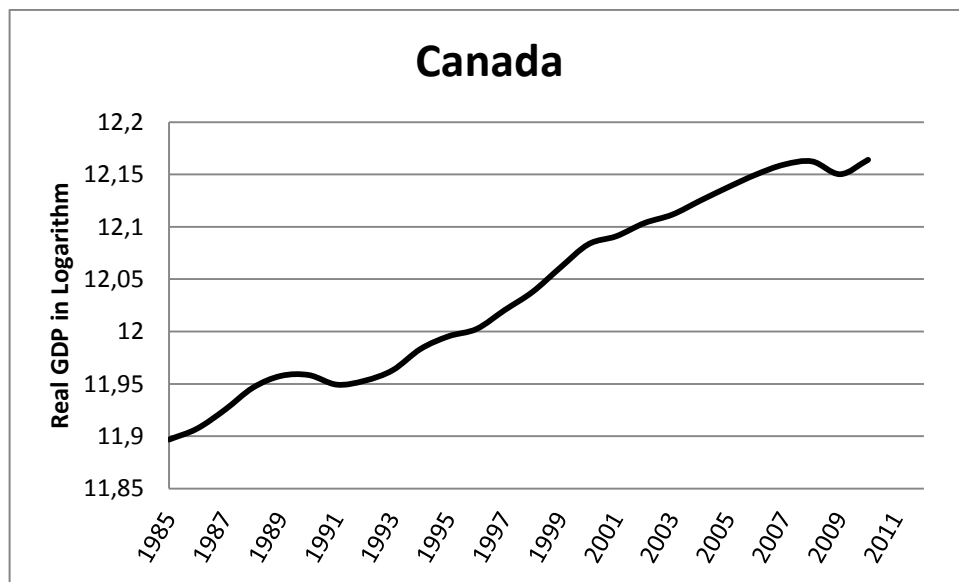


Figure 26. Real GDP in Canada

As the figure 26 shows the real GDP in Canada has increased in a steady form since 1985.

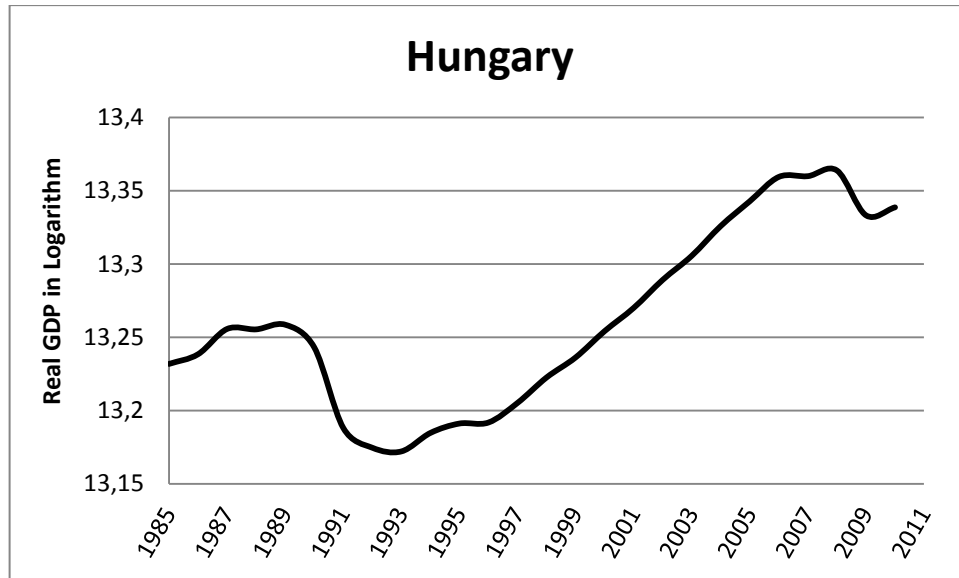


Figure 27. Real GDP in Hungary

The maximum amount of GDP occurred in 2008 resulting from Hungary join to European Union in 2004.

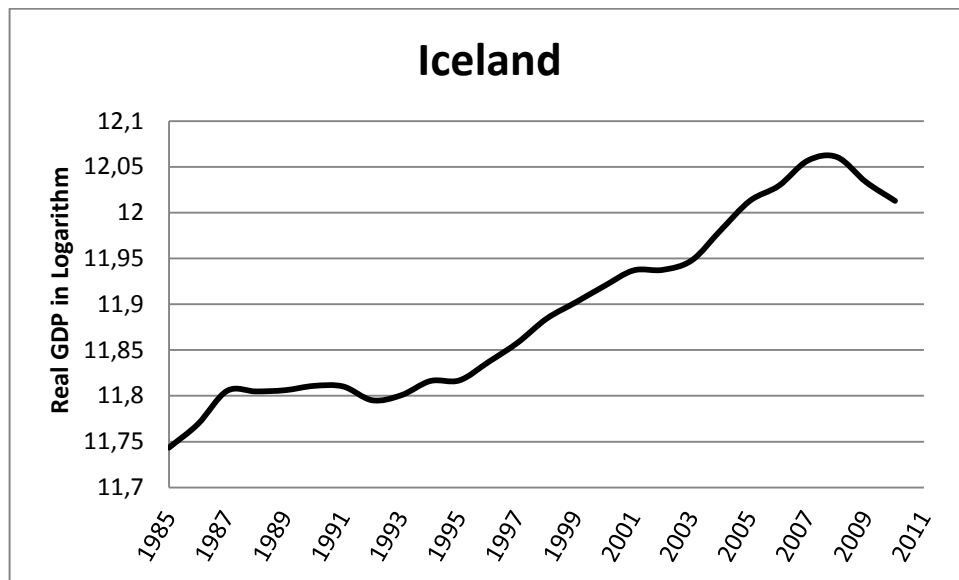


Figure 28. Real GDP in Iceland

As this figure 28 shows GDP growth rate in India has been always positive until 2009, which then faced a negative growth rate leading to decline in real GDP amount.

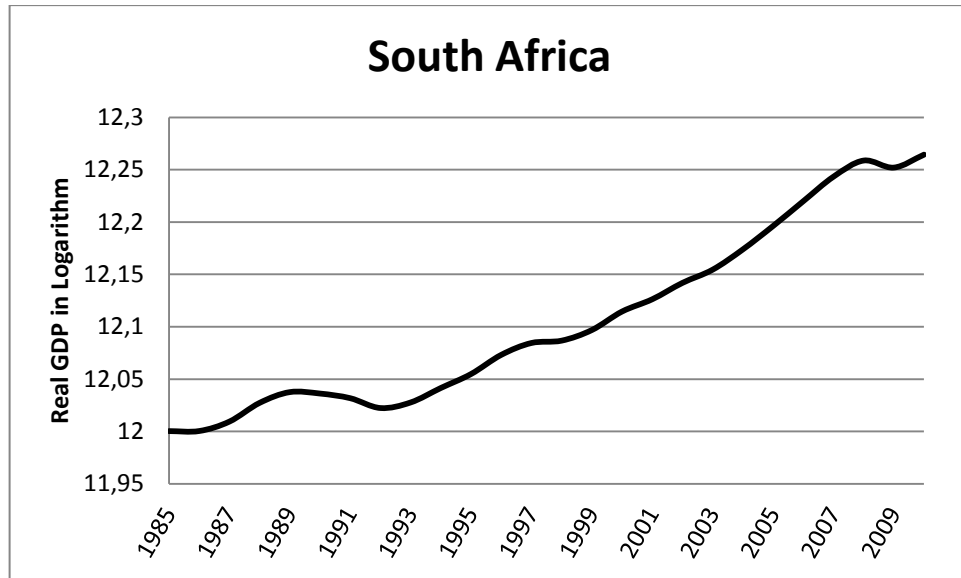


Figure 29. Real GDP in South Africa

Real GDP growth rate was always positive for South Africa as shown in figure 29 which has a smooth trend in real GDP amount.

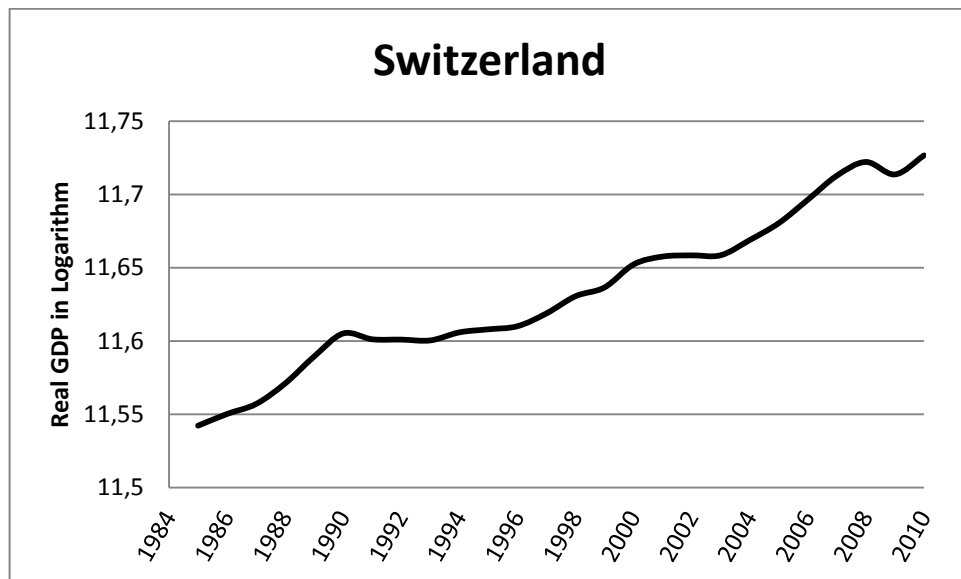


Figure 30. Real GDP in Switzerland

Real GDP in Switzerland always has been in increasing phase although it faced a minimal negative form in 2009.

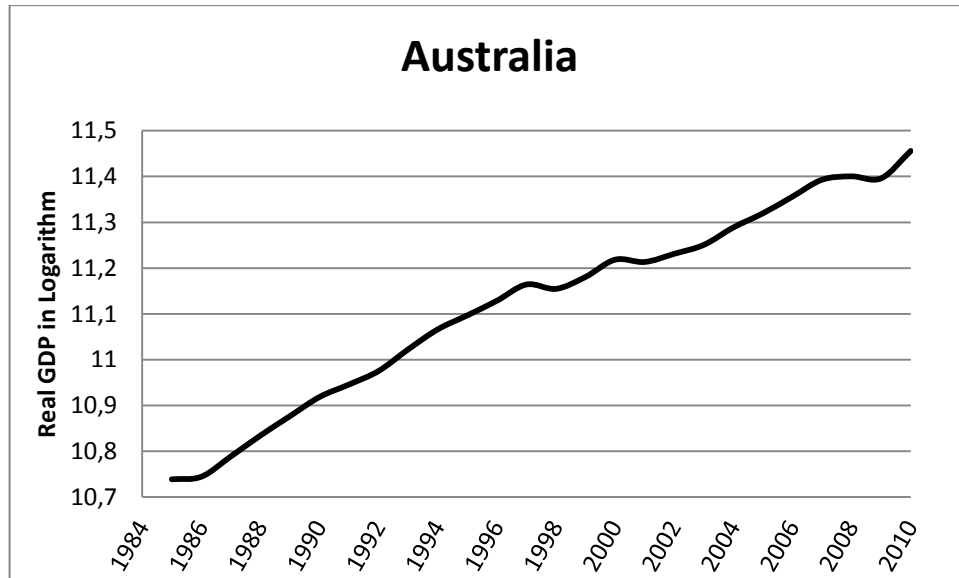


Figure 31. Real GDP Growth in Australia

In the case of Australia the countries minimal impact from the crisis has created them great opportunity to keep their pace of GDP increase in steady form as seen in Figure

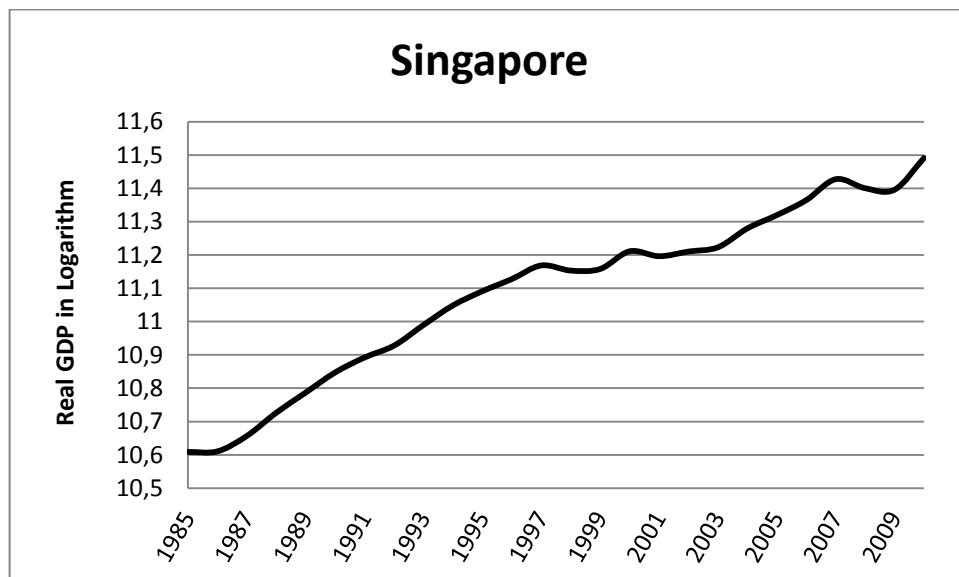


Figure 32. Real GDP in Singapore

Singapore case shows that this country between years 1997 and 2003 also between 2007 and 2009 has faced no growth in real GDP.

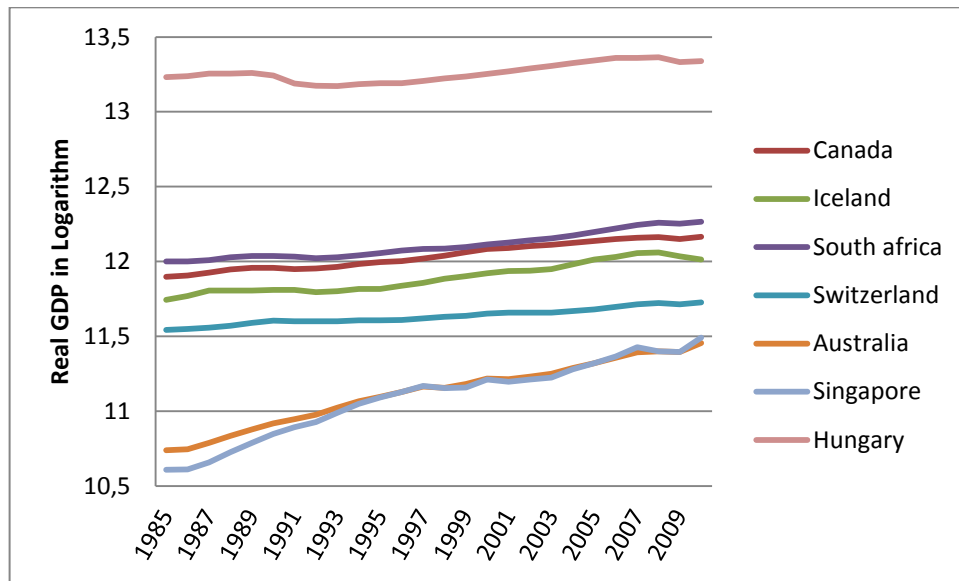


Figure 33. Real GDP in Selected Countries

All the real GDPs for different selected countries have been gathered in Figure 33 to show the upward movement of the real GDP. As it pertains all the countries have been in an increase phase since 1985.

## Chapter 3

### MODEL, DATA and METHODOLOGY

#### 3.1 Model Specification

As mentioned previously in the text there are several different theories about money demand. There are in general synchronizations, among these money demand theories which their key components are real income, wealth, permanent income or opportunity cost. For example, Kimbrough and Faig postulate following money demand:

$$\frac{M_t}{P_t} = L(Y_t, R_t) \quad L_Y > 0, L_R < 0 \quad (8)$$

In this function,  $M_t$  represent nominal money demand in period  $t$ ;  $P_t$  represents the price level for period  $t$ ;  $Y_t$  represents output level for period  $t$ ; and  $R_t$  represents the nominal interest rate in period  $t$ . The function  $L$  is supposed to be positive in  $Y_t$  and negative in  $R_t$ . Therefore, the proposed money demand function for selected countries shown in figure 1 in the form of log-level are as follow:

$$\text{Model 1:} \quad \ln\left(\frac{M_t}{P_t}\right) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 i_t \quad (9)$$

$$\text{Model 2:} \quad \ln\left(\frac{M_t}{P_t}\right) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 i_t + \ln\left(\frac{M}{P}\right)_{t-1} \quad (10)$$

Where,  $\beta_1$  in both equations (9) and (10) is the income elasticity of money demand and  $\beta_2$  in both equation is the semi-elasticity of money demand with respect to interest rate and in the positive sign is expected for income coefficient, while the



domestic interest rate coefficient is expected to be negative. Both models 1 and 2 are log level models which uses the level of interest rates. In our case we will add key variable of Financial Development (G) to the models mentioned above in order to find the relationship of development in financial sector on the amount of money demand so we come up with following models:

$$\text{Model 3:} \quad \ln\left(\frac{M_t}{P_t}\right) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 i_t + \beta_3 G \quad (11)$$

$$\text{Model 4:} \quad \ln\left(\frac{M_t}{P_t}\right) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 i_t + \beta_3 G + \ln\left(\frac{M}{P}\right)_{t-1} \quad (12)$$

### 3.2 Pooled OLS Regression Analysis

Three Types of Data Sets which are applicable in Economics are as follow:

- 1- Cross Section: This kind of data set usually allows us to examine one or more fixed number of samples once.
- 2- Time Series: The case is common practices of data which is available ; the case where we examine one or more key variables for a period of time.
- 3- Panel Data: This model has combined the two Time series and cross section. In this case key components of the same cross sectional unit are measured over time.

Panel data (Longitudinal) is a statistical method that all the observations are pooled in ordinary least square regression. The main assumption of the model is that key variables obtained including intercept are the same for all the entities.

Panel data regression can be best shown as:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \dots + \beta_{Kit} + \varepsilon_{it}$$

Where:  $i = 1, \dots, N$  and  $t = 1, \dots, N$

X represents explanatory variable

Y represents dependent variable

i represents individual index

$\varepsilon_{it}$  represents the error

$\beta$  represents coefficient

### 3.2.1 Random Effect

Random Effect assumes that individual has matchless effects on the dependent variables. In the case of Random effect for pooled regression analysis the model neglect the heterogeneity and take same coefficient for all entities and all the unfitness for individuals are summed up in error term. The case suggests that the estimation is biased since the error terms and independent variables are uncorrelated.

### 3.2.2 Fixed Effect

The fixed effect assumes a different and unique intercept value for each individual that suggest that there is heterogeneity among individuals. When using FE we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. This is the rationale behind the assumption of the correlation between entity's error term and predictor variables. FE removes the effect of those time-invariant characteristics from the predictor variables so we can assess the predictors' net effect (Oscar 2008).

### **3.3 Data**

The thesis uses annual data of 7 selected countries from 5 continents including: Canada, Iceland, South Africa, Switzerland, Australia, Singapore, and Hungary for the period of 1985 to 2010 for empirical analysis. Data include broad Money ( $M_2$ ), the consumer price index (CPI), Real GDP, the nominal interest rate, real GDP, and financial development. The source of data is World Bank. The up to date data were drawn from the website for data panel analysis. It is important to note that the nominal interest rate were obtained by adding available inflation rates to real interest rate since the website did not present the nominal interest rate as a separated data series.

## Chapter 4

### POOLED REGRESSION RESULT

In this section the regression results and their interpretations are being presented for each country. Seven Countries are included in the sample in which three European countries and four from other continents are there. Countries include: Australia, Canada, Hungary, Iceland Singapore, South Africa, and Switzerland. Multiple regressions with fixed effect have been conducted for this study. Regression estimates the money demand function which results in finding coefficients for the function for selected countries as whole. It will show the effect of interest rate and level income and furthermore financial development on quantity of real money demand.

Many studies have been conducted in order to evaluate changes in desired dependent variables over time in a form of group data. Panel data regression analyses encompass a set of procedures to produce a model about changes in outcome that happens over time. Panel data regression may happen in two main forms: The fixed effect assumes a different and unique intercept value for each individual that suggest that there is heterogeneity among individuals. Random Effect assumes that individual has matchless effects on the dependent variables. Based on statistical or theoretical consideration one of these two alternative can be applied. This thesis defines the use of panel data analysis using fixed effect. In this chapter we gathered the all data for the seven countries which include four different variables. Dependent variable is quantity of

real money demand and Independent variables includes GDP, nominal interest rate and financial development. The data time period cover 1985 to 2010. The Data were regressed using E-views to find the relation between Variables. Probability, T-Statistics and R-squared are provided by E-views for variables. T-Statistic will be used in order to find level of significances.

The E-views output would be in the form of coefficient where correlation of dependent and independent variables are generated. Positive coefficient means that independent variable effect on dependent variable is positive; increase in independent variable will result in increase in dependent variable. Negative coefficient means that independent variable effect on dependent variable is negative; increase in independent variable will result in decrease in dependent variable.

Following table shows T-value and its level of significant of estimated coefficients.

Table 3. Level of Significances

The symbols	The level
(t-value)*	Significant at 10%
(t-value)**	Significant at 5%
(t-value)***	Significant at 1%

Following abbreviations were used to make it easy to name the variables:

- LOG(GDP): Logged value of GDP(as LCU)
- INT: Nominal interest rate
- G: Financial Development.

- LOG(M<sub>2</sub>/P): logged value of real quantity of money demand

#### 4.1 Effect of GDP and INT, on Quantity of Real Money Demand

$$\text{LOG}(M_2/P) = -13.0802 + 1.3088 \text{ LGDP} - 0.0049 \text{ INT}$$

$$(-6.85)^{***} \quad (19.02)^{***} \quad (-1.19)$$

R-squared: 0.9724

Adjusted R-squared: 0.9711

S.E. Of Regression: 0.2220

Then it can be concluded that:

- Based on these regression results, a one percent rise in GDP is linked with a 1.3088 % rise in quantity of real money demand.
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Interest rate will lead to 0.49 percent decrease in quantity of real money demand
- Interest rate is Insignificant
- GDP is Significant at 1 % level.

## 4.2 Effect of GDP and INT, on Quantity of Real Money Demand

(Lagged)

$$\text{LOG}(M_2/P) = -1.1871 + 0.1227\text{LGDP} - 0.0016\text{INT} + 0.9072\text{LOG}(M_2/P)(-1)$$

(-1.49)      (1.97)\*\*      (-1.60)      (18.96) \*\*\*

R-squared: 0.9953

Adjusted R-squared: 0.9950

S.E. Of regression: 0.0917

Then it can be concluded that:

- Based on these regression results, a one percent rise in GDP is linked with a 0.1227 % rise in quantity of real money demand.
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Interest rate will lead to 0.16 percent decrease in quantity of real money demand
- Based on these regression results, a one percent increase in Quantity of real money demand of last year is associated with a 0.90725 % increase in quantity of real money demand.
- Interest rate is Insignificant
- GDP is Significant at 5 % level.
- Quantity of real money demand of last year is significant at 1% level.

### 4.3 Effect of GDP, INT, and Financial Development on Quantity of Real Money Demand

$$\text{LOG}(M2/P) = 0.5639 + 0.7739\text{LGDP} + 0.0123\text{G} - 0.0045\text{INT}$$

(0.57)      (20.85)\*\*\*      (16.23)\*\*\*      (-2.35)\*\*

R-squared: 0.9917

Adjusted R-squared: 0.9912

S.E. Of regression: 0.1223

Then it can be concluded that:

- Based on these regression results, a one percent increase in GDP is associated with a 0.7739 % increase in quantity of real money demand.
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Interest rate will lead to 0.45 percent decrease in quantity of real money demand
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Financial development will lead to 1.23 percent increase in quantity of real money demand
- Interest rate is Significant at 5% level
- GDP has 1 % Significant level.
- Financial Development represented by G has 1% significant level.



#### 4.4 Effect of GDP, INT, and Financial Development on Quantity of Real Money Demand (Lagged)

$$\text{LOG}(M_2/P) = 1.2109 + 0.2442\text{LGDP} + 0.0054G - 0.0021\text{INT} + 0.6355\text{LOG}(M_2/P)(-1)$$

(1.91)\*    (3.75)\*\*\*    ( 3.75) \*\*\*    (-2.81)\*\*\*    (7.02)\*\*\*

R-squared: 0.9970

Adjusted R-squared: 0.9968

S.E. Of regression: 0.0726

Then it can be concluded that:

- Based on these regression results, a one percent increase in GDP is associated with a 0.2442 % increase in quantity of real money demand.
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Interest rate will lead to 0.21 percent decrease in quantity of real money demand
- Therefore, holding all other independent variables constant, a unit or 1 percent increase in Financial development will lead to 0.54 percent increase in quantity of real money demand
- Based on these regression results, a one percent increase in Quantity of real money demand of last year is associated with a 0.6355 % increase in quantity of real money demand.
- Interest rate is Significant at 1% level
- GDP is Significant at 1 % level.
- Financial Development is significant at 1% level.
- Quantity of real money demand of last year is significant at 1% level.

## Chapter 5

### CONCLUSION

#### 5.1 Conclusion

The empirical analysis of real quantity of money demand for seven different developed and developing countries reveals plausible evidences regarding their economy. The evidence was obtained by conducting a fixed effect version of pooled ordinary regression analysis. The data that collected was generated by World Bank stored in its website. Time period of study was 1985 to 2010. The main key variables studied were:  $M_2$  as Broad money,  $P$  which represent price level, GDP as real gross domestic product, Nominal interest rate represented by INT and finally the financial development which was abbreviated to G. The data gathered and evaluated by E-views in a form of panel data. The desired key coefficient then regressed.

The evidence captured from the data helped us to be able to reject the entire null hypothesis showed in table 2 in first step meaning that all the coefficients found, were nonzero. As assumed, It is notable from regression that real domestic gross product has biggest impact on quantity of real money demand. Typical real income elasticity is a value between 0.7 and 1. The obtained real income elasticity of 0.77 in our study (appendix 3) indicates how close and consistent our results are. The negative sign of real interest rate coefficients implies that there is inverse relationship between quantity real money demand and nominal interest rate and this is as expected. Model 3 specified in

text best describe the key variables impact on quantity of real money demand. Another interesting result were obtained is about financial development. The regression showed that quantity of real money demand is proportional to financial development in direct way meaning that advancement in financial sector will increase quantity of money holding by people.

## **5.2 Implication**

A correctly specified money demand function is very important in the determination of the optimal way in which the central bank formulates and conducts its monetary policy. These derived empirical results from the study imply that central banks can focus on real gross domestic product, nominal interest rate and financial development for quantity of real money demand. Over all the study has created a reference that will benefit the economies by giving the policy makers a tool to assess the control of monetary policies.

One of the most useful features of the theory of money demand is that it allows us to see how changes in the quantity of real demand money affect interest rates or real GDP. The study provides a tool for policy makers to adjust for desired economic factors such as Interest rate. The benefits of the study can be seen in the case of imbalances in economies that makes equilibriums to shift. Equilibrium interest rates usually increase if there is an increase in money demand or decrease in money supply. Also equilibrium in interest rates decreases if there is decrease in money demand or increase in money supply. The provided economic key variables in this study deliver a theoretically consistent model which suggests the amount and kinds of changes needed to be done in order to reach to the equilibrium.

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## **APPENDICES**

## Appendix 1

Dependent Variable: LOG(M2/P)

Method: Panel Least Squares

Date: 04/03/13 Time: 19:48

Sample: 1985 2010

Periods included: 26

Cross-sections included: 7

Total panel (unbalanced) observations: 180

White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.08024	1.906812	-6.859744	0.0000
LOG(GDP)	1.308833	0.068784	19.02817	0.0000
INT	-0.004914	0.004096	-1.199638	0.2319

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.972391	Mean dependent var	22.65169
Adjusted R-squared	0.971099	S.D. dependent var	1.305559
S.E. of regression	0.221949	Akaike info criterion	-0.124030
Sum squared resid	8.423703	Schwarz criterion	0.035618
Log likelihood	20.16273	Hannan-Quinn criter.	-0.059300
F-statistic	752.8177	Durbin-Watson stat	0.228501
Prob(F-statistic)	0.000000		

## Appendix 2

Dependent Variable: LOG(M2/P)  
 Method: Panel Least Squares  
 Date: 04/03/13 Time: 19:46  
 Sample (adjusted): 1986 2010  
 Periods included: 25  
 Cross-sections included: 7  
 Total panel (unbalanced) observations: 173  
 White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.187135	0.791752	-1.499378	0.1357
LOG(GDP)	0.122738	0.062019	1.979021	0.0495
LOG(M2(-1)/P(-1))	0.907256	0.047837	18.96540	0.0000
INT	-0.001566	0.000974	-1.606926	0.1100

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.995257	Mean dependent var	22.67784
Adjusted R-squared	0.994995	S.D. dependent var	1.288555
S.E. of regression	0.091163	Akaike info criterion	-1.896275
Sum squared resid	1.354636	Schwarz criterion	-1.714003
Log likelihood	174.0277	Hannan-Quinn criter.	-1.822328
F-statistic	3800.072	Durbin-Watson stat	1.875987
Prob(F-statistic)	0.000000		



## Appendix 3

Dependent Variable: LOG(M2/P)  
 Method: Panel Least Squares  
 Date: 04/03/13 Time: 20:10  
 Sample: 1985 2010  
 Periods included: 26  
 Cross-sections included: 7  
 Total panel (unbalanced) observations: 180  
 White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.563900	0.976666	0.577372	0.5645
LOG(GDP)	0.773926	0.037115	20.85217	0.0000
G	0.012320	0.000759	16.23266	0.0000
INT	-0.004521	0.001920	-2.354609	0.0197

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.991664	Mean dependent var	22.65169
Adjusted R-squared	0.991223	S.D. dependent var	1.305559
S.E. of regression	0.122315	Akaike info criterion	-1.310478
Sum squared resid	2.543371	Schwarz criterion	-1.133092
Log likelihood	127.9430	Hannan-Quinn criter.	-1.238556
F-statistic	2247.021	Durbin-Watson stat	0.163312
Prob(F-statistic)	0.000000		

## Appendix 4

Dependent Variable: LOG(M2/P)  
 Method: Panel Least Squares  
 Date: 04/03/13 Time: 20:08  
 Sample (adjusted): 1986 2010  
 Periods included: 25  
 Cross-sections included: 7  
 Total panel (unbalanced) observations: 173  
 White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.210906	0.632764	1.913676	0.0574
LOG(GDP)	0.244220	0.065111	3.750828	0.0002
LOG(M2(-1)/P(-1))	0.635547	0.090445	7.026930	0.0000
G	0.005382	0.001434	3.754155	0.0002
INT	-0.002140	0.000760	-2.815840	0.0055

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.997008	Mean dependent var	22.67784
Adjusted R-squared	0.996823	S.D. dependent var	1.288555
S.E. of regression	0.072627	Akaike info criterion	-2.345492
Sum squared resid	0.854494	Schwarz criterion	-2.144994
Log likelihood	213.8851	Hannan-Quinn criter.	-2.264151
F-statistic	5398.074	Durbin-Watson stat	1.054930
Prob(F-statistic)	0.000000		