

MACRO ECONOMIC IMPLICATIONS  
OF FINANCIAL MARKET LIBERALIZATION  
IN ETHIOPIA

A THESIS

Submitted to the School of Graduate  
Studies, Addis Ababa University

In partial Fulfillment of the Requirements for the Degree of Masters of  
Science in Economic Policy Analysis

By

Menelik Solomon

June 2005



**ADDIS ABABA UNIVERSITY  
SCHOOL OF GRADUATE STUDIES**

**Macro Economic Implications of Financial Market  
Liberalization in Ethiopia**

**By  
Menelik Solomon Geremew**

Approved by the Board of Examiners:

Dr. C. Panda

Advisor

[Signature]

Signature

Dr. Syed Hasan Sayed

Examiner

[Signature]

Signature

Dr. Eyob Tesfaye

Examiner

[Signature]

Signature

## Abstract

*This study has tried to assess the practical implications of financial market development and liberalization on macroeconomic variables like saving, investment, inflation and Economic growth in Ethiopia, using a time series data covering the period 1974/75 –2003/04. The Johansen Maximum likelihood estimation procedure has been employed to see the short and long-run dynamics of selected financial variables and major macroeconomic variables.*

*To test the Mckinnon-Shaw hypothesis that removal of repressive policies and development of financial markets can enhance saving, investment and ultimately growth; the life-cycle saving model, the flexible accelerator model, Fry's inflation and Growth model were used as theoretical foundations.*

*The result indicated that saving is positively and significantly affected by the real deposit rate of interest and income growth. Domestic investment has a positive long-run equilibrium relationship with output growth whereas the real depreciation of the exchange rate and an increasing level of government debt on domestic financial system were found to affect investment negatively. Inflation was found to be non-responsive to the growth in per capita stock of money supply and income, reflecting the structural rigidity of the economy.*

*Finally, liquid liabilities of the financial system showed a significant and positive relationship with growth in per capita income whereas variables which proxy private sector credit growth were found to be insignificant in both the saving and growth functions.*

*Nevertheless, this study has certain limitations, i.e. it doesn't consider the informal and semi-formal financial markets in the analysis due to inavailability of organized data.*

## **Acknowledgement**

At this juncture, I would like to express my deepest gratitude to all those who have helped me in accomplishing this study.

My special thanks goes to my father, Solomon Geremew and my mother Haimanot Woldu who had been with me all the time morally and materially, my advisor Dr. C.Panda., Dr. Haile Kibret and Dr. Gebrehiwot Ageba for their relentless efforts in giving me their valuable comments, Daniel and Metasebia from Ethiopian Economic Association, staff of the library of the National Bank of Ethiopia for their helpful cooperation and Etagegn Teklu and Selamawit Besufekad for their efficient secretarial services.

Menelik Solomon

June 2005



| List of Tables                                                                                                           | Pages |
|--------------------------------------------------------------------------------------------------------------------------|-------|
| Table 1 Structure of Lending Rates by Sector.....                                                                        | 15    |
| Table 6.1 Results of Unit Root Tests for Order of Integration of Variables in<br>the saving function.....                | 74    |
| Table 6.2 Results of tests for cointegration among variables in the saving function.....                                 | 75    |
| Table 6.3 Test for zero restriction on $\alpha$ - coefficients in the saving function.....                               | 77    |
| Table 6.4 Test for zero restriction on $\beta$ - coefficients in the saving function.....                                | 77    |
| Table 6.5 Results of Unit Root Tests for Order of Integration of Variables in<br>the Investment Function.....            | 80    |
| Table 6.6 Results of tests for cointegration among variables in the Investment Function.....                             | 80    |
| Table 6.7 Test for zero restriction on $\alpha$ - coefficients in the Investment Function.....                           | 82    |
| Table 6.8 Test for zero restriction on $\beta$ - coefficients in the Investment Function.....                            | 82    |
| Table 6.9 Results of Unit Root Tests for Order of Integration of Variables in<br>the Investment Efficiency Function..... | 84    |
| Table 6.10 Results of tests for cointegration among variables in the Investment<br>Efficiency Function.....              | 84    |
| Table 6.11 Test for zero restriction on $\alpha$ - coefficients in the Investment<br>Efficiency Function.....            | 85    |
| Table 6.12 Test for zero restriction on $\beta$ - coefficients in the Investment<br>Efficiency Function.....             | 86    |
| Table 6.13 Results of Unit Root Tests for Order of Integration of Variables<br>in the inflation function.....            | 87    |
| Table 6.14 Results of tests for cointegration among variables in the inflation function.....                             | 87    |
| Table 6.15 Test for zero restriction on $\alpha$ - coefficients in the inflation function.....                           | 88    |
| Table 6.16 Results of Unit Root Tests for Order of Integration of Variables<br>in the Growth function.....               | 89    |
| Table 6.17 Results of tests for cointegration among variables in the Growth function.....                                | 90    |
| Table 6.18 Test for zero restriction on $\alpha$ - coefficients in the Growth function.....                              | 91    |
| Table 6.19 Test for zero restriction on $\beta$ - coefficients.....                                                      | 92    |

## List of Figures

Page

|       |                                                                                                                                                   |    |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Fig 1 | Sectoral Contribution To GDP (1980/81-1990/91).....                                                                                               | 10 |
| Fig 2 | Growth Rate of Real GDP and Per Capita Income<br>(1980/81-1990/91).....                                                                           | 11 |
| Fig 3 | Gross Domestic Saving, Gross Fixed Capital Formation<br>and Resource Gap (1980/81-1990/91).....                                                   | 12 |
| Fig 4 | Trends in Gross Domestic Saving, Fixed Capital Formation<br>and Resource Gap (1991/92-2003/04).....                                               | 20 |
| Fig 5 | Trends in Money Supply (M2), Domestic Private Sector<br>Credit (DPSC), Claims on Government (CLGOV) and<br>Foreign Assets (FA) (AS % of GDP)..... | 23 |
| Fig 6 | Liquidity Preference and the Interest Rate.....                                                                                                   | 26 |

**Chapter One****Introduction**

|                                     |   |
|-------------------------------------|---|
| 1.1 Background of the problem ..... | 1 |
| 1.2 Statement of the problem .....  | 3 |
| 1.3 objectives of the Study .....   | 5 |
| 1.4 Hypothesis of the study .....   | 6 |
| 1.5 Organization of the Paper ..... | 6 |

**Chapter Two****Overview of the Ethiopian Economy**

|                                                                                                         |    |
|---------------------------------------------------------------------------------------------------------|----|
| 2.1 Introduction.....                                                                                   | 7  |
| 2.2 Macroeconomic Performance of the Ethiopian Economy<br>during the Derg period (1974/75-1990/91)..... | 9  |
| 2.2.1 Overall performance of the Economy.....                                                           | 9  |
| 2.2.2 Trends in Saving and Investment.....                                                              | 11 |
| 2.2.3 Structure and Performance of the Financial Sector.....                                            | 13 |
| 2.3 Macroeconomic Performance of the Ethiopian Economy post<br>Derg period (1991/92-2003/04).....       | 17 |
| 2.3.1 General Macroeconomic Policy Framework.....                                                       | 17 |
| 2.3.2 Trends in Saving and Investment .....                                                             | 19 |
| 2.3.3 Structure of the financial system and Monetary Policy<br>Post Derg Period.....                    | 20 |
| 2.3.4 Monetary Aggregates .....                                                                         | 22 |

**Chapter Three****Literature Review**

|                                                                              |    |
|------------------------------------------------------------------------------|----|
| 3.1 Theoretical Literature .....                                             | 24 |
| 3.1.1 Introduction.....                                                      | 24 |
| 3.1.2 Financial Development Models in the Keynesian School.....              | 25 |
| 3.1.3 The Mckinnon-Shaw Financial Development Framework.....                 | 28 |
| 3.1.4 Critics of Financial Liberalization<br>a) Neostructuralists .....      | 32 |
| b) Market Failures and Information Asymmetries in Financial<br>Markets ..... | 34 |

|                                                        |    |
|--------------------------------------------------------|----|
| 3.2 Empirical Literature                               |    |
| 3.2.1 Introduction.....                                | 38 |
| 3.2.2 The Impact of Financial Variables on Saving..... | 39 |
| 3.2.3 Financial Variables and Investment Ratios.....   | 42 |
| 3.2.4 Financial Conditions and Economic Growth.....    | 45 |

## **Chapter Four**

### **Methodology**

|                                                                    |    |
|--------------------------------------------------------------------|----|
| 4.1 Model Specification .....                                      | 47 |
| 4.1.1 The Saving Function.....                                     | 47 |
| 4.1.2 The Investment Function                                      |    |
| a) Effect of Financial Conditions on the Volume of Investment..... | 51 |
| b) Efficiency of Investment.....                                   | 55 |
| 4.1.3 Inflation.....                                               | 57 |
| 4.1.4 Economic Growth and Financial Variables.....                 | 61 |

## **Chapter Five**

### **Data Description and Estimation Procedure**

|                                  |    |
|----------------------------------|----|
| 5.1 Type and Source of Data..... | 63 |
| 5.2 Estimation Procedure.....    | 63 |

## **Chapter Six**

### **Estimation Results and Discussion**

|                                                                      |    |
|----------------------------------------------------------------------|----|
| 6.1 The Saving Function.....                                         | 73 |
| 6.2 The Investment Function.....                                     | 79 |
| 6.2.1 Effects of Financial Conditions on the volume of Investment... | 79 |
| 6.2.2 Efficiency of Investment.....                                  | 83 |
| 6.3 Inflation.....                                                   | 87 |
| 6.4 Economic Growth.....                                             | 89 |

## **Chapter Seven**

### **Conclusion, Policy Implications and Recommendations.....**

|                         |           |
|-------------------------|-----------|
| <b>References .....</b> | <b>97</b> |
|-------------------------|-----------|

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the problem

Historically the first modern bank – Bank of Abyssinia was set up in Ethiopia in 1905. The first insurance company (Istituto Nazionale per L'Assocurazione Contro gli infortuni sul larvaro) was established in 1922. However it was after the 1960's that a rapid and stable financial development took place. In the period between 1960 – 1974, privately – owned banks were operating alongside the commercial bank of Ethiopia which was state owned, branches of foreign banks (Banco di Roma, Banco di Napoli) and the Addis Ababa Bank (with foreign equity participation) were in operation.

Apart from commercial banks, there were specialized financial institutions (Ethiopian Investment Corporation, Imperial Savings and Home Ownership Public Association and Savings and Mortgage Corporation of Ethiopia) established to provide development and mortgage finance.

During the period between 1974-1991, the Ethiopian economy was oriented by the socialist doctrine. Private capital accumulation and investment was officially banned, market rule was over-ridden and a centrally planned, command economy was set up. Accordingly, a state – owned mono bank system, where all banks acted, in effect, as branches of the central bank, was established; “financing the plan” was set as the over -riding mission of banks and foreign participation in the financial sector was prohibited. Consequently the financial sector was characterized by a high degree of financial repression that resulted in credit rationing other than the interest rate, while an informal market develops at uncontrolled rates. Regulations

2006  
2997  
⑨:⑥

on the foreign exchange market and the highly overvalued exchange rate has led to the development of the parallel market widening the premium.

The fragmentation of the credit market has resulted in favored borrowers obtaining funds at subsidized often highly negative, real interest rates, while others must seek credit in inefficient, expensive informal markets. Due to the misguided “financing the plan” doctrine of the government in the banks, mostly inefficient and politically prioritized sectors and enterprises were major borrowers of the formal financial sector which led to accumulation of non-performing loans in the banks balance sheets.

In the period post 1991, Ethiopia has adopted economic reform programs contained in the Structural Adjustment Programme (SAPs) framework of the International Monetary Fund (IMF). The policy prescriptions in SAPs include removal of price controls, devaluations of the birr and subsequent determination of the exchange rate through the auction system, gradual liberalization of interest rates, opening up of the financial sector for private participation, privatization of state – owned enterprises and provision of foreign currency through the auction system. (See the detailed reform measures taken in chapter two)

Despite the above measures, recent monetary aggregates for Ethiopia indicate that currently the financial sector in the country is characterized by a high degree of monopoly and state intervention (the share of Commercial Bank of Ethiopia from total outstanding credit is 67.45% and the share of public banks including Development bank of Ethiopia and construction and business bank from total outstanding credit is 87.15 % by 2001/02) The no. of private banks established since 1991 is 6 with a total capital of 535 million Ethiopian birr by 2001/02 which accounts only for 21.2% of the total banking sector capital in the country. When we look at the spatial distribution of private banks in the country, from the total no of 97 private bank branches, 52 of them are found in Addis Ababa and 45 of them are in the regions. There are eight private insurance companies currently operating

in the country with a branching network of 35 in Addis Ababa and 40 in the regions. There are no foreign banks or insurance companies in the Ethiopian financial sector. No secondary markets exist. The poor intermediation capacity of the financial sector can be exemplified by the stagnating and declining growth of (gross domestic saving/GDP) ratio which had declined from 5-7.8 percent from the period 1993/94-1997/98 to 2.5 percent by 2002/03<sup>1</sup>.

## **1.2 Statement of the Problem**

Financial market liberalization and its contributions to economic growth in developing countries is still an unresolved, debatable issue among economists nowadays. At present, there seems to be no clear consensus on the effects that allowing interest rates to be market determined (or raising them to positive real levels) or reducing reserve requirements or eliminating the spread between the exchange rates in the official and parallel markets – policies that are central in financial reform packages – would have on the economy.

Basically there are two schools of thought who argue for and against the implications of financial market liberalization in the development process of developing countries. The McKinnon – Shaw School which comprises prominent economists (McKinnon (1973, 1991), Shaw (1973), Fry (1988, 1995), Mathieson (1983), Kapur (1992) and others) argue that financial repression which consists of various measures, such as interest rate ceilings, high reserve requirements, and directed credit policies,

---

<sup>1</sup>All %age calculations are my own based on statistical figures from the Annual Report of The National Bank of Ethiopia (2001/02)



that impose discriminatory taxes on financial intermediation reduce the incentive to hold money and other financial assets, and so reduce the overall availability of loanable funds to investors. Not only may the credit shortage encourage more low yielding self- financed investment, but low subsidized interest rates to priority borrowers may also reduce the average return on credit – financed investment. Hence they conclude that financial liberalization can increase economic growth by increasing investment and its productivity.

On the other hand Neostructuralists represented by Buffie (1984), Khosaka (1984), Taylor (1983), and van Wijnbergen (1983) predict the opposite effects of financial liberalization. In the neostructuralist models, the nominal interest rate, which is determined in the curb or noninstitutional credit market, adjusts to equate demand for and supply of money and credit. Income adjusts to equilibrate demand and supply in the goods market.

Hoff and Stiglitz (1990) advance an explanation based on imperfect information on credit worthiness and differences in the costs of screening, monitoring and contract enforcement across lenders. In the presence of imperfect information and costly contract enforcement, market failures result from adverse selection<sup>2</sup> and moral hazard<sup>3</sup>, which undermine the operation of financial markets, through interest rates that affect the risk composition of financial portfolios.

---

<sup>2</sup>Adverse selection–occurs when some borrowers are excluded from the credit market, despite the fact that they could profitably borrow if creditors knew their characters. The good quality borrowers with access to relatively safe projects, are rationed out of the credit market

<sup>3</sup>Moral Hazard is an adverse incentive problem that occurs after the loan has been extended. In this case individuals do not have the same incentive to look after other people's property as they look after their own. The term originated in the insurance literature to describe the reduced diligence people take in caring for their own property after it has been insured. In the case of borrowing, borrowers have less incentive to look after borrowed money than they have to look after their own money. Fry (1995)



Concerned about greater risk, lenders may resort to non-price rationing rather than raise interest rates when forced with excess demand for credit. As a result, credit rationing may characterize market equilibrium even in the absence of interest rate ceilings and direct allocation. Liberalized markets do not necessarily ensure pareto-efficient allocation (stiglitz, 1994).

Nevertheless, many developing countries including Ethiopia have undergone reform programs in their financial sectors guided by the policy prescriptions from the IMF and World Bank. Hence it would be worth to ask; *Are the liberalization steps so far taken adequate enough to mobilize saving, enhance investment and achieve the desired growth rate in the economy? Is the sequencing of policy reform on the right track? And what are the impacts of these reform measures on the macroeconomic variables of this country?*

## **1.2 Objectives of the study**

- To identify major variables that could play an important role for “successful financial market liberalization” in Ethiopia.
- To analyze the impact of financial market development and liberalization on saving, investment, domestic inflation and economic growth in Ethiopia.
- To assess the pace of financial market liberalization in Ethiopia in the past fourteen years and inform policy makers about possible corrective measures to be undertaken in the future.
- To provoke further research on the area of financial market development and growth in Ethiopia.

#### **1.4 Hypothesis of the study**

This study based on the pioneering works of Mckinnon (1973) and Shaw (1973) hypothesizes that removal of repressive policies and minimization of government intervention in the financial sector would lead to financial deepening, better capability of the formal financial sector in mobilizing saving, higher domestic investment and higher growth of the economy; for given improved institutional capacity, prudential regulation system, an independent central bank and stable macroeconomic and political environment in Ethiopia.

---

#### **1.5 Organization of the Paper**

Hereafter the paper continues as follows. Chapter two briefly discusses macroeconomic performance of the Ethiopian economy during the Derg and post Derg period; chapter three reviews the available theoretical and empirical literature on financial development/liberalization and its impacts on saving, investment and economic growth; chapter four presents the specific theoretical and empirical models and the different variables incorporated in the different models; Chapter five and six elaborate on the estimation procedure and the estimation results respectively; and chapter seven concludes and gives some policy recommendations.

## **CHAPTER TWO**

### **Overview of the Ethiopian Economy**

#### **2.1 Introduction**

In the past three decades the structure of the Ethiopian economy has not changed much. The fact that 85% of the population has been engaged in a technologically backward rain fed agriculture that has been providing a decreasing income for the farming population for at least the past four decades is a clear manifestation of its structural rigidity and its unbalanced sectoral composition.(EEA, 2003/04) Currently with a total population of 69 million, Ethiopia is the second most populous country in Sub-Saharan Africa, next to Nigeria. In purchasing power parity dollars (PPP) terms, Ethiopia ranked 202<sup>nd</sup> out of 207 countries in the most recent world development report.<sup>4</sup>

During the Derg period the average growth of real GDP was 1.9% which ranged between the highest growth registered in 1986/87 (14%) and the lowest in 1984/85 (-9.7%). This average real growth in GDP when compared with an average population growth of 3% led to a net decline in per capita income of 1.2% per year.<sup>5</sup> In this period the economy was guided by the economic principles of the socialist doctrine and the government was the major playmaker in every sector of the economy. With the rapidly growing population, a stagnantly growing agricultural sector (on average it grew by mere 2%) which accounted for 52.9% of GDP, recurrent droughts and continuous war in the northern part of the country, Ethiopia was a terrible place to live on the planet earth.

---

<sup>4</sup> World Development Report, 2003, pp 234-235

<sup>5</sup> Source: The Ethiopian Economic Association (EEA) Annual Report on the Ethiopian Economy, Vol I, 1999/2000

After the down fall of the derg regime in 1991, EPRDF (Ethiopian Peoples Revolutionary Democratic Front) took power and the Transitional Government of Ethiopia (TGE) was set up. With the new government different policy reform measures (which will be assessed later on) were undertaken in different sectors of the economy. The socialist led economic policy of the derg was replaced by a “market led” economic principle (though the definition of market led is governed by the broader EPRDF’s concept of “Revolutionary Democracy” which advocates a certain level of government intervention in the economy as opposed to the classical economic theory of free market economy).

During the period between 1991/92-2002/03, the average growth rate of real GDP was 4.5%. The structure of the economy changed very little in this period with agriculture contributing 47.8%, industry 10.8% and the service sector 41.4% of GDP. According to the latest report of the Ethiopian Economic Association (EEA) (2003/04), the per capita income growth for the past forty two years in Ethiopia is a little less than zero. That is, the current living standard of the population is almost the same as what it used to be forty years ago. The 1.6% growth in per capita income that has been recorded since 1991 has yet to fully offset the about 1% per annum decline registered between 1974 and 1991 and its compounded effects.

With these highlights on the Ethiopian economy for the past three decades, this section continues as follows: Section 2.2 assesses the macroeconomic performance of the Ethiopian economy during the derg period taking into account trends in saving and investment and structure and performance of the financial sector. Section 2.3 also assesses the macroeconomic performance of the country post-derg period looking into trends in saving and investment, structure and performance of the financial sector and monetary aggregates. (N.B unless otherwise stated, all percentage figures in subsequent sections of this chapter are derived from the raw time series data used for the empirical analysis in this study.)

## **2.2 Macroeconomic Performance of the Ethiopian Economy**

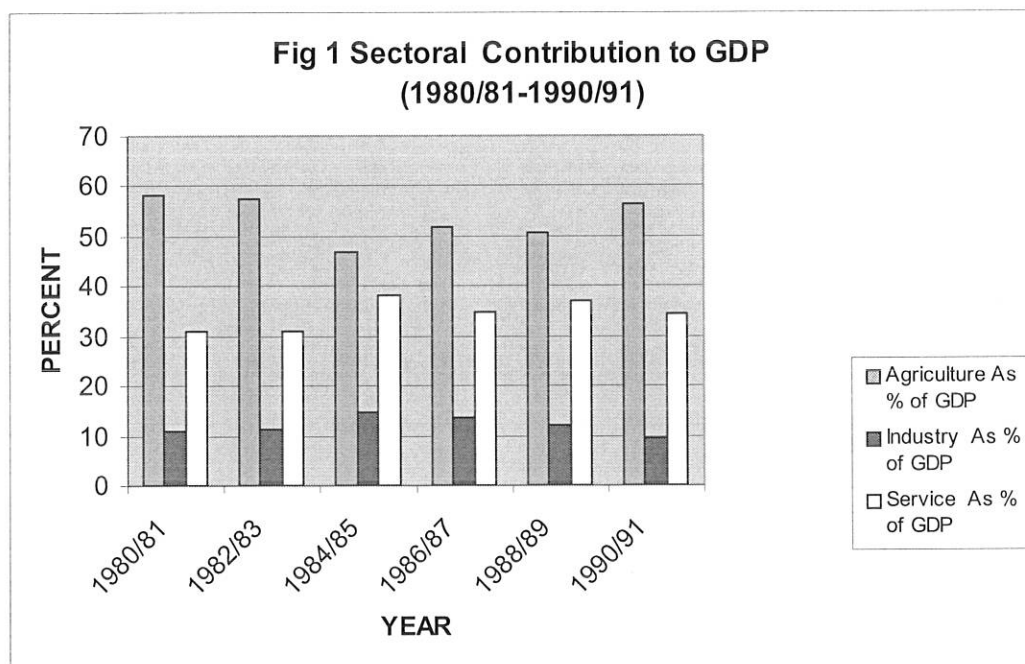
### **During the Derg period (1974/75-1990/91)**

#### **2.2.1 Overall Performance of the Economy**

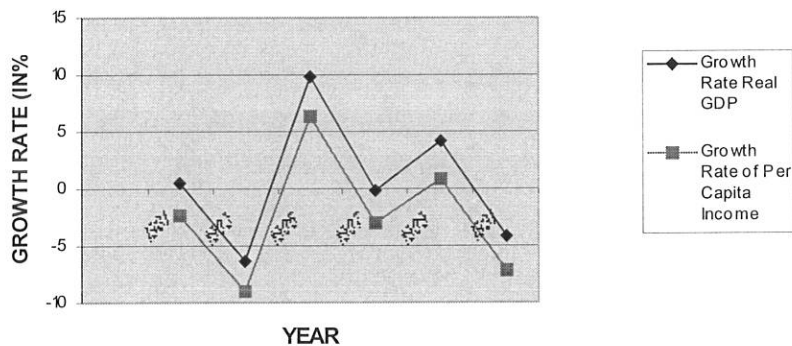
After throwing down the Haileselassie government in 1974, derg declared “Hiberetesebawinet” (Ethiopian Socialism) which meant “equality, self reliance, the dignity of the labor, the supremacy of the common good and the indivisibility Ethiopian unity.” as the guiding ideology. Successive proclamations and decrees proved that the government was the owner and decision maker of productive resources in the country. It delineated sectors and activities/areas reserved for the state, those for joint state-private capital participation/co-operation, and those left to the private sector; major machineries of the economy like the financial sector, heavy industries, large-scale business and commercial farms were in the hands of the government. To fulfill the envisaged plan of the state a swift wave of nationalization followed. Starting from rural and urban lands and extra houses to banks and insurance companies were brought under the control of government. Limits on private investment capital ranging from Br 200,000 (US\$ 96,000) for retail establishments to Br 500,000 (raised to Br 1 million in 1985) for industry. It prohibited pooling together of capital through partnership or company (with the exception of general partnerships, which should not exceed 5 persons) .the number of licenses (or business activities) was limited to one per individual and with no branches and individuals with a permanent job or any other source of income were prohibited from getting a license.

The overall effect of these misguided policies was manifested through: a decline in per capita income 1.2 % per year, which can be disaggregated into a real GDP growth of 1.9% per year and population growth rate of 3% year, very little change in the structure of the economy (by 1980/81-the share of agriculture, industry and service sectors to the GDP respectively were 58.1, 10.9 and 31percentage points and by 1990/91-the terminating point of the

Derg era- the share of these sectors to the GDP were 56.3, 9.4 and 34.3 percentages respectively), a growing external debt to GDP ratio which was 25.6% in 1981/82 grew to 39.1% by 1990/91, highly repressed financial sector resulting in poor intermediary capacity of financial institutions (Gross Domestic –Saving/GDS/ to GDP and Gross Fixed Capital Formation to GDP on average from 1980/81 to 1990/91 were 7.2% and 14.3 % respectively implying a resource gap of -7.1%). Generally this dismal performance was reflected in almost all sectors of the economy, but to critically observe the performance of the economy, let us now turn to the trends in the major macroeconomic variables and sectors, which are the focus of this paper.



**Fig 2 GROWTH RATE OF REAL GDP & P.CAPITA INCOME(1980/81-1990/91)**



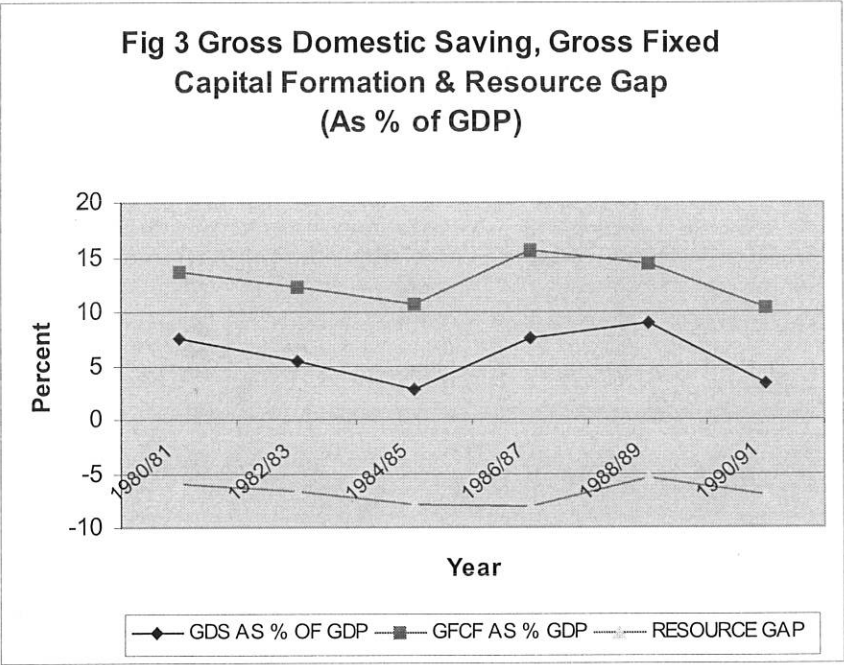
### 2.2.2 Trends in Saving and Investment

As it is clear from the theory of economics, growth is a function of the incremental output –capital ratio or investment which is again a function of the financial resources a country can mobilize or the amount of domestic saving. Therefore we have a chain of relationship between saving, investment and growth.

The fact that the Derg completely monopolized the financial sector, nationalized all “excess” private capital and put ceilings on private investment had given rise to mistrust of the government (loss of confidence on the business environment). The hostile policies and decrees towards the private sector had even led to misconduct in the business circle. Gebrehiwot (1997) emphasizes that the hostile government attitude towards the private sector remained a major obstacle to private investment and development. He also asserts that the limits on single borrower loans (which were just Br 500,000) in the case of AIDB/Agricultural & Industrial Development Bank/and Br 1 million in the case of CBE/Commercial Bank of Ethiopia/ which were intended to limit large exposures by banks, lack of access by the private sector to trained manpower, unfavorable progressive business income tax; the marginal tax rates for unincorporated business incomes and

profits were 82% in industry and 89% in agriculture, and were applicable to annual incomes above Br. 36,000, constituted major constraints for the development of private investment.

The unresting situation in saving and investment during the Derg period can be seen from GDS as a percent of GDP which was decent and reasonably steady overtime reaching 13% in the last years of the imperial regime showed a tremendous fluctuation in the Derg period ranging from a high of 12.5 % in 1987/88 and low of 3.4% in the last year. On average GDS was 7.2% over the last ten years of the regime. Gross Fixed Capital Formation/GFCF/ as percent of GDP averaged about 14.2% per annum during the ten years reaching a peak of 20.4% percent in 1987/88 and dropping to about half that level in the last year.





### 2.2.3 Structure & Performance of the Financial Sector

Derg nationalized private commercial banks, specialized financial institutions and insurance companies on January 1, 1975. The Addis Ababa bank, Banco di Roma (Ethiopia) and Banco di Napoli (Ethiopia), which were formerly private banks were merged into one bank known as Addis Bank. On July 1, 1980 Addis Bank and Commercial Bank of Ethiopia were merged to create a single commercial bank, which was named the Commercial Bank of Ethiopia (CBE)<sup>6</sup>. The Savings and Mortgage Corporation and the Imperial and the Imperial Savings and Home Ownership Public Association were also merged into a new housing and Savings Bank (HSB). The Agricultural and Industrial Development Bank (AIDB) continued as the government's principal agent for extending medium and longer term-credit.

Both CBE and AIDB were engaged in medium and short-term finance to the agricultural and industrial sectors. The HSB specialized in mortgage loans, but CBE was also extending such loans as well, which shows the existence of overlapping. Moreover CBE's large branch network also made to serve as an agent for the specialized banks in the different parts of the country. (EEA, 1999/00)

In January 1975, thirteen private insurance companies were nationalized and amalgamated to create the Ethiopian Insurance Corporation (EIC). According to proclamation no. 99/1976, the National Bank of Ethiopia (NBE)<sup>7</sup>, the country's central bank had the power to formulate and implement monetary and credit policies of the country. This proclamation also allowed the bank to exercise exchange controls, allocate foreign exchange and determine interest rate administratively. In addition, the NBE,

---

<sup>6</sup> CBE was created in 1963 as a result of the division of the state bank of Ethiopia, which was discharging both central bank and commercial bank functions since its establishment in 1942.(proc. No. 207/1963)

<sup>7</sup> The National Bank of Ethiopia was created in 1963 to do central banking functions (proc no. 207/1963)

had the power to “.....control the operations of banks and other financial institutions” and to “.....direct banks and other financial institutions to deny credit allocations to enterprises...” remarking the existence of financial repression in its severe form in the financial sector.

The financial system was characterized by segmentation and public monopoly in which case financial institutions having specialized functions; specialization not based on efficiency in risk and transaction cost considerations: individual institutions were operating in specific businesses allocated to them, each enjoying a monopoly in its own segment. (Gebrehiwot, 1997)

AIDB specialized in development loans by raising funds only through (both foreign and domestic) borrowing and time deposits. HSB had monopolized the loan business for housing development and construction industries. It was authorized to mobilize funds through time and savings deposits but not current accounts (proc no. 60/1975). It was also specified by the central bank that time and savings deposits of government-owned undertakings (i.e public enterprises and state farms) shall be maintained only with the AIDB or HSB, while saving deposits shall be maintained only with the HSB or CBE. Neither AIDB nor HSB provided other banking services such as overdrafts, remittance transfers, safe keeping and exchanges import and export to the general public. During this time, the only formal contractual saving institutions, specialized in insurance and pensions, were the EIC and the Pension social Security Authority (PSSA) but in addition to this the informal financial institutions such as *Eqqub* and *Idir* were also in existence.

### **Credit Allocation and Structure of Interest Rates**

The financial sector during the Derg period was geared to fulfill the finance needs of the socialized sector (i.e public enterprises, state farms and cooperatives) credit from banks was administratively allocated. The outright control and ownership of the banking sector had given the opportunity for

the government to differentially give access and deny loans to different sectors of the economy. In proclamation no. 99/1976, the government emphasized that "...it has become necessary to establish a wider base for growth by recognizing, coordinating, controlling and centralizing the banking system in order to assure a more rational and effective allocation of resources and banking services with due regard to the country's social and economic needs and in keeping with the broad objectives of the national plan." Hence interest rates on loans to different economic and social sectors were administratively fixed (see table1), reflecting the priorities and the ideological intent of the government as opposed to economic reasons.

**Table 1 Structure of Lending Rates by Sector**

|                                                     | Through June<br>30,1986 | As of July 1, 1986 |       |         |
|-----------------------------------------------------|-------------------------|--------------------|-------|---------|
|                                                     |                         | Cooper...          | State | Private |
| <u>Lending Rates</u> (by CBE and specialized banks) |                         |                    |       |         |
| <b>Sector</b>                                       |                         |                    |       |         |
| Agriculture                                         | 9-10.5                  | 5                  | 6     | 7       |
| Industry, mining, power and water resources         | 9.5                     | 6                  | 8     | 9       |
| Domestic trade                                      | 9.5                     | 6                  | 8     | 9.5     |
| Transport and communications                        | 9.5                     | 6                  | 8     | 8       |
| Export trade                                        | 8.5                     | 6                  | 6     | 6       |
| Import trade (agricultural inputs)                  | 9.5                     | 5                  | 6     | 7       |
| Import trade (other)                                | 9.5                     | 6                  | 8     | 9.5     |
| Hotel and tourism                                   | 9.5                     | 6                  | 8     | 9       |
| Construction                                        | 9.5                     | 6                  | 8     | 9       |
| Housing (1) purchase                                | 10                      | 6                  | 6     | 8       |
| (2) Construction                                    | 9                       | 4.5                | 4.5   | 7       |
| Central Government                                  | 3-5                     | --                 | 3-5   | --      |
| Banks and financial institutions                    | 5-6.5                   | --                 | 2.5-4 | --      |
| Personal loans                                      | 10                      | --                 | --    | 10      |

Source: The National Bank of Ethiopia, Annual Reports

Interest rates on deposits were administratively set depending on the type of depositor and maturity time, which ranged between 1-7.5%.

The minimum period required for time deposits to earn interest rates was 1 year. Saving deposits earn interest based on the amount of money saved. Saving deposits up to br. 100,000 earn 6% per annum while deposits above this were earning 2%, the exact opposite of the structure commonly found in market oriented economies. The government also specified the types of instruments each financial institution could issue, hence public and private enterprises as well as individuals can hold, thereby severely limiting the ability to diversify portfolio and manage funds. (Gebrehiwot, 1997). The earning financial instruments available to the public were restricted to savings and time deposits only. The use of credit instrument such as overdraft facility was discouraged. In addition to these, high reserve and liquidity ratio requirements and exchange controls were in place.

Due to “directed credit” and “financing the plan” policies of the government private sector crowding out was significantly high. During the period 1974/75-1991/92 the average share of CBE credit extended to public enterprises in total credit to non-government sector was 63.6%, 35.5% to the private sector and 0.9% for cooperatives. Gebrehiwot (1997) however notes that the observed low share of the private sector partly could have resulted from lack of private sector demand; the various restrictions the sector faced translated into limited demand for investment and consequently for credit, by the private sector.

In addition to being price-discriminated through the interest rate schedule, the private sector also faced other hurdles in accessing bank credit. The lengthy process for approval of loans which emanated from lack of trained personnel and corrupted bureaucracy in the banking system and the requirement of insuring assets both of which increase the effective cost of borrowing and the single borrower limits imposed on AIDB and CBE loans can be cited as the major factors contributing to the limited bank finance extended to the private sector.

In general a high degree of repression and monopoly, poor intermediation capacity, absence of secondary markets and segmentation characterized the Ethiopian financial system during the Derg period.

## **2.3 Macro Economic Performance of the Ethiopian Economy Post Derg period (1991/92-2004)**

### **2.3.1 General Macro-Economic Policy Framework**

We can broadly classify EPRDF's policy items into four. The first one is the government's strategy, known as Agriculture Development Led Industrialization (ADLI) policy. The essence of this strategy rests in the belief that the agricultural sector can serve as the driving force for the rest of the economy. The strategy hopes to increase the level of productivity in agriculture via the introduction of modern agricultural techniques and a supply of agricultural technology ranging from fertilizers and improved seeds to comprehensive extension services. The increase in income of the rural population following the increase in productivity has more than egalitarian benefits. Higher incomes imply higher savings that can then be harnessed for investment in other sectors. Demand for industrial goods, particularly consumer goods and agricultural inputs, will also grow as a result of rising living standard of the rural population. Surplus agricultural output also benefits industry by making relatively cheap raw materials available for industrial processing. The fact that agriculture is at such a low level of development in Ethiopia also meant that small improvements in agricultural techniques, requiring relatively small capital outlay, have a potential to increase output significantly. In other words, the capital output ratio in agriculture is so low that it is much cheaper strategy to increase economic growth compared with other strategies. All these advantages, the government believe makes the strategy suitable for Ethiopian conditions.

The second policy item is based on the role of government in the economy. The current government believes that massive government intervention in the economy ranging from actually producing goods and services that the private sector finds unprofitable, protecting local industries when necessary, providing subsidies, or even segregating certain areas of production to the state sector or to the local private sector, can enhance the performance of the economy.

The third belief regarding the urban economy sees the urban economy directly benefiting from the main strategy of ADLI. It emphasizes that the key role of the state in the cities is to be a supplier of adequate social and physical infrastructure, which is expected to encourage the private sector to do productive investment in the cities and generate employment; lack of which is considered the most important problem of the cities.

Finally, the fourth, core thinking strongly believes in achieving some kind of regional balance as a key objective of its overall policy.

Around these core beliefs one finds detailed policy pronouncements on a range of issues. According to the government's policy framework paper for 1996/97-1998/99, in the area of fiscal policy, the government wishes to improve tax base on the revenue side and reduce expenditure to less than that of nominal GDP and improve expenditure efficiency. It also hopes to minimize government crowding out of the private sector by minimizing government borrowing from domestic sources. In the area of monetary and credit policy, the government tries to ensure growth of monetary aggregates consistent with targets for inflation and economic growth. It plans to create an environment to establish a modern competitive financial system. It also plans to increase private investment by taking measures to encourage the private sector by speeding up privatization, improving the investment code, institutionalizing a regular dialogue between the private sector and ensure the adequate supply of urban land for investment purposes. (See the details

of these and other numerous policy objective and measures agreed upon by the government and its donors in the policy framework paper prepared for the consultative group meeting of December 10-12, 1996, Addis Ababa).

Given the above policy measures, how does the economy in Ethiopia perform in the past fourteen years? In subsequent sections we will see major trends in the macroeconomic variables since 1991/92 onwards.

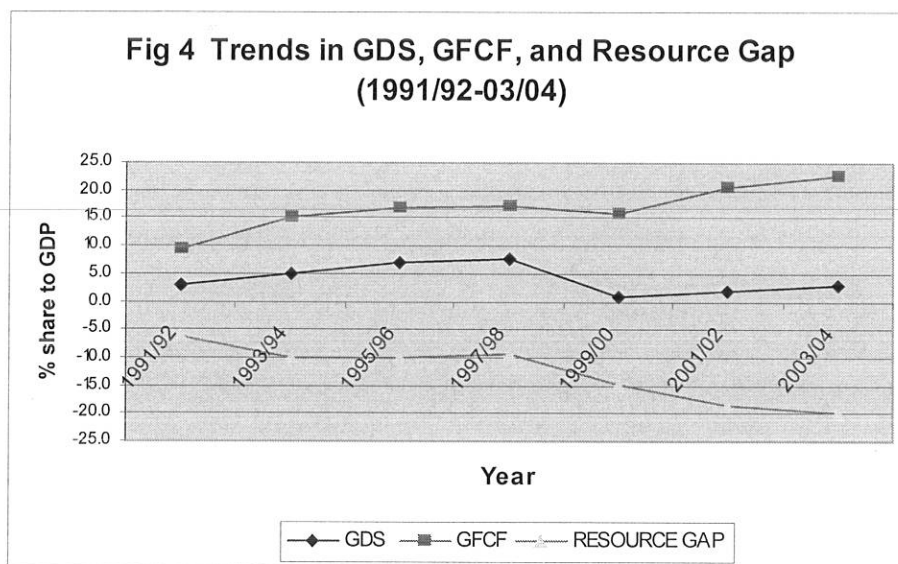
### **2.3.2 Trends in Saving and Investment**

Since taking power, the EPRDF government had taken different measures to change the unconducive investment climate, which was persisting during the Derg period. Some of these measures include; the proclamation to provide for the Encouragement, Expansion and Coordination of Investment (no.15/1992), provision of guarantees and constitutional protection of private investment, tax holidays, customs duty exemptions on equipment and machinery, tax reductions, and investment tax credit. Income tax for organizations, which was 59%, has been reduced first to 40% in 1994/95 and then to 35%. Export taxes have also been abolished except for coffee.

Despite the different measures taken by the government, trends in Gross Domestic Saving (GDS), Gross Fixed capital Formation (GFCF) and Resource Gap show that there still needs much to be done in terms of mobilizing resources domestically and raising the necessary required investment for a sustainable and rapid growth of the economy. GDS as percent of GDP, which has been 3% in 1991/92, reached to a peak of 7.7% in 1997/98 only to decline to 2.8% in 2003/04. The average GDS during this period was 4.3%, which is lower than that of the Derg period (7.1%). GFCF has shown an increasing trend in this period reaching to a high of 22.6% by 2003/04, even though this figure is still lower than the recommended 25% share of investment to GDP for sustainable economic growth in sub-Saharan African countries (ECA, 2003). Resource Gap, which is a good indicator of the



capacity of the financial sector to mobilize domestically available resources for investment, has shown an ever-declining trend during the past 14 years. (See figure 4). The resource gap which has been -6.2% in 1991/92 has reached to a high of -19.8% by 2003/04 indicating heavy reliance of the economy on external sources.



### 2.3.3 Structure of the Financial System and Monetary Policy Post Derg Period.

It is to be recalled that with the downfall of the Derg regime and the ascend of EPRDF to power in Ethiopia many policies have been changed. In January 1994, the government issued two proclamations namely Monetary and Banking proclamation, and the Licensing and Supervision of Banks and Insurance companies. In the first proclamation, NBE was given increased autonomy and authority to supervise the banking system.

The second proclamation allowed private sector to participate in banking and insurance business. In addition, in 1995 the Housing and Saving Bank and Agricultural and Industrial Development Bank were restructured and renamed Construction and Business Bank and Development Bank of



Ethiopia, respectively. The government also recapitalized government owned financial institutions. The treasury has also taken over non-performing loan portfolio of Development Bank of Ethiopia to state farms.

Since the introduction of private sector participation in the financial sector, six private banks, namely, Awash International Bank, Dashen Bank, Abyssinia Bank, Nib International Bank, Wogagen Bank, and United Bank and nine insurance companies, namely, Nyala Insurance, Nile Insurance, Africa Insurance, National Insurance, Awash Insurance, United Insurance, Lion Insurance, Global Insurance and NIB Insurance were established.

When we look at the branch network of the banking system, by 2001/02 state owned banks had 223 branches (69.7%) and private banks had 97 branches (30.3%) throughout the country. From the total banking sector capital; state owned banks comprise 78.8% (from which 59.2% is of CBE) and private banks share amounts to 21.2%, indicating state monopoly and insufficient growth of the private banking system; which could possibly be attributed to the prohibition of entry of foreign banks into the market.

Other important financial sector reform measures include:

- Elimination of priority access to credit.
- Interest rate liberalization
- Introduction of profitability criteria
- Restructuring (including portfolio cleaning and re-capitalization of state- owned banks)
- Reduced direct government control of financial intermediaries and limits on central bank and bank loans to government;
- Introduction of treasury bills auction market.
- Enhancement of the supervisory, regulatory and legal infrastructure and power of the NBE.
- Issuance of a proclamation, which allows the establishment of micro financing Institutions
- Directive on inter-bank money market (issued in September 1998)

## **Interest Rate policy**

One of the components of the financial reform program was interest rate liberalization, which started from raising nominal interest rates on deposits and loans and elimination of discrimination of credit access and interest rates by type of ownership. The liberalization in September 1994 eliminated sectoral discrimination of lending rates, which were increased to 14-15% for all sectors of the economy, and deposit rates to 10-12 %. However on January 1995, the central bank switched to a policy of floors on deposit interest rates and ceilings on lending rates, allowing banks to set interest rates (provided they do not discriminate between similar categories of depositors and of borrowers). On January 1998, further interest rate liberalization was taken by eliminating the ceiling on lending rates, hence removing the policy limit on interest spread.

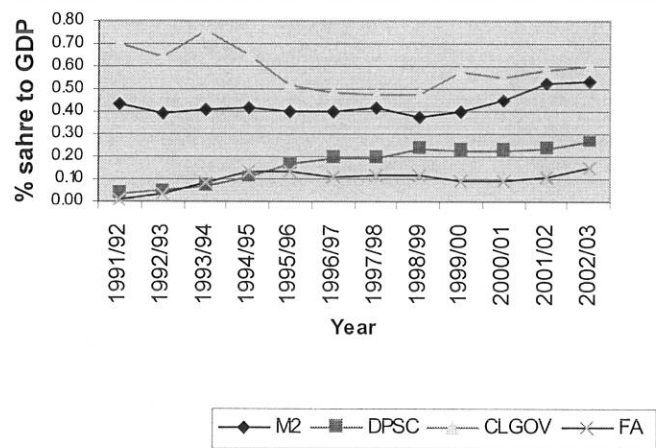
A government securities market was established (January 1996) through the introduction of monthly (later made bi-weekly) auction of 91-day treasury bills, with 28- day and 182 -day bills added in December 1996. T-bills are now on offer to financial institutions, business firms as well as the general public.

### **2.3.4 Monetary Aggregates**

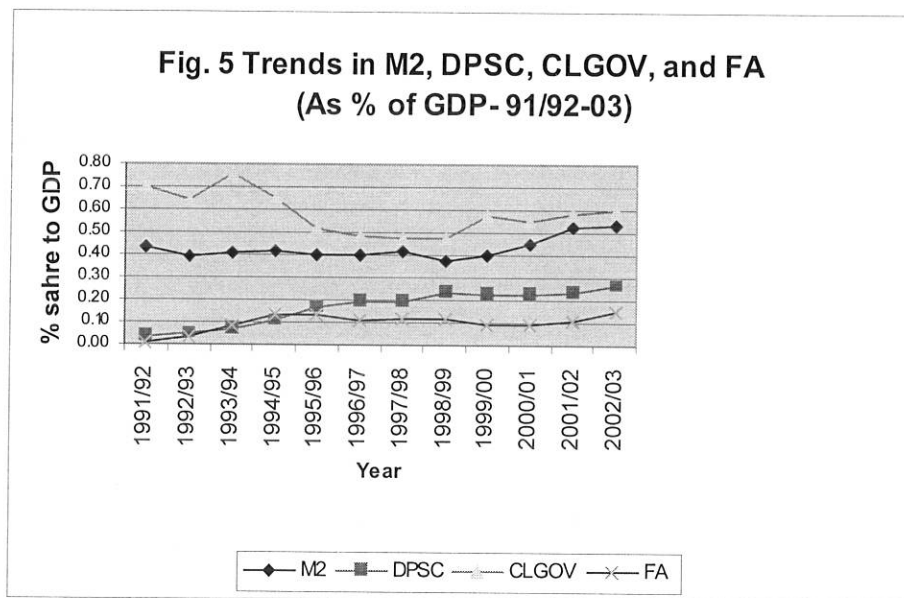
In the period between 1991/92-2002/02 broad money supply (M2) - the sum of demand deposits, currency outside banks and quasi-money- had an average growth rate of 12% per annum. Domestic Private Sector Credit (DPSC) which had been 3% of GDP in 1991/92 has also shown a tremendous increase (21%) by 2002/03. Net Claims on Government (CLGOV) which accounted 70% of GDP in 1991/92 declined to 48% in 1998/99, showing repayment of domestic debt and gradual decline in reliance on domestic banking system for deficit financing, but increased to

62% by 2002/03 which could possibly be due to the occurrence of drought and the aftermath of the border conflict with Eritrea. The 1% share of Foreign Assets (FA) to GDP in 1991/92 had increased to 15% in 2002/03. (See figure 5)

**Fig. 5 Trends in M2, DPSC, CLGOV, and FA  
(As % of GDP- 91/92-03)**



62% by 2002/03 which could possibly be due to the occurrence of drought and the aftermath of the border conflict with Eritrea. The 1% share of Foreign Assets (FA) to GDP in 1991/92 had increased to 15% in 2002/03. (See figure 5)



## **CHAPTER THREE**

### **Literature Review**

#### **3.1 Theoretical literature**

##### **3.1.1 Introduction**

Theories linking financial development to the growth of the real economy are so diverse and date back to the age of Karl Marx, who recognized the importance of the financial system in the process of capitalist economic development over a century ago. Lenin impressed by the powerful political and economic influence of the European banks in the eighteenth and nineteenth centuries, also understood the crucial role of the financial system. He nationalized all Russian banks immediately after the 1917 revolution as the fastest and most effective way of ending capitalism and assuming control over the entire Russian economy. John Maynard Keynes was also wary of the potential damage wrought by financial systems in capitalist economies. He believed that without careful management money could disrupt economic activity quite seriously.

Different economists in the 20<sup>th</sup> century hypothesized different arguments about the role of financial markets in economic development. Different policy prescriptions have derived and tested in different countries. Nevertheless, Fry (1995) asserts that to understand the relationships between financial and real variables it is necessary to understand the way in which financial markets operate and how they differ from other markets. It is also necessary to understand the process of economic growth and how financial variables affect that process. To that end, I have tried to assess the different theoretical financial development models developed during the 20<sup>th</sup> century and the recent past.

**3.1.2 Financial Development Models in the Keynesian School**

Fry (1995) states that the simplest money demand function in use before the Keynesian revolution was the Cambridge equation:

$$M^d = k \cdot y \cdot p \dots\dots\dots(3.1)$$

Where  $M^d$  is the aggregate demand for money,  $k$  is the public's desired ratio of money balances to income,  $y$  is real income or income expressed at constant prices, and  $p$  is the price level.

Keynes criticized the Cambridge equation precisely because it neglects the role of interest rates in determining the demand for money. Keynes offers an alternative formulation of the demand for money, which he calls liquidity preference. This money demand function can be expressed:

$$M^d = \beta_0 + \beta_1/(i - i_t) \dots\dots\dots(3.2)$$

Where  $i_t$  is the liquidity-trap interest rate.

Figure (6), shows a money demand curve that becomes perfectly interest elastic at the low rate of interest  $i_t$ . If the money supply increases from  $M_0^s$  to  $M_1^s$ , some people find that they are holding more money than they wish. Their reaction is to buy bonds, which raises bond prices and so lowers the interest rate.

At point A, however, the interest rate has fallen so far below its normal level that virtually everyone has the same expectation that the interest rate will rise sufficiently in the future for capital losses to wipe out all interest earnings on bonds.(Keynes, 1936) If the money supply increases from  $M^s_2$  to  $M^s_3$ , therefore, no one would want to buy more bonds. Everyone would prefer to hold the additional money rather than risk capital losses by holding bonds.

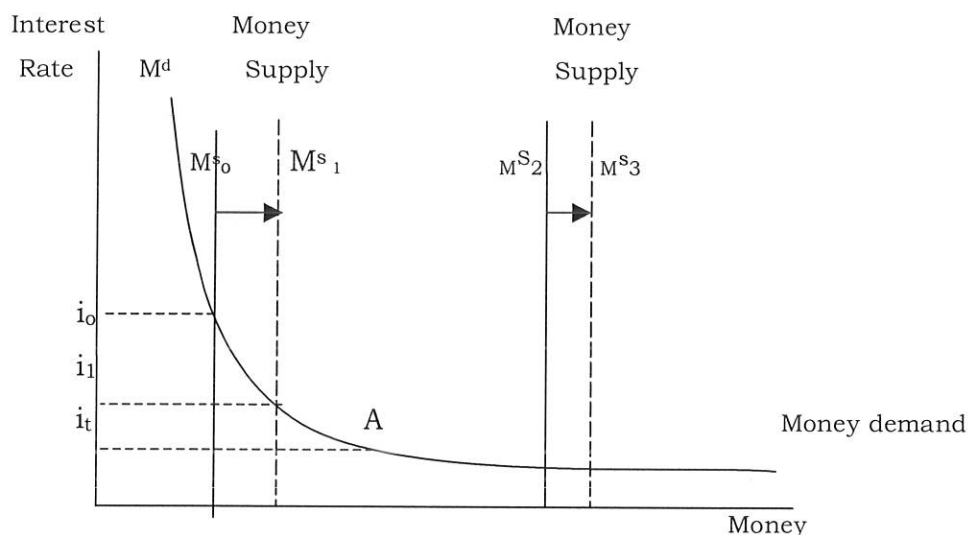


Figure: 6 Liquidity Preference and the Interest Rate

This floor to the interest rate has a crucial implication to the equilibrium level of output in an economy. In the simple Keynesian model, saving  $S$  is determined solely by the level of income  $Y$ , while desired or planned investment is determined solely by the real interest rate or the nominal interest rate adjusted for inflation  $r$ . If the liquidity trap sets a floor to the interest rate at a certain level, desired investment would be less than planned saving at the full employment level of income. This disequilibrium is resolved by a fall in real income that in turn reduces planned saving.

The relative attractiveness of holding money as an asset instead of holding productive capital is the cause of the inadequate level of investment. The simple Keynesian model resolves the disequilibrium through a reduction in income. However Keynes recognizes an alternative adjustment mechanism—a change in the relative returns on the two competing assets, money and capital. If the price level is fixed and expectations about the future price level are therefore static, expansionary monetary policy could reduce the interest rate and at the same time satisfy the increase in liquidity preference. Were an interest rate ceiling imposed by the authorities, investment could still be stimulated by the lower imposed interest rate, provided that accommodative

monetary policies were pursued. This Keynesian solution has strong appeal but ignores the inflationary consequences of monetary expansion or accommodation. (Fry, 1995)

Tobin (1965) develops one of the earlier models linking financial conditions and economic growth using Solow's (1956) neoclassical growth model. In Tobin's model of money and economic growth, economic units allocate their wealth between two assets, money  $M$  and productive capital  $K$ . In this economy, the economic units are all small household producers. Hence, the business sector is identical to the household sector. The demands for money and productive capital can be expressed in the following form:

$$M^d = [b_{10} + b_{11}r + b_{12}\pi] W \dots\dots\dots(3.3)$$

$$K^d = [b_{20} + b_{21} + b_{22}\pi] W \dots\dots\dots(3.4)$$

Where  $M^d$  and  $K^d$  are demands for money and productive capital, respectively,  $r$  is the real return on productive capital and  $\pi$  is the inflation rate and  $W$  is household's wealth. In this case,  $r + \pi$  equals the nominal interest rate  $I$  and constitutes the opportunity cost of holding money, while  $r$  is the real return to productive capital. The opportunity cost of holding money is the forgone return, which could have been obtained from holding productive capital.

The coefficients  $b_{10}$   $b_{11}$   $b_{12}$   $b_{20}$   $b_{21}$  and  $b_{22}$  are subject to two restrictions derived from the fact that equations (3.3) and (3.4) represent a complete system of demand equations. The two constraints are:

$$b_{10} + b_{20} = 1$$

$$b_{11} + b_{21} = 0 = b_{12} + b_{22}$$

In Tobin's model, if the return on capital relative to money rises, households increase the ratio of capital to money in their portfolios. This portfolio shift produces a higher capital/labor ratio, higher productivity of labor and



greater per capita incomes. The rate of economic growth accelerates during the transition from a lower to a higher capital/labor ratio that occurs after the relative yield on money falls. Hence reducing the return on money increases welfare. This can be accomplished either by reducing deposit rate of interest, or by taxing money or by simply accelerating the rate of growth in the money stock thereby raising the inflation rate.

Sidrauski (1967) shows that the steady-state capital/labor ratio in Tobin's model is invariant to the relative return on capital when individuals optimize over an infinite horizon. However, Drazen (1981b) replicates Tobin's results in a finite horizon optimizing framework. Fischer (1979b) demonstrates that, even in Sidrauski's model, the speed with which the economy approaches the steady state can be affected by the rate of monetary growth and hence the relative yield on money in the way asserted by Tobin.

### **3.1.3 The McKinnon-Shaw Financial Development Framework**

Liberal attitudes to finance can be traced back at least to the seventeenth century. Among the earlier writers who stressed the importance of sound money and unfettered financial intermediation were Locke (1665), Smith (1776), Bentham (1787) and Schumpeter (1912). Schumpeter stresses the importance of finance in the process of development. The pure entrepreneur who embodies development by trying out new techniques requires credit. "He can only become an entrepreneur by previously becoming a debtor" He stresses further that, granting credit in this sense operates as an order on the economic system to accommodate itself to the purposes of the entrepreneur, as an order on the goods which he needs. Which means entrusting him with productive forces. It is only thus that economic development could arise from the mere circular flow in perfect equilibrium.

For 60 years from the onset of World War I, advocates of financial liberalization were a rare breed. During this period the bulk of theoretical work relating financial conditions to economic development detected

possibilities of negative or, at best, neutral effects of financial development on income levels or growth rates.

In 1973 the dominant theoretical position was forcefully challenged. Mckinnon (1973) and Shaw (1973) both develop models of economic development in which financial liberalization and development accelerate the rate of economic growth. They also highlight some of the deleterious effects of financial repression- interest rate ceilings, high reserve requirements, directed credit policies and discriminatory taxation of financial intermediaries- on economic growth.

Mckinnon’s formal analysis of how the real deposit rate of interest affects saving, investment and growth is based implicitly on an outside money model<sup>8</sup>. It rests on two assumptions: a) All economic units are confined to self-finance. b) Indivisibilities in investment are of considerable importance – investment expenditures are lumpier than consumption expenditures.

Mckinnon formalizes his complementarity hypothesis, “the basic complementarity between money and physical capital” Mckinnon (1973) which he applies to “semi-industrial LDCs”; complementarity is reflected in the demand for money function.

$$M/P = f (Y, I/Y, d-\pi^e ) .....(3.5)$$

Where M is the money stock (broadly defined to include saving/time deposits as well as demand/ sight deposits and currency incirculation-M2), P is the price level, Y is real GNP, I/Y is the ratio of gross investment to GNP, and  $d-\pi^e$  is the real deposit rate of interest (d is the nominal deposit rate of interest and  $\pi^e$  is expected inflation, both continuously compounded.)

---

<sup>8</sup> Outside money model relies on the assumption that all economic units are confined to self-finance where firms cannot borrow to finance investment.

Complementarity works both ways: “The conditions of money supply have a first-order impact on decisions to save and invest.”(Mckinnon, 1973) Hence Mckinnon’s complementarity can also be expressed in an investment function of the form

$$I/Y = f(r^*, d-\pi^e) \dots\dots\dots(3.6)$$

Where  $r^*$  is the average return to physical capital. Complementarity appears in the partial derivatives:

$$\frac{\partial (M/P)}{\partial (I/Y)} > 0 \quad , \quad \frac{\partial (I/Y)}{\partial (d-\pi^e)} > 0 \dots\dots\dots (3.7)$$

Shaw (1973) constructs a monetary model in which money is backed by productive investment loans to the private sector. The larger is this monetary stock in relation to the level of economic activity, the greater is the extent of financial intermediation between savers and investors through the banking system. Shaw maintains that expanded financial intermediation between savers and investors resulting from financial liberalization (higher real institutional interest rates) and financial development increases the incentives to save and invest; it also raises the average efficiency of investment. Financial intermediaries raise real returns to savers and at the same time lower real costs to investors by accommodating liquidity preference, reducing risk through diversification, reaping economies of scale in lending, increasing operational efficiency and lowering information costs to both savers and investors through specialization and division of labor.

Financial intermediation is repressed and suboptimal when interest rate are administratively fixed below their equilibrium levels. When interest rates are employed as rationing devices (allowed to find their equilibrium levels),

financial intermediaries can use their expertise to allocate efficiently the larger volume of investible funds which is then forthcoming.

Shaw's debt-intermediation view is based firmly on an inside money model<sup>9</sup>. It produces a demand for money function that can be characterized as follows (Shaw, 1973)

$$M/P = f(Y, V, d-\pi^e) \dots\dots\dots(3.8)$$

Where V is a vector of opportunity costs in real terms of holding money. Shaw expects real yields on all forms of wealth, including money, to have a positive effect on the saving ratio.

Molho (1986a) argues that the models of Mckinnon and Shaw need not be viewed as incompatible with one another, even though Mckinnon's formal analysis uses outside money. He asserts, "Mckinnon's complementarity hypothesis, on the one hand, emphasizes the role of deposits in encouraging self-financed investment. A rise in the deposit rate stimulates demand for capital by making savings accumulation more rewarding and by increasing the amount of internally financed investment. Shaw's debt-intermediation view, on the other hand, focuses on the role of deposit accumulation in expanding the lending potential of financial intermediaries.

Higher deposit rates encourage the inflow deposits to banks, which in turn can increase lending, thereby stimulating externally financed investment.

---

<sup>9</sup> Inside money model assumes investors are not constrained to self-finance.

Although the Shaw and Mckinnon theses emphasize different aspects of the process of accumulation of financial assets and liabilities, it is clear from the discussion so far that these theses should be viewed as complementary rather than competing theories.....The two approaches complement each other because most projects are financed in part with own funds and in part with borrowings.” (Molho, 1986a)

### **3.1.4 Critics of Financial Liberalization**

#### **a) Neostructuralists**

Neostructuralists represented by Buffie (1984), Khosaka (1984), Taylor (1983) and van Wijnbergen (1982, 1983a, 1983b), mounted an assault on the Mckinnon-Shaw school in the early 1980s using a markup pricing framework, a cost-push inflation model and Keynesian adjustment mechanisms, the neostructuralist models predict the opposite effects of financial development and liberalization to those derived from the Mckinnon-Shaw models. In the neostructuralist models, the nominal interest rate, which is determined in the curb or noninstitutional credit market, adjusts to equate demand for and supply of money and credit. Income adjusts to equilibrate demand and supply in the goods market. Neostructuralist models are based on five assumptions that differ fundamentally from the basic assumptions of the Mckinnon-Shaw school: (a) Wages are determined institutionally or exogenously through class conflict; (b) Inflation is determined by the relative power of capitalists and workers (who may themselves be influenced by the state of the economy); (c) Saving takes place only out of profits, not wages; (d) The price level is determined by fixed markups over cost of labor, imports, and working capital finance (the interest rate) ; and (e) developing countries have a critical need for imports of raw materials, capital equipment, and intermediate goods (Taylor, 1983). Assumption (d) and (e) imply that a restrictive monetary policy that raises the price of imports can produce

stagflation – an acceleration in the inflation rate and a reduction in the rate of economic growth at the same time.

Neostructuralists treat curb markets, in which money lenders and indigenous banks intermediate between savers and investors, as a crucial feature of their models of developing economies. Neostructuralists view these markets as “often competitive and agile” (Taylor, 1983). Since reserve requirements constitute a leakage in the process of financial intermediation through commercial banks, Neostructuralists claim that banks cannot intermediate as efficiently as curb markets between savers and investors.

All Neostructuralist models base household asset allocation on Tobin’s portfolio framework. Households face three categories of assets: gold or currency, bank deposits, and curb market loans. The McKinnon-Shaw models specify only two assets (gold or other inflation hedges and money) in household portfolios. Hence substitution into money must come from substitution out of inflation hedges. Taylor (1983) and van Winbergen (1982) point out that whether higher deposit rates do increase the total real supply of credit depends on the required reserve ratio and on whether the increased holdings of real money balances come mainly at the expense of inflation hedges or mainly from direct lending in the curb market. Buffie (1984), Kohsaka (1984), Taylor and van Winbergen conclude that, in practice, financial liberalization is likely to reduce the rate economic growth by reducing the total real supply of credit available to business firms.

The Neostructuralists assume that funds flow freely between the banking system and the curb market; savers and investors can use either market, at least to some extent. Hence the relevant interest rate in the Structuralist models is the curb market rate: it represents the marginal cost of borrowing on the one hand, and enters the money demand function on the other hand, since curb market loans constitute an alternative to holding money balances. Any increase in the curb market rate raises the price level because a rise in the curb market rate increases the cost of working capital; prices

are determined by fixed markups over costs in all the Neostructuralist models. A rise in the curb market rate also reduces output by deterring investment. An increase in the deposit rate of interest may raise the curb market rate and so depress growth if it reduces the total supply of working capital – working capital supplied by both the banking system and the curb market. Buffie (1984) also concludes that “once we allow for repercussions in the curb market, financial liberalization becomes a perilous undertaking.”

## **b) Market Failures and Information Asymmetries in Financial Markets**

Stiglitz (1994) has criticized financial liberalization on different grounds. His argument focuses on the prevalence of market failures in financial markets. He argues that there is an important role for government intervention and even financial repression in financial markets due to pervasive market failures. An essential function of financial markets is collecting, processing, and conveying information for allocating funds and monitoring their use. Costly information creates market failures.

One market failure arising from costly information occurs because monitoring is public good. If one individual conducts research to determine the solvency of a financial institution and then acts upon that information, other can benefit from copying his actions. Because information about the management and solvency of financial institution is a public good, there is suboptimal expenditure on monitoring them. When financial institutions know that they are not adequately monitored by depositors, they have incentive to take greater risk with deposits.

Costly information can also produce externalities. For example, when several banks fail, depositors may assume that there is an increased probability that other banks will fail. Their reaction in the form of deposit withdrawal may produce the predicated failure. Externalities can also be transmitted across markets. For example, the provision of a bank loan makes it easier



for a firm to raise equity capital. The bank loan provides a signal that the firm is sound and prospective equity participants can also expect the bank to monitor the firm in which they will be investing. Naturally financial institutions are rarely concerned about these externality effects. Hence, private interest can diverge from public interests.

Markets in which information is imperfect are likely to be inefficient even if they are competitive. However, costly information ensure that such markets are unlikely to be fully competitive. Hence, government intervention could improve welfare. In contrast to depositors, borrowers can not switch easily from one bank to another. First, information about a prospective borrower involves a fixed cost. The borrower's current bank has already incurred this cost, while a new bank would charge a higher interest rate or decline to lend. This produces an element of natural monopoly for the current bank. Second, the new bank may decline to lend because it faces an adverse selection problem: Has the current bank restricted credit because the borrower is no longer a good risk? (Stiglitz 1994, 29).

In any event, governments are involved in financial systems. Governments can not ignore impending collapses of one or more major financial institutions precisely because of the externalities that such a collapse would produce. The government becomes an insurer and this alters behavior. Specifically, "banks, knowing that they are effectively insured, may take greater risks than they otherwise would. In particular, they may undertake risks similar to those undertaken by other banks, since they assume that although the government might ignore the problems of a single bank, it could not allow the entire financial system to go belly-up. So long as the bank does what other banks are doing, the probability of a rescue is extremely high" (Stiglitz 1994, 27).

Stiglitz (1994, 27) continues: "once we recognize the role of government as an insurer (willing or unwilling), financial market regulations can be seen from a new perspective, as akin to the regulations an insurance company



imposes. The effects of some versions of financial market liberalization are similar to an insurance company's deciding to abandon fire codes, with similar disastrous consequences."

Because the government can enforce membership in insurance programs, it can avoid the adverse selection problem. It may also be able to mitigate moral hazard problems by compelling more disclosure of information and using a range of indirect instruments of control. But because of compulsion, the government can not discriminate in the same way that private insurance companies can and do. Assessing risk is subjective but competitive markets convert many subjective evaluations into an objective market standard. If individuals object to their car insurance premiums, they can shop around. Banks can not shop around for alternative deposit insurance programs (Stiglitz 1994, 28)

The existence of market failures justifies government intervention. Stiglitz (1994, 33-39) provides some principles for appropriate government intervention. On the one hand, governments have powers arising from compulsion and proscription that the private sector does not possess. On the other hand, governments have constraints and limitations that can make them less effective than private sector agents in various activities. The first set of appropriate interventions springs from the role of government as the implicit or explicit insurer of the financial system. Here the government can use incentives and restraints designed to reduce the moral hazard problems in ways similar to those used by private insurers. The simplest device to reduce moral hazard problems is to increase capital requirements. The risk-weighted capital-adequacy framework produced by the Bank of International Settlements has rapidly become the worldwide standard to achieve this.

Stiglitz argues that a second set of appropriate government interventions arises from the externalities created by information problem. Given information imperfections, Stiglitz (1994, 39-42) argues that financial

repression can improve the efficiency with which capital is allocated. First, lowering interest rates improves the average quality of the pool of loan applicants. Second, financial repression increases firm equity because it lowers the cost of capital. Third, financial repression could be used in conjunction with an alternative allocative mechanism such as export performance to accelerate economic growth. Fourth, directed credit programs can encourage lending to sectors with high technological spillovers.

The importance of information imperfections and the role of government intervention in the area of prudential regulation and supervision can be accepted without accepting the case for financial repression. First, lowering interest rates does not necessarily increase the average efficiency of investment because lower interest rates can encourage entrepreneurs with lower-yielding projects to bid for funds. Second, financial repression may not lower the marginal cost of capital. Third, using past performance as a criterion for allocating credit discriminates against new entrants and perpetuates monopoly power.

De Gregorio (1993), King and Levine (1993b), and Roubini and Sala-i-Martin (1992b) demonstrate that financial repression reduces growth both in theory and in practice. Therefore, they too disagree with Stiglitz over the efficacy of financial repression. Bencivenga and Smith (1993) show that a government program designed to reduce the cost of credit to a particular group of borrowers has the opposite effect to that desired because it exacerbates the adverse selection problem that already exists. In their model, "the program reduces the availability of credit to the group that is its intended beneficiary" (Bencivenga and Smith, 1993)

## **3.2 Empirical Literature**

### **3.2.1. Introduction**

Empirical research on financial repression focused initially on its saving and investment effects. The worldwide inflation immediately following the publication of the books by McKinnon (1973) and Shaw (1973) turned financial restriction into financial repression or worsened existing financial repression in many industrial and developing economies. Gaps between controlled and free-market interest rates widened, and institutional interest rates (loan as well as deposit rates) became negative in real terms almost everywhere. The result was disintermediation into direct financial claims where they existed or into inflation ledges (Cole and Patrick 1986, Galbis. 1979)

In evaluating the experience of negative real institutional interest rates, Long (1983) enumerates the following effects: reduced national saving, more capital flight, worse misallocation of resources, excessive lending to prime borrowers, resurgence of non institutional money markets, increased use of foreign financial institutions, and increased problems of monetary control. Since then potential effects of financial conditions have been tested on numerous groups of countries with an array of alternative techniques. While few would disagree that financial development occurs in conjunction with rising per capita incomes, the issue of causality is hotly disputed. In order to clearly assess whether financial development causes economic growth or it follows passively in the wake of economic growth, Fry (1995) suggests that one solution is to isolate exogenous financial variables, another is to conduct some form of causality test.

In line with the objective of this paper which is broadly speaking “the assessment of the impact of financial reform on macro economic variables i.e. saving, investment, inflation and economic growth” I have tried to

organize the empirical evidence as follows. Section 3.2.2 discusses the impact of financial variables on saving in different developing countries. Section 3.2.3 and 3.2.4 discuss also the diversified results obtained from different studies on the implications of financial variables on investment (its efficiency and volume) and economic growth in different countries respectively. Unfortunately, there are only very few empirical works on financial market development/Liberalization and macroeconomic impacts in Ethiopia. Leulseged (2004) assessed the impact of financial sector liberalization on the environment using a time series data and the Engle-Granger Methodology. Many of the studies presented here are cross-country studies made on several developing countries.

### **3.2.2. The Impact of Financial Variables on Saving.**

The debate over the interest sensitivity of saving in developing and industrialized countries is still unsettled and continues to generate more heat than light. Modigliani (1986) asserts that “despite a hot debate, no convincing general evidence either way has been produced, which leads me to the provisional view that  $s$  (the saving ratio) is largely independent of the interest rate” However, Olson and Bailey (1981) claim that “the case for positive time preference is absolutely compelling, unless there is an infinite time horizon with the expectation of unending technological advance combined with what we call “drastically diminishing marginal utility”.

Boskin (1978) finds a significantly positive interest rate coefficient in a saving function for the United States. Fry (1978, 1979,a 1981,c 1984,1991a) reveals significantly positive interest rate effects on saving ratios in a sample of 14 Asian developing countries and Turkey. Dornbusch and Reynoso (1989) state: "Evidence from the United States and other industrialized countries supports skepticism in that virtually no study has demonstrated a discernible net effect (of real deposit rates on saving ratios)"

Fry and Mason (1982) estimated the variable rate-of-growth effect in the life-cycle saving model on pooled time series data for 7 Asian countries using two-stage least squares (2SLS) with country dummy variables.

The estimated function with dummy country variables whose coefficients are not reported here gives (t values in parenthesis):

$$\begin{aligned}
 \text{SNY} = & 1.535 \text{ (YG)} - 8.157 \text{ (DR)} - 0.344 \text{ (SFY)} \\
 & (2.018) \quad (-2.281) \quad (-3.333) \\
 & - 54.001 \text{ (DR)} \text{ YG} + 4.197 \text{ (d-}\Pi^e\text{)}. \text{ YG} \quad \dots\dots\dots (3.2.1.) \\
 & (-1.605) \quad (3.142) \\
 & \text{Adj } R^2 = 0.836
 \end{aligned}$$

Where d is the nominal 12-month time deposit rate of interest expressed as continuously compounded proportional rather than percentage rate of change,  $\Pi^e$  is the expected inflation rate estimated by applying polynomial distributed lags to current and past inflation rates, and YG is the endogenous rate of growth in real GNP. Here the variable used for the population dependency ration DR is a linear transformation of DEPR, the population under age 15 divided by population aged 15 to 64:  $DR = 0.0523 (DEPR - 0.3082)$ . This rescaling makes DR zero for zero population growth and 0.03 for a 3 percent population growth rate in long run demographic equilibrium (Mason 1981)

Considering the fact that since the mid -1970s many developing countries have borrowed extensively on commercial terms from the international banking system, Fry and Mason (1982) conclude that treating foreign saving as exogenous is no longer valid for the majority of the above sample countries. In addition, terms-of-trade changes have become more pronounced in the past decade, making growth in real GNP an increasingly poor proxy for income growth. Hence they estimated the saving function for 14 Asian developing countries by dropping SFY (foreign saving) and including TTG, income growth attributable-to-terms of trade changes:

$$\begin{aligned}
\text{SNY} = & 1.144 (\text{YG}) + 0.266 (\text{TTG}) + 0.122 (\text{d-}\Pi^e) \\
& (4.440) \quad (4.375) \quad (7.105) \\
& - 6.013 (\text{DR}) - 25.967 (\text{DR}).\text{YG.} \dots\dots\dots (3.2.2) \\
& (-6.162) \quad (-2.869) \quad \text{Adj } R^2 = 0.828
\end{aligned}$$

A more recent estimate by Fry (1991a) for Bangladesh, India, Indonesia, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, and Thailand for the period 1961-1988 corrects for heteroscedasticity across countries using iterative weighted two stage least squares finds:

$$\begin{aligned}
\text{SNY} = & 0.470 (\text{INCG}) - 0.084 (\text{DEPR}) - 0.853 (\text{DEPR}). \text{YG} \\
& (6.119) \quad (-1.629) \quad (-3.316) \\
& + 0.037 (\text{d-}\Pi^e) + 0.775 (\text{SNY})_{t-1} \dots\dots\dots (3.2.3) \\
& (3.916) \quad (24.155) \\
& \text{Adj } R^2 = 0.933
\end{aligned}$$

In this estimate the population dependency ratio DEPR is not rescaled and includes the population aged 65 and over. Equation (3.2.3.) combines income growth attributable to terms-of-trade improvements with output growth in the variable INCG.

He concludes that on average, the national saving ratio is increased in the long run by about 2.1 percentage point for each 1 percentage point rise in the real deposit rate of interest. Although this effect is statistically significant, its magnitude is not large enough to warrant much policy significance. As a device for increasing saving, the real deposit rate is subject to an upper bound at its competitive free-market equilibrium level normally lying in the range of 0 to 5 percent. Hence only in countries where the real deposit negative by a considerable margin can there be much scope for increasing saving directly by raising the deposit rate.

Rittenberg (1988) estimates Turkey's national saving ratio over the period 1961-1985 and produces coefficients of 0.24 and 0.29 for the real deposit rate of interest (using the actual inflation rather than any estimate of expected inflation). Celasun and Tansel (1993) also detect a positive and

significant effect of the real deposit rate on private saving in Turkey over the period 1972-1988. When estimating the saving ratio with the real deposit rate and the square of the real deposit rate, Rittenberg (1988) finds that the coefficient of the squared term is negative which means that a rising real deposit rate increases the saving ratio at a decreasing rate. While an increase in the real deposit rate from -30 percent to -20 percent raises the saving ratio by 5.6 percentage points, an increase from -5 to +5 percent raises the saving ratio by only 1.8 percentage points.

De Melo and Tybout (1986) find that the real interest rate exerted a significantly positive, albeit small (0.083), effect on the saving ratio in Uruguay over the period 1962-1973, but they could detect no effect after financial liberalization accrued in 1973.

### **3.2.3 Financial Variables and Investment Ratios**

McKinnon (1991) questions, "what are the channels by which increased financial deepening, price-level stability, and positive real interest rates contribute to higher output growth? Back in 1973 when writing *Money and capital*, I was rather agnostic regarding the relative importance of higher social saving (as a share of GDP) versus the improved productivity of capital. As financial assets become more attractive, does the release of financial repression have its major impact on growth through the increased share of investment (saving) in GDP or through the improved "quality" of investment?"

Gelb (1989) derives estimates of both the incremental output-capital ratio, IOCR, and the ratio of investment (domestic plus foreign saving) to GDP, denoted by IGDP for thirty four countries. After partitioning the sample interval into two (1965-73) and (1974-85), he found that the average IOCR for the thirty four countries fell sharply from 0.32 in the earlier period (1965-73) to just 0.13 in the recent one (1974-85)- a rather spectacular fall in investment efficiency that could be linked to the higher inflation as well as

the greater volatility in exchange rates in the later period. On the other hand, the IGDP rose slightly from 0.21 to 0.24 - perhaps in part from the large absorption of foreign capital (borrowing from the international banks) in the late 1970s and early 1980s.

Over the whole 1965-85 period (using his pooled observations from the two sub periods), however, Gelb found that the varying investment efficiency across counties was strongly and positively correlated with the average real deposit rate (RR)

$$\text{IOCR} = c + 0.989 \text{ RR} - 0.139 \text{ SHIFT} \dots\dots\dots (3.2.4)$$

(5.90)
(-5.39)

$$\text{Adj } R^2 = 0.563$$

In estimating the effect of the real interest rate on measured social saving - domestic and foreign – Gelb found that

$$\text{IGDP} = c + 0.248 \text{ RR} + 0.042 \text{ SHIFT} \dots\dots\dots (3.2.5.)$$

(2.21)
(2.43)

$$\text{Adj } R^2 = 0.090$$

The statistical significance of (3.2.5) tended to fade when Gelb added more explanatory variables on the right-hand side; the coefficient of RR becomes smaller and less significant in explaining aggregate saving as a share of GNP

Fry (1995) states that under conditions of disequilibrium interest rates and credit rationing, the quantity of credit rather than its price determines investment. Rama (1990) reviews empirical studies of investment behavior and lists 18 studies, all of which estimate positive coefficients of the credit availability variable.



One 2SLS pooled time-series estimate of the flexible accelerator model for 61 developing countries for the period 1961-1975 by Fry (1980a) gives the following results.

$$\begin{aligned}
 IY = & 0.4715 + 0.1234 (YG) + 0.1874 (FY) + 0.0140 (DCY) + 0.1036 \Delta \log (DCY) \\
 & (2.3169) (1.9952) \quad (5.0169) \quad (0.3269) \quad (10.3615) \\
 & + 0.0063(PX) + 0.0198 (P/P^e) + 0.5222 (IY)_{t-1} \dots \dots \dots (3.2.6) \\
 & (1.8686) \quad (3.0328) \quad (10.1033) \\
 & \text{Adj } R^2 = 0.68
 \end{aligned}$$

Where IY is the ratio of domestic investment to GNP (expressed in current prices), YG is the continuously compounded rate of growth in real GNP, DCY is the ratio of domestic credit to GNP, FY is the ratio of foreign exchange receipts to GNP, PX is purchasing power of exports or income terms of trade, and P/P<sup>e</sup> is the ratio of the endogenous actual price level to the expected price level. The rate of change in the ratio of domestic credit to GNP has a highly significant positive coefficient.

Demetriades and Devereux (1992) estimate a positive, albeit insignificant, effect of negative real interest rates on investment in a pooled time-series estimate for 63 developing countries over the period 1962-1990. In contrast, they find a highly significant positive coefficient for a variable that includes the difference between the real U.S. treasury bill rate and the real domestic loan rate. They interpret this result to indicate that by lowering the real marginal cost of borrowing, financial repression stimulates investment. This argument is based on the model presented by Arestis and Demetriades (1993), in which subsidized credit is always available in a fixed proportion to curb market loans.

Greene and Villanueva (1991) find a significantly negative coefficient of the real deposit interest rate in a pooled time-series estimate of private investment ratios for 23 developing countries over the period 1975-1987; the inflation rate also exerts a significantly negative effect on the private investment ratio.

### 3.2.4 Financial Conditions and Economic Growth

According to economists of all persuasions, financial conditions may affect the rate of economic growth in both the short and medium runs. (Fry, 1995). Tobin's monetary growth model predicts a negative impact of a higher real return on money holdings in the medium run but has nothing to say about the short-run. The Mckinnon-Shaw school expects financial liberalization (institutional interest rates rising towards their competitive free-market equilibrium levels) to exert a positive effect on the rate of economic growth in both the short and medium runs. The Neostructuralists predict a stagflationary (accelerating inflation and lower growth) outcome from financial liberalization in the short-run. In the medium run, there is the possibility that the saving ratio will increase by enough to outweigh the negative influence of portfolio adjustments.

Khan and Reinhart (1990) show that there is a strong positive relationship between economic growth and the ratio of private investment to total investment in a sample of 24 developing countries using average data for the period 1970-1979. Since credit availability is an important determinant of private investment, they suggest that the effect of financial conditions on growth may occur through this channel.

Khan and Villanueva (1991) estimate the effects of real interest rates on growth for 23 developing countries using average data for the period 1975-1987 in equations that control for the ratio of private investment to GDP (IPY).

$$\begin{aligned}
 \text{YGN} &= -1.13 + 0.25(\text{IPY}) + 0.08 (\text{d-}\pi) \dots\dots\dots (3.2.7) \\
 &\quad (-1.3) \quad (3.4) \quad (2.4) \quad \text{Adj } R^2 = 0.55 \\
 \\
 \text{YGN} &= -1.997 + 0.184(\text{IPY}) + 0.241(\text{XKG}) + 0.067(\text{d-}\pi) \dots\dots\dots (3.2.8) \\
 &\quad (-2.36) \quad (2.86) \quad (3.37) \quad (2.34) \\
 &\quad \text{Adj } R^2 = 0.718
 \end{aligned}$$

Where YGN is the rate of growth in per capita real GDP, IPY is the private investment ratio and XKG is the rate of growth in exports at constant prices. They conclude that, "after allowing for changes in the rate of private investment, the real interest rate has a significant direct positive effect on per capita growth, suggesting that the direct favorable effects of real interest rates on the efficient use of capital, and thus on factor productivity, outweigh any possible negative impact on the rate of private investment"

Ghani (1992) estimates growth equations for a sample of 50 developing countries following an approach used by Barro (1991). The initial levels of human capital (as measured by years of schooling) and financial development (as measured by the ratio of total assets of the financial system to GDP or the ratio of private sector credit to GDP) in 1965 yield significantly positive coefficients, while the initial level of per capita real GDP produces a negative coefficient in an equation explaining average growth rates over the period 1965-1989. De Gregorio and Guidotti (1993) produce similar results for middle and low-income countries using Barro's data set. Hermes and Lensink (1993) also find that growth in per capita real GDP is positively affected by the ratio private sector credit to aggregate domestic credit in 14 Latin American countries over the period 1963-1989 using five year averages for all variables.

# CHAPTER FOUR

## Methodology

### 4.1 Model Specification

#### 4.1.1 The Saving Function

In this study the specific saving function to be used for empirical testing is based on the “life-cycle saving” model. The standard life-cycle saving model assumes that young, income earning households save to finance consumption when they become old, non-earning households.

The simplest life-cycle model assumes that each household consumes all its resources over its life time; the level of household consumption  $L$  over its lifetime is equal to 1.

$$L = \int C(a) da \dots\dots\dots (4.1)$$

Where  $L$  is consumption over life time

$C(a)$  is consumption of household aged  $a$ .

Even if no household saves over its life time, this life-cycle model shows that aggregate saving can still be positive, provided that there is positive growth in aggregate real income. With positive growth, the life time resources of young savers exceed those of old dissavers and there will be positive aggregate saving. Because incomes of younger earning households are higher than incomes of older, non-earning households, saving exceeds dissaving in the society as a whole.

The aggregate saving ratio is determined by the age profile of the average household's saving  $S(a) = E(a) - C(a)$ , where  $E(a)$  is income, and by the lifetime resources that each age group can mobilize. If  $V(a)$  is the ratio of lifetime resources of all households aged  $a$  to aggregate real income, then

$V(a) S(a)$  is the total saving of age group  $a$  as a fraction of aggregate real income. The aggregate saving ratio  $S$  is derived by summing across all age groups:

$$S = \int V(a) S(a) da \dots\dots\dots (4.2)$$

With steady-state growth,  $V(a)$  is independent of time and given by

$$V(a) = V(0) e^{-ga} \dots\dots\dots (4.3)$$

Where  $V(0)$  is the ratio of life time resources of newly formed households to aggregate real income,  
and  $g$  is the rate of growth in aggregate real income.

If  $g$  is zero, then

$$S = V(0) (1-L) = 0 \dots\dots\dots (4.4)$$

All aggregate real income is consumed because  $V(a)$  is a constant,  $L$  equals 1 and  $\int S(a)da$  is  $1-L$ .

With positive growth in aggregate real income, the lifetime resources  $V(a)$  of young savers exceed those of old dis-savers and there can be positive aggregate saving. This is the rate-of-growth effect. The rate-of-growth effect is itself determined by the relationship between income and consumption over the household's lifetime. Mason (1987) shows that the timing of household saving can be defined in terms of the mean ages of consumption and  $\mu_c$  and income  $\mu_y$ . These are the average ages weighted by (weighted by the values of consumption expenditure and income at each age) at which half-life time consumption and income are reached. The higher is the rate of economic growth, the richer is the current generation compared with the previous generation. The rate-of-growth effect can be positive only to the extent that households on average accumulate wealth when they are younger in order to dispose off these assets when they are older. In countries where households can borrow against future income, households

may have spent more than they have earned, in cumulative terms, for a large part of their lifetime. In this case, the rate-of-growth effect can be negative.

The aggregate saving ratio can be represented approximately as function of  $g$ ,  $L$ ,  $\mu_c$  and  $\mu_y$ . All factors that influence the aggregate saving ratio must enter through one of the four variables (Fry and Mason, 1982)

$$S = -\log (L) + (\mu_c - \mu_y)g..... (4.5)$$

Equation (4.5) allows factors that influence the timing of consumption or income over the lifecycle to enter the saving function interactively with the rate of growth of income.

The level of household consumption can be approximated by a log-linear function in a vector of independent variables  $Z$ .

$$L = e^{-\delta z} ..... (4.6)$$

The difference between the mean ages of consumption and income is represented by a linear function in the same vector of independent variables  $Z$ .

$$\mu_c - \mu_y = \beta Z..... (4.7)$$

substituting equations (4.6) and (4.7) into equation (4.5) gives

$$S = \delta z + \beta Zg..... (4.8)$$

The specific saving function to be used for empirical testing can be specified as follows:

$$SNY_t = a_{10} + a_{11}DEPR_t + a_{12}CRDAV_t + a_{13}RDI_t + a_{14} \ln RPB_t + a_{15} YG_t + a_{16}D + e_t ..... (4.9)$$

## Description of Variables

$SNY_t$  -National Saving Ratio = National Saving/Nominal GNP National Saving (which is the dependent variable) is calculated by subtracting foreign saving (SF) from domestic gross investment (Ig). Foreign saving is obtained by subtracting exports of goods and services (EX) and net factor income from abroad (NFI) from imports of goods and services (IM) as  $SF = IM - EX - NFI$

$DEPR_t$ -Dependency Ratio= $[(\text{Age} < 14) + (\text{Age} > 64)] / (\text{Age} 15 - 64)$

Mason (1981) shows that a rise in the population dependency ratio is likely to reduce the mean age of consumption but to have a relatively small effect on the mean age of earning. Hence an increase in the population dependency ratio reduces the rate-of-growth effect in the aggregate saving function. (Mason 1981, 1987; Fry and Mason 1982)

$YG_t$ - Growth Rate in Real GDP-which reflects the rate-of-growth effect in the life-cycle saving model. Theoretically a higher income growth in an economy will have a positive impact on the national saving ratio.

$CRDAV_t$ -Credit Availability-Calculated as the ratio of Domestic Credit to the Private Sector to Nominal GNP. This ratio is used as a proxy for the available credit in the domestic economy. As stated in Fry (1995) credit rationing is endemic in the developing world. Even where interest rates are relatively free for investment lending, there may be restrictions on consumer lending. If some households are liquidity-constrained consumer, an increase in credit availability will raise consumption and lower saving.

$RDI_t$ - Real Deposit Rate of Interest =  $(r - \text{inf}) / (1 + \text{inf})$ , where  $r$  is the nominal average twelve month deposit rate and  $\text{inf}$  is the change in the Addis Ababa price index. An increase in the real return on financial assets

raises the relative price of current to future consumption. If the substitution effect outweighs the income effect as posited by Olson and Bailey (1981), then the saving ratio rises with an increase in the domestic real interest rate.

$\ln RPB_t$ - Rural Population Per Bank Branch- this is the ratio of the rural population of Ethiopia divided by the number of rural bank branches existing in the country for each year of the study period (here all bank branches except those in Addis Ababa are included) This variable is used as a proxy for proximity or accessibility of depository institutions' branches in rural areas. Given other things increased bank proximity could raise the saving ratio.

D- Dummy Variable which is 0 for the pre liberalization period (1974-1992) and 1 for the post liberalization period (1992-2003)

$e_t$  – Disturbance Term

### 4.1.2 The Investment Function

#### a) Effect of Financial Conditions on the Volume of Investment

The particular investment function selected for empirical testing in this study is based on the “accelerator model”. As stated by Blejer and Khan (1984) and Fry (1989a, 1995) even though estimation of neoclassical investment functions for developing countries are difficult due to in availability of data on measures of the capital stock or its rate of return, there is little choice but to use some version of the accelerator model.

The accelerator model sets the desired capital stock  $K^*$  proportional to real output  $y$  as:

$$K^* = \delta y \dots\dots\dots (4.10)$$



This can be expressed in terms of a desired ratio of investment to output  $(I/Y)^*$  as:

$$(I/Y)^* = \delta \gamma \dots\dots\dots (4.11)$$

Where  $\gamma$  is the rate of growth in output.

The adjustment mechanism allows the actual investment ratio to adjust partially in any one period to the difference between the desired investment ratio and the investment ratio in the previous period:

$$\begin{aligned} \Delta(I/Y) &= \lambda [ (I/Y)^* - (I/Y)_{t-1} ] \\ \text{Or} \quad I/Y &= \lambda(I/Y)^* + (1 - \lambda)(I/Y)_{t-1} \dots\dots\dots (4.12) \end{aligned}$$

Where  $\lambda$  is the coefficient of adjustment. The flexible accelerator model allows economic conditions to influence the adjustment coefficient  $\lambda$ . Specifically,

$$\lambda = \beta_0 + \left[ \frac{\beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \dots}{(I/Y)^* - (I/Y)_{t-1}} \right] \dots\dots\dots (4.13)$$

Where  $Z_i$  are the variables (including an intercept term for the depreciation rate) that affect  $\lambda$ .

The partial adjustment mechanism specified for the investment ratio is somewhat more complicated than the equivalent mechanism for the level of investment. Specifically, there could be a lag in achieving the same investment ratio this year as last year if output rose rapidly last year; this year's desired investment level will be higher than last year's, despite a constant desired ratio of investment to output. To incorporate this adjustment lag, last year's growth rate  $\gamma_{t-1}$  can be included as an additional explanatory variable. (Fry, 1995)

Based on the theoretical foundations of the flexible accelerator model the specific saving function to be estimated in this study can be specified as follows:

$$DIY_t = b_0 + b_1CRDAV_t + b_2Yg_t + b_3CRGOV_t + b_4lnREXR_t + b_5FL_t + b_6D + e_t \quad (4.14)$$

**Description of Variables**

**DIY<sub>t</sub>** – Investment Ratio- This is the dependent variable, which is calculated as the ratio of Total Domestic Investment (capital formation) to Nominal GNP.

**CRDAV<sub>t</sub>**- Credit Availability- This variable is calculated as the ratio between Domestic Private Sector Credit and Nominal GNP. Blinder and Stiglitz (1983), Fry (1980b) and Keller (1980) emphasize that the availability of institutional credit can be an important determinant of the investment ratio in developing countries. They argue that, banks specialize in acquiring information on default risk. Such information is highly specific to each client and difficult to sell. Hence the market for bank loans is a customer market, in which borrowers and lenders are imperfect substitutes. A credit squeeze rations out some bank borrowers who may be unable to find loans elsewhere and so be unable to finance their investment projects. Therefore the availability of credit to the private sector is expected to have a positive relationship with the investment ratio.

**Yg<sub>t</sub>** – Growth in Real GDP – Theoretically growth in real output is expected to affect the investment ratio positively.

**CRGOV<sub>t</sub>** – Credit to Government- This variable is calculated as the ratio of Net Domestic Credit to Government to Total Domestic Credit. This

variable is used here as a proxy for the general state of macroeconomic management and the crowding out effect on domestic private investment. As emphasized by Hamilton and Flavin (1986) the weaker is fiscal performance, as proxied by the ratio, Net Domestic Credit to Government, the greater is the probability of increased asset taxation in the future. For this reason, a higher value of CRGOV would deter domestic investment.

$\ln \text{REXR}_t$  – Real Exchange Rate =  $[\text{D GNP D} / \text{US WPI}] * 1 / \text{OFF RATE}$ , where D GNP D is Domestic GNP Deflator, US WPI is US Whole Sale Price Index and OFF RATE is Domestic Currency per US dollar. This variable is used as a proxy for the price of non-tradable goods in relation to import prices. Fry (1995) states that the price of intermediate imports may affect the profitability of investment projects in developing countries. Therefore, a higher value REXR implies a lower relative price of imports. By appreciating the real exchange rate, capital inflows may stimulate investment.

$\text{FL}_t$  – Foreign Liabilities – This is the cumulated end of year net foreign liabilities scaled by nominal GNP. It serves as a proxy for the country-specific risk premium (Dooley 1986, Edwards 1986). This ratio may affect the investment ratio negatively either because it reduces the expected net return to domestic investment or because it reflects a higher cost of investible funds.

D- Dummy Variable, which is 0 for the pre liberalization period (1974-1992) and 1 for the post liberalization period (1992-2003)

$\epsilon_t$  – Disturbance Term

**b) Efficiency of Investment**

If financial intermediaries allocate investible funds more efficiently than other allocative mechanisms, then raising real deposit rates of interest up to the point where interest rates reach their competitive free-market levels will improve the quality of investment (Fry, 1995) Real interest rates could influence the average efficiency of investment in the ways suggested by Galbis (1977), Mckinnon (1973), and Shaw (1973)

Mckinnon(1991) shows the derivation of the average efficiency of investment which is monotonically related to the incremental output/capital ratio  $\sigma$ , using the traditional Harrod-Domar one sector growth model as follows:

$$Y = \sigma K..... (4.15)$$

Equation (4.15) is a valid representation of the productivity of capital in the presence of unlimited supplies of labor if the real wage is fixed (Kapur, 1986). Then any increase in K is implicitly associated with proportional increases in the supply of labor. We can now represent the change in output growth dY as:

$$dY = \sigma dK + Kd\sigma, \text{ where } dK=I=S .....(4.16)$$

Where d is the differential operator.

Equation (4.16) partitions the sources of growth into that associated with new investment for a given  $\sigma$  and increases in  $\sigma$  for a given capital stock. The impact of new investment per se on output growth is captured by the first term on the right-hand side.

The familiar Harrod-Domar growth model assumes that the second term on the right-hand side of equation (4.16) is zero; then dividing through by Y, we get

$$dY/Y = \sigma(I/Y) = \sigma s, \text{ Where } s = S/Y \dots \dots \dots (4.17)$$

The rate of growth for a single country is simply the propensity to save times the average (marginal) productivity of capital; incremental output/capital ratio (IOCR).

By construction then,

$$IOCR = \frac{dY/Y}{(I/Y)} = \sigma \dots \dots \dots (4.18)$$

Gelb (1989) partitioned the sources of output growth from increases in the real deposit rate of interest as follows. Differentiate (4.17) with respect to the real deposit rate of interest RR to get:

$$\frac{\partial dY/Y}{\partial(RR)} = \frac{\partial(IOCR)}{\partial(RR)} [(I/Y)] + \frac{\partial(I/Y)}{\partial(RR)} IOCR \dots \dots \dots (4.19)$$

For explaining output growth rates across countries, Gelb then assessed the relative importance of the two terms on the right hand side of (4.19): the efficiency effect, measured by weighted changes in IOCR, versus the investment effect, measured by weighted cross-country differences in investment as a share of GDP. He then found that the efficiency effect was almost four times as important as the investment effect in explaining differences in real GDP growth across his sample of thirty-four countries. Higher real deposit rates of interest had their major impact through increased investment efficiency (as measured by IOCRs) rather than through investment or aggregate saving as a share of GDP.

The specific model to be used for empirical testing in this study can then be formulated as:

$$IOCR_t = c_0 + c_1 RDI_t + c_2 D + e_t \dots \dots \dots (4.20)$$

### Description of Variables

$IOCR_t$  – Incremental Output Capital Ratio =  $Yg/(Inv/GDP)$ , where  $Yg$  is the growth rate in real GDP,  $Inv/GDP$  is domestic Investment (capital formation) to GDP ratio. It is the dependent variable.

$RDI_t$  – Real Deposit Rate of Interest, which is calculated as the ratio between the nominal deposit rate of interest and the annual percentage change in the Addis Ababa CPI, using the formula presented above. The real deposit rate of interest is expected to affect the efficiency of investment  $IOCR$  positively.

$D$ - Dummy Variable, which is 0 for the pre liberalization period (1974-1992) and 1 for the post liberalization period (1992-2003)

$\epsilon_t$  – Disturbance Term

### 4.1.3 Inflation

To test the impact of financial reform on one of the major macroeconomic variables, inflation, I have used Fry's (1995) model, in which inflation is determined explicitly as the difference between growth rates in per capita nominal money supply and per capita real money demand. It states that, provided that the money market clears within the time period under consideration, inflation can be explained proximately by the rate of change in nominal money supply and the determinants of the rate of change in real money demand. The equilibrium condition in the money market can be expressed:

$$M^s = M^d \dots\dots\dots (4.21)$$

$$\text{Or } M^s = P \cdot N \cdot m^d \dots\dots\dots (4.22)$$

Where  $M^s$  is the nominal money supply (broadly defined to include saving/time deposits as well as currency in circulation and demand deposits –  $M^2$ ),  $M^d$  is nominal money demand,  $P$  is the price level,  $N$  is population and  $m^d$  is per capita demand for real money balances  $(M^d/P)/N$ . It seems reasonable to expect the market clearing or equilibrium condition – Short-run demand equal to supply – to hold for annual models applied to most developing economies because of the prevalence of auction markets. (Fry, 1995)

Equation (4.22) can be expressed in first difference logarithmic form:

$$\Delta \log(M^s) = \Delta \log(P) + \Delta \log(N) + \Delta \log(m^d) \dots \dots \dots (4.23)$$

Which can be rearranged:

$$\Pi = \Delta \log(M^s/N) - \Delta \log(m^d) \dots \dots \dots (4.24)$$

Where  $\Pi$  is the continuously compounded rate of change in the price level  $\Delta \log (P)$

The inflationary process can be understood fully only through an analysis of the determinants of both nominal money supply and real money demand. However provided that any feedback from inflation to money supply growth occurs with a lag, the model is recursive (Aghveli and Khan, 1977). In such case, changes in the nominal money supply can be treated as if they were exogenous for the purpose of estimating inflation.

Real money demand is invariably specified as a function of one or more price (interest rate) variables and a budget constraint. Here the price variable is the real deposit rate of interest  $d - \Pi^e$  and the budget constraint is per capita permanent or expected real income  $y_p$ . The long-run or desired money demand function takes the standard form:

$$m^* = cy_p^b e^{a(d - \Pi^e)} \dots \dots \dots (4.25)$$

Where  $m^*$  is the long-run or desired level of real money balances and  $a$ ,  $b$  and  $c$  are constants.

The actual level of real money balances may be adjusted with a lag to changes in the determinants of money demand. To allow for this, short-run or actual money demand is specified:

$$\log(m^d) = \log(m_{t-1}) + \theta[\log(m^*) - \log(m_{t-1})] \dots \dots \dots (4.26)$$

some fraction  $\theta$  of the gap between desired money balances and money balances held in the previous time period is eliminated in the current period. Equations (4.26) and (4.27) can be combined and expressed in first difference logarithmic form:

$$\Delta \log(m^d) = \theta b \Delta \log(y_p) + \theta a \Delta(d - \Pi^e) + (1 - \theta) \Delta \log(m_{t-1}) \dots \dots \dots (4.27)$$

Now defining  $\gamma^e$  as the rate of change in per capita permanent income  $\Delta \log(y_p)$  and substituting equation (4.27) into equation (4.24):

$$\Pi = \Delta \log(M_s/N) - \theta b \gamma^e - \theta a \Delta(d - \Pi^e) - (1 - \theta) \Delta \log(m_{t-1}) \dots \dots \dots (4.28)$$

Based on the above theoretical foundation the empirical model to test the response of inflation for changes in the financial variables can be formulated as follows:

$$INF_t = d_0 + d_1 MS_t + d_2 PCY_t + d_3 RDI_t + d_4 D + e_t \dots \dots \dots (4.29)$$



## Description of Variables

$INF_t$  – Inflation Rate – This is the dependent variable, which is calculated as the percentage change in the annual Addis Ababa CPI.

$MS_t$  – Growth in Per Capita Stock of Money =  $\Delta (M2_t/POP_n_t)$ , where  $M2_t$  is broad money supply at year  $t$  (= demand deposit + currency in circulation + quasi money/saving & time deposit/) and  $POP_n_t$  is the total number population of Ethiopia at year  $t$ . Theoretically growth in the money supply is expected to affect the inflation rate positively.

$PCY_t$  – Per Capita Income Growth =  $\Delta (Y_t/POP_n_t)$ , where  $Y_t$  is Real GDP at year  $t$  and  $POP_n_t$  is the total number population of Ethiopia at year  $t$ . Fry (1995) states that if actual price level or inflation exceeds expected price or inflation, entrepreneurs interpret the difference to reflect a real increase in the demand for their products. Their response is to raise the rate of capacity utilization of existing capital to increase output in the short run, and to invest more to increase capacity in the long run. Which reflects the positive relationship between output or per capita income growth and inflation.

$RDI_t$  – Real Deposit Rate of Interest- Calculated as in the above functions. Kapur (1976a), Mathieson (1980) and Fry (1980b) all conclude that an increase in the nominal deposit rate of interest that raises the real deposit rate towards its competitive free-market equilibrium level may reduce the inflation rate.

$D$ - Dummy Variable, which is 0 for the pre liberalization period (1974-1992) and 1 for the post liberalization period (1992-2003)

$e_t$  – Disturbance Term

#### **4.1.4 Economic Growth and Financial Variables**

“A simple way of discriminating between the Mckinnon-Shaw school and others would be to examine episodes of financial liberalization and see whether or not these were accompanied by higher or lower rates of economic growth. In practice, however, most clear-cut cases of financial liberalization were accompanied by other economic reforms (such as fiscal, international trade and foreign exchange reforms). In such cases it is virtually impossible to isolate the effects of financial components of the reform package. This is unfortunate, since causality can be inferred when financial conditions have been deliberately and substantially changed, as in the case of discrete financial liberalization. Examining the association between financial conditions and economic growth over time provides in itself no evidence of causality.” (Fry, 1995) With this caveat however many empirical works, relating financial episodes and economic growth, have been done as indicated in the empirical literature part of this paper.

The effect of financial conditions on economic growth can also be calculated in the medium run indirectly from the effects of disequilibrium real deposit rates on saving and investment ratios section 4.1.1, 4.1.2 and 4.1.3. Khan and Reinhart (1990) show that, since credit availability is an important determinant of private investment, the effect of financial conditions on growth may occur through this channel.

Given these facts, I have tried to assess the impact of financial conditions on economic growth in Ethiopia by incorporating financial variables other than the real deposit rate of interest based on the arguments of King and Levine (1993a, 1993b, 1993c)

The empirical model can be stated as follows:

$$PCY_t = f_0 + f_1 LLY_t + f_2 DCR_t + f_3 DCRY_t + f_4 D + e_t, \dots \quad (4.30)$$

### **Description of Variables**

$PCY_t$  – Per Capita Income Growth –Dependent variable, calculated based on the formula given in the above section.

$LLY_t$  – Growth in Liquid Liabilities =  $\Delta (M2_t/GDP_t)$ , where  $M2_t$  is broad money supply at year t (= demand deposit + currency in circulation + quasi money/saving & time deposit/) This variable is selected to see the impact of financial deepening or the degree of monetization on economic growth. Theoretically it is expected to have a positive relationship with per capita income growth.

$DCR_t$  – Private Sector Credit to Aggregate Domestic Credit – This variable is the ratio between private sector credit to total domestic credit at year t.

$DCRY_t$  – Private sector credit to GDP – This is the ratio of total private sector credit to GDP at year t.

Both the above variables are expected to affect PCY positively.

D- Dummy Variable which is 0 for the pre liberalization period (1974-1992) and 1 for the post liberalization period (1992-2003)

$e_t$  – Disturbance Term

## CHAPTER FIVE

### Data Description and Estimation Procedure

#### 5.1 Type and Source of Data

The data used for estimation purpose in this study is a secondary annual time series data collected from different sources i.e National Bank of Ethiopia, Ethiopian Economic Association, Ministry of Economic Development and Cooperation and Central Statistical Authority. Data on rural bank branch network was collected from the head offices of each bank both government (Commercial Bank of Ethiopia, Construction and Business Bank and Development Bank of Ethiopia) and private (Awash International Bank, Dashen Bank, Wogagen Bank, Abyssinia Bank, Nib International Bank and United Bank S.C) which are currently operating in the country. The latest edition of IMF CD-ROM database has also been used for comparison purposes.

The data period is from 1974 – 2003 G.C. Standard definitions and calculations have been applied, as shown in the description of each variable, to the crude data to arrive at the final data to be estimated.

#### 5.2 Estimation Procedure

Since the data used for estimation in this study is a time series data, let us first look at its basic features that could lay down the basis for estimation.

**Stochastic process** – from a theoretical point of view a time series is a collection of random variables  $\{x_t\}$ . Such a collection of random variables ordered in time is called a *stochastic process*. The word stochastic has a Greek origin and means *pertaining to change*.

**Stationarity** – A time series is said to be strictly stationary if the joint distribution of  $X_{t1}, \dots, X_{tn}$  is the same as the joint distribution of  $X_{t1+\tau}, \dots, X_{tn+\tau}$  for all  $t1, \dots, tn$ , and  $\tau$ . The distribution of the stationary process remains unchanged when shifted in time by an arbitrary value  $\tau$ . Thus the parameters, which characterize the distribution of the process, do not depend on  $t$ , but on the lag  $\tau$ .

A process  $X_t$  is said to be second-order/ weak/ wide sense/ covariance stationary if :

Mean:  $E(X_t) = E(X_{t+\tau}) = \mu$  (a constant)

Variance:  $E(X_t^2) = E(X_{t+\tau}^2) = \sigma^2$  (a constant)

Covariance:  $Cov(X_{t1}, X_{t2}) = Cov(X_{t1+\tau}, X_{t2+\tau}) = \gamma_{t1,t2} = \gamma_\tau$

Where  $t1 - t2 = \tau$

In modeling time series, second-order stationarity is the most commonly used form of stationarity. (Madalla and Kim, 1998)

**Integrated Variables and Cointegration** – In time series analysis we are not always lucky to work with stationary data. Most macroeconomic data we encounter are nonstationary. If we consider the following two processes  $x_t$  and  $y_t$

$$x_t = \rho x_{t-1} + u_t, \quad |\rho| < 1$$

$$y_t = y_{t-1} + v_t$$

the error terms  $u_t$  and  $v_t$  are assumed to be normally independently identically distributed with mean zero and unit variance,  $u_t, v_t \sim iin(0,1)$ , i.e., a purely random process. Both  $x_t$  and  $y_t$  are AR(1) models. The difference between the models is that  $y_t$  is a special case of an  $x_t$  process when  $\rho = 1$  and is called a *random walk model*. It is also referred to as an AR(1) model with a unit root since the root of the AR(1) equation is 1. When we consider the statistical behavior of the two processes by investigating the mean, the

variance and autocovariance, they are completely different. Although the two processes belong to the same AR(1) class,  $x_t$  is stationary process, while  $y_t$  is a nonstationary process. The variance and covariance of  $y_t$  are functions of  $t$ , while those of  $x_t$  converge to a constant asymptotically. Thus as  $t$  increases the variance of  $y_t$  increases, while the variance of  $x_t$  converges to a constant.

Since the variance of the nonstationary series is not constant over time (not covariance stationary or just not stationary), the conventional asymptotic theory cannot be applied for these series. One of the easiest ways to analyze those series is to make those series stationary by differencing as follows:

$$\Delta y_t = y_t - y_{t-1} = (1 - L)y_t = e_t \dots\dots\dots(5.1)$$

Where  $L$  is the lag operator. Since the error  $e_t$  is assumed to be independently normal, the first difference of  $y_t$  is stationary. The variance of  $\Delta y_t$  is constant over the sample period. When the nonstationary series needs to be transformed to the stationary series by differencing once, the series is said to be *integrated of order 1* and is denoted by  $I(1)$ . If the series needs to be differenced  $k$  times to be stationary, then the series is said to be  $I(k)$ .

Most econometric analysis is based on the variance and covariance among the variables. For example, the OLS estimator from the regression of  $y_t$  on  $x_t$  is the ratio of the covariance between  $y_t$  and  $x_t$  to the variance of  $x_t$ . Thus if the variances of the two variables behave differently, the conventional asymptotic theory cannot be applicable. When the order of integration is different, the variance of each process behaves differently. For example, if  $y_t$  is an  $I(0)$  variable and  $x_t$  is an  $I(1)$ , the OLS estimator from the regression of  $y_t$  on  $x_t$  converges to zero asymptotically, since the denominator of the OLS estimator, the variance of  $x_t$ , increases as  $t$  increases, and thus it dominates the numerator, the covariance between  $x_t$  and  $y_t$ . That is, the OLS estimator does not have an asymptotic distribution.

**Cointegration** An important property of  $I(1)$  variables is that there can be linear combinations of these variables that are  $I(0)$ . If this is so then these variables are said to be *cointegrated*. The concept of *cointegration* was introduced by Granger (1981). Suppose that we consider two variables  $y_t$  and  $x_t$  that are  $I(1)$ . Then  $y_t$  and  $x_t$  are said to be cointegrated if there exists a  $\beta$  such that  $y_t - \beta x_t$  is  $I(0)$ . This is denoted by saying that  $y_t$  and  $x_t$  are  $CI(1,1)$ . More generally, if  $y_t$  is  $I(d)$  and  $x_t$  is  $I(d)$ , then  $y_t$  and  $x_t$  are  $CI(d,b)$  if  $y_t - \beta x_t$  is  $I(d-b)$  with  $b > 0$ . What this means is that the regression equation

$$y_t = \beta x_t + u_t$$

makes sense because  $y_t$  and  $x_t$  do not drift too far apart from each other over time. Thus, there is a long-run equilibrium relationship between them. If  $y_t$  and  $x_t$  are not cointegrated, that is  $y_t - \beta x_t = u_t$  is also  $I(1)$ , then  $y_t$  and  $x_t$  would drift apart from each other over time. In this case the relationship between  $y_t$  and  $x_t$  that we obtain by regressing  $y_t$  and  $x_t$  would be *spurious*.

**Cointegration and Error Correction** A principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. If the system is to return to the long-run-equilibrium, the movements of at least some of the variables must respond to the magnitude of the disequilibrium. (Enders, 1995) For example, theories of the term structure of interest rates imply a long-run relationship between long and short-term rates. If the gap between the long and short-term rates is “large” relative to the long-run relationship, the short-term rate must ultimately rise relative to the long-term rate. The gap can be closed by (1) an increase in the short-term rate and/or a decrease in the long-term rate, (2) an increase in the long-term rate but a commensurately larger rise in the short-term rate., or (3) a fall in the long-term rate but a smaller fall in the short-term rate. Enders asserts that without a full dynamic specification of the model, it is not possible to determine which of the possibilities will occur. Nevertheless, the short-run dynamics must be influenced by the deviation from the long-run relationship.

The dynamic model implied by the above discussion is one of *error correction*. In an error-correction model, the short-term dynamics of the variables in the system are influenced by the deviation from equilibrium.

Having seen the basic characteristics of a time series data, let us now proceed to the different techniques of the testing procedure i.e Johansen Maximum Likelihood Testing Procedure (the one used in this study) and the Engle-Granger Methodology.

**Testing for Cointegration** There are two important ways to test for cointegration. The Engle-Granger (1987) methodology seeks to determine whether the residuals of the equilibrium relationship are stationary. The Johansen (1988) and Stock-Watson (1988) methodologies determine the rank of cointegration.

When we compare the two methods, the Johansen procedure is found more superior in many ways. First the Engle-Granger methodology is sensitive to the variable selected for normalization. This means if we have a regression of  $Y_t$  on  $Z_t$ , it is possible that we may find the variables are cointegrated, whereas reversing the order (i.e regression of  $Z_t$  on  $Y_t$ ) might indicate no cointegration. In addition to this, in tests using three or more variables, we know that there may be more than one cointegrating vector, but the method has no systematic procedure for the separate estimation of the multiple cointegrating vectors.

Another serious defect of the Engle-Granger procedure is, it relies on a two step-estimator. The first step is to generate the error series ( $e_t$ ) and the second step uses these generated errors to estimate a regression of the form  $\Delta e_t = a_1 e_{t-1} + \dots$ . Thus, the coefficient of  $a_1$  is obtained by estimating a regression using the residuals from another regression. Hence, any error introduced by the researcher in step 1 is carried into step 2. (See Enders 1995, Madalla and kim 1998). Due to these defects of the Engle-Granger



methodology, the Johansen (1988) maximum likelihood estimation procedure is used in this study.

The Johansen procedure as opposed to the Engle-Granger methodology doesn't take any variable as exogenous a priori. The core of the procedure involves determining the number of cointegrating vectors in a system of equations and thereby the exogenous and endogenous variables.

If we have for instance a multivariate model generalized to allow for a higher-order autoregressive process:

$$x_t = A_1x_{t-1} + A_2x_{t-2} + ..... + A_px_{t-p} + e_t .....(5.2)$$

Where  $x_t$  = the (nx1) vector ( $x_{1t}, x_{2t}, ..... ,x_{nt}$ )  
 $e_t$  = is an independently and identically distributed n-dimensional vector with zero mean and variance vector  $\Sigma_e$

Equation (5.2) can be put in a more usable form by subtracting  $x_{t-1}$  from each side to obtain:

$$\Delta x_t = (A_1 - I)x_{t-1} + A_2x_{t-2} + A_3x_{t-3} + ..... + A_px_{t-p} + e_t .....(5.3)$$

Now by adding and subtracting  $(A_1 - I)x_{t-2}$  we obtain

$$\Delta x_t = (A_1 - I) \Delta x_{t-1} + (A_2 + A_1 - I)x_{t-2} + A_3x_{t-3} + ... + A_px_{t-p} + e_t .....(5.4)$$

Continuing in this fashion, we get:

$$\Delta x_t = \sum \pi_i \Delta x_{t-i} + \pi x_{t-p} + e_t .....(5.5)$$

Where 
$$\pi = - (I - \sum_{i=1}^p A_i)$$

$$\pi_i = - \left( I - \sum_{j=1}^i A_j \right)$$

The key feature to note in (5.5) is the rank of the matrix  $\pi$ ; the rank of  $\pi$  is equal to the number of independent cointegrating vectors. If rank of  $(\pi) = 0$ , the matrix is null and (5.5) is the usual VAR in first differences. Instead, if  $\pi$  is rank of  $n$ , the vector process is stationary. In intermediate cases, if rank  $(\pi) = 1$ , there is a single cointegrating vector and the expression  $\pi x_{t-p}$  is the error correction factor. For other cases in which  $1 < \text{rank}(\pi) < n$ , there are multiple cointegrating vectors. The number of distinct cointegrating vectors can be obtained by checking the significance of the characteristic roots of  $\pi$ <sup>10</sup>

The test for the number of characteristic roots that are insignificantly different from unity can be conducted using the following two test statistics.

$$\lambda_{\text{trace}}(r) = -T \sum \ln(1 - \lambda_i^*)$$

$$\lambda_{\text{max}}(r, r+1) = -T \ln(1 - \lambda_{r+1}^*)$$

Where,  $\lambda_i^*$  = the estimated values of the characteristic roots (also called eigen values) obtained from the estimated  $\pi$  matrix.

$T$  = the number of usable observations.

---

<sup>10</sup> We know that the rank of a matrix is equal to the number of its characteristic roots that differ from zero. Suppose we obtained the matrix  $\pi$  and ordered the  $n$  characteristic roots such that  $\lambda_1 > \lambda_2 > \dots > \lambda_n$ . If the variables in  $x_t$  are not cointegrated, the rank  $\pi$  is zero and all the characteristic roots will equal zero. Mathematically characteristic roots are defined as follows:

The first statistic (trace test) tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to  $r$  against a general alternative. The second statistic (the maximum eigen value test) tests the null hypothesis that the number of cointegrating vectors is  $r$  against the alternative of  $(r + 1)$  cointegrating vectors.

In order to test restrictions on the cointegrating vectors, Johansen defines the two matrices  $\alpha$  and  $\beta$ , both of dimension  $(n \times r)$ , where  $r$  is the rank of  $\pi$ . The properties of  $\alpha$  and  $\beta$  are such that

$$\Pi = \alpha \beta'$$

, The matrix  $\beta$  is the matrix of cointegrating parameters and the matrix  $\alpha$  the matrix of weights with which each cointegrating vector enters the  $n$  equations of the VAR. In a sense,  $\alpha$  can be viewed as the matrix of the speed of adjustment parameters.

---

Let  $A$  be an  $(n \times n)$  square matrix with elements  $a_{ij}$  and  $x$  an  $(n \times 1)$  vector. The scalar  $\lambda$  is called a characteristic root of  $A$  if :

$$Ax = \lambda x \dots\dots\dots(a)$$

Let  $I$  be an  $(n \times n)$  identity matrix, so that we rewrite (a) as

$$Ax - \lambda x = 0$$

Or

$$(A - \lambda I)x = 0 \dots\dots\dots(b)$$

Since  $x$  is a vector of cointegrating values not identically equal to zero, (b) requires that the rows of  $(A - \lambda x)$  be linearly dependent. Equivalently (b) requires that the determinant  $|A - \lambda x| = 0$  Thus we can find the characteristic roots of (a) by finding the values that satisfy  $|A - \lambda I| = 0$

Due to the cross-equation restrictions, it is not possible to estimate  $\alpha$  and  $\beta$  using OLS. (See Enders, 1995). However, with maximum likelihood estimation it is possible to

- 1) estimate (5.2) as an error-correction model
- 2) define the rank of  $\pi$
- 3) use the  $r$  most significant vectors to form  $\beta'$ , and
- 4) select  $\alpha$  such that  $\Pi = \alpha \beta'$

Using  $\alpha$  and  $\beta'$  equation (5.5) for the case of a single cointegrating vector (rank of  $(\pi) = 1$ ) can be formulated in a matrix form:

$$\Delta x_t = \sum_{i=1}^{p-1} \pi_i \Delta x_{t-i} + \alpha \beta' x_{t-p} + e_t \dots\dots\dots(5.6)$$

Where the single cointegrating vector is

$\beta = (1, \beta_2, \beta_3, \dots, \beta_n)'$  and the speed of adjustment parameters are given by

$$\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n)'$$

once  $\alpha$  and  $\beta'$  are determined, testing various restrictions on  $\alpha$  and  $\beta'$  is straight forward: if there are  $r$  cointegrating vectors, only these  $r$  linear combinations of the variables are stationary. Thus the test statistic involve comparing the number of cointegrating vectors under the null and alternative hypothesis. Let  $\lambda^*_1, \lambda^*_2, \dots, \lambda^*_n$  and  $\lambda^{\sim}_1, \lambda^{\sim}_2, \dots, \lambda^{\sim}_n$  denote the ordered characteristic roots of the unrestricted and restricted models, respectively. To test restrictions on  $\beta$ , form the test statistic:

$$T \sum_{i=1}^r [ \ln (1 - \lambda^{\sim}_i) - \ln(1 - \lambda^*_i) ] \dots\dots\dots(5.7)$$

Asymptotically, this statistic has a  $\chi^2$  distribution with degrees of freedom equal to the number of restrictions placed on the  $\beta$ . Small values of  $\lambda^{\sim}_i$  relative to  $\lambda^*_i$  (for  $i \leq r$ ) imply a reduced number of cointegrating vectors.

Hence, the restriction embedded in the null hypothesis is binding if the calculated value of the test statistic exceeds that in a  $\chi^2$  table.

Restrictions on  $\alpha$  can be tested in the same way. The procedure is to restrict  $\alpha$  and compare the  $r$  most significant characteristic roots for the restricted and unrestricted models using (5.7). If the calculated value of (5.7) exceeds that from a  $\chi^2$  table, with degrees of freedom equal to the number of restrictions placed on  $\alpha$ , the restrictions can be rejected.

## **CHAPTER SIX**

### **Estimation Results and Discussion**

In the previous chapter I have tried to show the basic characteristics of a time series data and the different testing procedures I have used in estimating the five basic macroeconomic functions (i.e saving, investment-its volume and the IOCR, inflation and economic growth) that are selected to assess the impact of financial reform on the macroeconomic conditions of Ethiopia. As I have described in the "data type" section, the data used for estimation of the five functions is a time series data covering the period 1974-2003 G.C. Let us now return to the results obtained for each function:

#### **6.1 The Saving Function**

It is to be well remembered that the specific saving function selected as a theoretical foundation for the derivation of the empirical model in this study was the "life cycle model" Accordingly all the variables entering into the saving function were indicated in equation (4.9). The first step taken was to test for the order of integration of each variable. To this end the ADF test statistic was used and the result indicated that the null of unit root could not be rejected at levels for all variables at 5% significance level, whereas the null of unit root was rejected at differences for the same significance level which leads us to the conclusion that all the variables in the saving function are  $I(1)$  (see table (6.1) for unit root test results).

**Table 6.1 Results of Unit Root Tests for Order of Integration of Variables in the saving function.**

| Variables             | ADF test statistic           |                 |                                  |
|-----------------------|------------------------------|-----------------|----------------------------------|
|                       | No Constant and Linear Trend | With a Constant | With a Constant and Linear Trend |
| SNY <sub>t</sub>      | -1.721023                    | -3.242486       | -3.289787                        |
| CRDAV <sub>t</sub>    | 0.102051                     | -1.684999       | -2.689366                        |
| DEPR <sub>t</sub>     | 0.377804                     | -2.224556       | -1.942866                        |
| RDI <sub>t</sub>      | 0.018081                     | -6.388944       | -4.008137                        |
| lnRPB <sub>t</sub>    | -0.502998                    | -0.328600       | -2.421461                        |
| YG <sub>t</sub>       | 0.119066                     | -5.525647       | -5.604371                        |
| ΔSNY <sub>t</sub> *   | -6.813933                    | -6.693290       | -5.098358                        |
| ΔCRDAV <sub>t</sub> * | -3.30186                     | -3.326808       | -3.267339                        |
| ΔDEPR <sub>t</sub> *  | -4.356498                    | -4.321141       | -5.374189                        |
| ΔRDI <sub>t</sub> *   | -5.270956                    | -5.138209       | -5.094910                        |
| ΔLRPB <sub>t</sub> *  | -3.540272                    | -3.529063       | -4.012363                        |
| ΔYG <sub>t</sub> *    | -11.27106                    | -11.06964       | -11.00220                        |

\* Shows significance at 5% level.

After checking the variables for their order of integration and based on the finding that all the variables are I(1), the next step is to test for cointegration among the variables. As it is shown in the previous chapter we will use the two Johanson’s test statistics namely the λ<sub>trace</sub> (r) “trace” and λ<sub>max</sub> (r, r+1) “maximum eigen value” tests to know the rank of matrix π. It should be noted here that in the Johansen maximum likelihood estimation procedure there is no a priori categorization of the variables as exogenous and endogenous. Therefore we can represent all the variables in the saving function by the vector x<sub>t</sub> and write the multivariate vector autoregressive process of order p as:

$$x_t = A_1x_{t-1} + A_2x_{t-2} + .....+ A_px_{t-p} + e_t..... (6.1)$$

which can be solved (see the previous chapter) to form

$$\Delta x_t = \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \Gamma_p x_{t-p} + e_t$$

Or  $\Delta x_t = \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \alpha \beta' x_{t-p} + e_t ..... (6.2)$

Which is the Vector Error Correction Model (VECM) counterpart of equation (6.1). Once we have the representation of our model as (6.2), our task will be to determine the number of cointegrating vectors and estimate  $\beta$  and  $\alpha$ , which are a vector of long-run parameters and speed of adjustment to disequilibrium respectively. The results of cointegration test are summarized in table (6.2) below.

**Table 6.2 Results of tests for cointegration among variables**

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Trace<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|--------------------|------------------------|---------|
| None *                       | 0.787030   | 112.9234           | 103.8473               | 0.0109  |
| At most 1                    | 0.635448   | 69.61852           | 76.97277               | 0.1594  |
| At most 2                    | 0.490181   | 41.36411           | 54.07904               | 0.4036  |
| At most 3                    | 0.436800   | 22.50051           | 35.19275               | 0.5618  |
| At most 4                    | 0.176624   | 6.425156           | 20.26184               | 0.9301  |
| At most 5                    | 0.034517   | 0.983560           | 9.164546               | 0.9536  |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Max-Eigen<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None *                       | 0.787030   | 43.30486               | 40.95680               | 0.0267  |
| At most 1                    | 0.635448   | 28.25442               | 34.80587               | 0.2452  |
| At most 2                    | 0.490181   | 18.86359               | 28.58808               | 0.5031  |
| At most 3                    | 0.436800   | 16.07535               | 22.29962               | 0.2929  |
| At most 4                    | 0.176624   | 5.441596               | 15.89210               | 0.8471  |
| At most 5                    | 0.034517   | 0.983560               | 9.164546               | 0.9536  |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

It is clear from the results of cointegration test that both the trace and maximum eigen value statistic identify only one cointegrating vector; the null of  $r = 0$  against the general alternative  $r \leq n-1$  is rejected at the 5%



level of significance, which assures us the existence of at least one cointegrating vector; and, the maximum eigen value statistic test rejects the null of  $r = 0$  against  $r = 1$  which again assures us the existence of one cointegrating vector.

Once we identify the existence of one cointegrating vector, the next step is to determine the  $\beta$  and  $\alpha$  coefficients. By normalizing the cointegrating coefficient of  $SNY_t$ , which is the dependent variable in our saving function, we obtain the following results.

The  $\beta$  vector is given by:

$$\begin{array}{cccccc}
 [\beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} & \beta_{16}] \\
 SNY_t & CRDAV_t & DEPR_t & \ln RPB_t & RDI_t & YG_t \\
 [1.000000 & 0.033281 & -0.053818 & -0.020411 & 0.034793 & 0.007267]
 \end{array}$$

and the  $\alpha$  vector is given by :

$$\begin{pmatrix} D(SNY_t) \\ D(CRDAV_t) \\ D(DEPR_t) \\ D(\ln RPB_t) \\ D(RDI_t) \\ D(YG_t) \end{pmatrix} = \begin{pmatrix} -0.542982 \\ 0.418249 \\ -0.000248 \\ -0.139699 \\ -39.13858 \\ -101.3947 \end{pmatrix} = \begin{pmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \\ \alpha_{51} \\ \alpha_{61} \end{pmatrix}$$

Having estimated the  $\beta$  and  $\alpha$  coefficients, we have to be assured of the endogeneity of our dependent variable  $SNY_t$  and the exogeneity of the other remaining variables in our hypothesized function. To this end, we restrict the values of the  $i^{th}$  row of the  $\alpha$  matrix to be zero and if we cannot reject the restriction, then the  $i^{th}$  variable in the  $\alpha$  matrix is said to be “weakly exogenous” with respect to the  $\beta$  parameters. (See Johansen, 1992b). The LR test statistic which has a  $\chi^2$  distribution with  $(n-r)$  number of degrees of freedom is used in this procedure (the formula to compute this statistic is

given in the previous chapter). The result of this test is shown in the following table.

**Table 6.3    Test for zero restriction on  $\alpha$ - coefficients**

|                                | SNY <sub>t</sub> | CRDAV <sub>t</sub> | DEPR <sub>t</sub> | LRPB <sub>t</sub> | RDI <sub>t</sub> | YG <sub>t</sub> |
|--------------------------------|------------------|--------------------|-------------------|-------------------|------------------|-----------------|
| $\alpha$ -coefficient          | -0.542982        | 0.418249           | -0.000248         | -0.139699         | -39.13858        | -101.3947       |
| LR-statistic: $\chi^2$<br>(~1) | 9.019937         | 9.929653           | 0.760261          | 2.574490          | 0.676824         | 4.824043        |
| P-value                        | 0.00267*         | 0.00162            | 0.38324           | 0.10859           | 0.41068          | 0.028065        |

\* Rejection at 5% level

According to the results of zero restriction on  $\alpha$  coefficients, the coefficient of the dependent variable  $\alpha_{11}$ = -0.542982 was found to be significantly different from zero and its sign is as expected. It indicates adjustment towards the long-run steady state path. If it were positive, it would indicate that SNY<sub>t</sub> would be deviating from the long-run steady-state path after a certain shock. Its magnitude (54%) indicates partial adjustment which is reasonable since full adjustment cannot be expected.

The remaining part is to test the long-run coefficients  $\beta$  for their significance in the long run equilibrium model which is given by:

$$SNY_t = 0.033281 CRDAV_t + 0.053818DEPR_t + 0.020411 LRPB_t + 0.034793RDI_t + 0.007267 YG_t$$

To test for the significance of each variable in the long-run model we again use the zero- restriction and the LR-statistic. The results are summarized below.

**Table    6.4    Test for zero restriction on  $\beta$ - coefficients**

|                                | SNY <sub>t</sub> | CRDAV <sub>t</sub> | DEPR <sub>t</sub> | LRPB <sub>t</sub> | RDI <sub>t</sub> | YG <sub>t</sub> |
|--------------------------------|------------------|--------------------|-------------------|-------------------|------------------|-----------------|
| $\beta$ -coefficient           | 1.0000           | 0.033281           | 0.053818          | 0.020411          | 0.034793         | 0.007267        |
| LR-statistic: $\chi^2$<br>(~1) | 32.61512         | 0.760325           | 7.706107          | 34.93035          | 41.67912         | 26.97936        |
| P-value                        | 0.00000*         | 0.38322            | 0.005503*         | 0.000000*         | 0.00000*         | 0.00000*        |

\*Rejection at 5% significance level.

The zero restriction result on the long-run equilibrium coefficients shows that except  $CRDAV_t$  variable, all variables were significantly different from zero. The hypothesized linkage between credit availability and the national saving ratio was based on Fry's (1995) hypothesis that; because credit rationing is endemic throughout the developing world, there may be restrictions on consumer lending even where interest rates are relatively free for investment lending. If some households are liquidity constrained, credit availability could affect consumption and saving behavior. For a liquidity-constrained consumer, an increase in credit availability will raise consumption and lower saving. But according to our result in this study the proxy for credit availability  $CRDAV_t$  was insignificant in relation to the national saving ratio, which could be due to (a) The fragmentation of the credit market into formal, semi-formal and informal and (b) the relative inaccessibility of formal financial sector credit as compared to the informal financial sector which is not incorporated in this model. Therefore, the marginal impact of formal financial sector liberalization in relaxing household borrowing constraint could depend on the degree of fragmentation of the market.

The significant effect of the dependency ratio is compatible with the theory that, an increase in the population dependency ratio reduces the rate-of-growth effect in the aggregate saving function.

The logarithm of rural population per bank which was used to proxy the proximity or accessibility of depository institutions' branches in rural areas, also affects the aggregate saving ratio significantly, even though with a smaller coefficient (0.02) which could be attributed again to the severe fragmentation of the market especially in rural areas.

The significant result of the real deposit rate of interest explains the fact that an increase in the real rate of return on financial assets raises the relative price of current to future consumption. It also partially explains Mckinnon's complementarity hypothesis. On average a 1 percentage point increase in

the real deposit rate of interest raises the national saving ratio by 3.4 percentage points in the long-run.

The rate of growth in real GDP also affects the national saving ratio significantly in the long run by 0.7 percentage points for a 1 percentage point rise.

## **6.2 The Investment Function**

### **6.2.1 Effects of Financial Conditions on the volume of Investment**

The procedure followed is all the same with the saving function. Therefore hereafter I will only focus on the results and interpretation of estimated results.

The variables shown in the investment function in section (4.1.2/a) were tested for their order of integration and the results showed that all the variables are  $I(1)$ . (See table (6.5) below)

After checking the variables for their order of integration and finding that all the variables are  $I(1)$ , the cointegration test for the number of cointegrating vectors using the  $\lambda_{\text{trace}}(r)$  "trace" and  $\lambda_{\text{max}}(r, r+1)$  "maximum eigen value" test statistics, show that there is one cointegrating vector in the unrestricted vector auto regression. (See table 6.6)

**Table 6.5 Results of Unit Root Tests for Order of Integration of Variables in the Investment Function.**

| Variables                      | ADF test statistic           |                 |                                  |
|--------------------------------|------------------------------|-----------------|----------------------------------|
|                                | No Constant and Linear Trend | With a Constant | With a Constant and Linear Trend |
| DIY <sub>t</sub>               | 0.571207                     | -1.151806       | -2.538748                        |
| CRGOV <sub>t</sub>             | -0.283663                    | -2.282770       | -2.461230                        |
| FL <sub>t</sub>                | 3.210094                     | 0.187671        | -2.459310                        |
| lnREXR <sub>t</sub>            | 0.035815                     | -1.588436       | -2.283009                        |
| YG <sub>t</sub>                | 0.119066                     | -5.525647       | -5.604371                        |
| $\Delta$ DIY <sub>t</sub> *    | -5.889592                    | -6.010780       | -5.977114                        |
| $\Delta$ CRGOV <sub>t</sub> *  | -4.180677                    | -4.076802       | -4.004887                        |
| $\Delta$ FL <sub>t</sub> *     | -2.302581                    | -2.813968       | -2.566379                        |
| $\Delta$ lnREXR <sub>t</sub> * | -5.248023                    | -5.228821       | -5.127501                        |
| $\Delta$ YG <sub>t</sub> *     | -11.27106                    | -11.06964       | -11.00220                        |

NB CRDAV was already checked in the saving function

\* shows significance at 5%

**Table 6.6 Results of tests for cointegration among variables**

**In the Investment function using  $\lambda_{\text{trace}}$  and  $\lambda_{\text{max}}$  Statistics**

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Trace<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|--------------------|------------------------|---------|
| None *                       | 0.731634   | 89.57814           | 83.93712               | 0.0184  |
| At most 1                    | 0.584718   | 52.74687           | 60.06141               | 0.1778  |
| At most 2                    | 0.480997   | 28.14052           | 40.17493               | 0.4576  |
| At most 3                    | 0.211691   | 9.776821           | 24.27596               | 0.8672  |
| At most 4                    | 0.096278   | 3.116593           | 12.32090               | 0.8329  |
| At most 5                    | 0.010023   | 0.282069           | 4.129906               | 0.6562  |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Eigenvalue | Max-Eigen<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None *                       | 0.731634   | 36.83126               | 36.63019               | 0.0474  |
| At most 1                    | 0.584718   | 24.60635               | 30.43961               | 0.2238  |
| At most 2                    | 0.480997   | 18.36370               | 24.15921               | 0.2507  |
| At most 3                    | 0.211691   | 6.660228               | 17.79730               | 0.8427  |
| At most 4                    | 0.096278   | 2.834524               | 11.22480               | 0.8129  |
| At most 5                    | 0.010023   | 0.282069               | 4.129906               | 0.6562  |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Being assured that there is one cointegrating vector in the investment function we can proceed with the estimation of  $\alpha$  and  $\beta$  coefficients that make up this cointegrating equation. Accordingly the vector error-correction estimation normalized with  $\beta_{11} = 1$  shows the following result:

The  $\beta$  vector is given by

|                  |                    |                    |                 |                     |                 |
|------------------|--------------------|--------------------|-----------------|---------------------|-----------------|
| $\beta_{11}$     | $\beta_{12}$       | $\beta_{13}$       | $\beta_{14}$    | $\beta_{15}$        | $\beta_{16}$    |
| DIY <sub>t</sub> | CRDAV <sub>t</sub> | CRGOV <sub>t</sub> | FL <sub>t</sub> | lnREXR <sub>t</sub> | YG <sub>t</sub> |
| [ 1.000000       | -0.229065          | -0.311961          | 0.091610        | -0.017188           | 0.098206 ]      |

and the  $\alpha$  vector is given by :

$$\begin{pmatrix} D(DIY_t) \\ D(CRDAV_t) \\ D(CRGOV_t) \\ D(FL_t) \\ D(\lnREXR_t) \\ D(YG_t) \end{pmatrix} = \begin{pmatrix} -0.497679 \\ 0.594435 \\ 1.080271 \\ -0.154045 \\ 4.980267 \\ 0.538759 \end{pmatrix} = \begin{pmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \\ \alpha_{51} \\ \alpha_{61} \end{pmatrix}$$

Testing the weak exogeneity of the variables by using a zero restriction on the  $\alpha$  coefficients, we get the following result: (see table 6.7)

**Table 6.7 Test for zero restriction on  $\alpha$ - coefficients**

|                                                  | DIY <sub>t</sub> | CRDAV <sub>t</sub> | CRGOV <sub>t</sub> | FL <sub>t</sub> | lnREXR <sub>t</sub> | YG <sub>t</sub> |
|--------------------------------------------------|------------------|--------------------|--------------------|-----------------|---------------------|-----------------|
| <b><math>\alpha</math>-coefficient</b>           | -0.497679        | 0.594435           | 1.080271           | -0.154045       | 4.980267            | 0.538759        |
| <b>LR-statistic:<math>\chi^2</math><br/>(~1)</b> | 4.343646         | 0.629547           | 6.125739           | 2.680724        | 1.534939            | 0.354973        |
| <b>P-value</b>                                   | 0.037147*        | 0.42752            | 0.013323           | 0.101570        | 0.215373            | 0.551311        |

\* Rejection at 5% level

The result that all the short-run adjustment coefficients except  $\alpha_{11}$  are insignificant confirms that we have one endogenous (weakly exogenous) variable (DIY<sub>t</sub>) in our vector autoregression. The value of the coefficient  $\alpha_{11} = -0.497679$  goes in line with the theoretical expectation that the volume of investment adjusts towards the long-run steady-state path with a 50% approximated value. We can therefore write the full equation of the investment function with the relevant long-run parameters as follows:

$$DIY_t = 0.229065CRDAV_t + 0.311961CRGOV_t + 0.091610FL_t + 0.017188lnREXR_t + 0.098206YG_t$$

To test the significance of each variable we again run a zero restriction test on the long-run parameters  $\beta$ . (see table 6.8)

**Table 6.8 Test for zero restriction on  $\beta$ - coefficients**

|                                                  | DIY <sub>t</sub> | CRDAV <sub>t</sub> | CRGOV <sub>t</sub> | FL <sub>t</sub> | lnREXR <sub>t</sub> | YG <sub>t</sub> |
|--------------------------------------------------|------------------|--------------------|--------------------|-----------------|---------------------|-----------------|
| <b><math>\beta</math>-coefficient</b>            | 1.000000         | -0.229065          | -0.311961          | 0.091610        | -0.017188           | 0.098206        |
| <b>LR-statistic:<math>\chi^2</math><br/>(~1)</b> | 80.27087         | 34.04093           | 73.37447           | 14.41570        | 25.08078            | 57.33894        |
| <b>P-value</b>                                   | 0.00000*         | 0.00000*           | 0.00000*           | 0.00014*        | 0.00000*            | 0.00000*        |

\* Rejection at 5% level

According to the result, all the variables in the investment function were found to be statistically significant at the 5% percent level.

The availability of institutional private sector credit scaled by nominal GNP is found significant but affects investment negatively. Even though we found

this variable in the national saving ratio insignificant, it could have affected investment through an increase in consumption expenditure which resulted due to relaxes in liquidity constraints at the household level and thereby a decrease in the domestic saving ratio.

The impact of poor fiscal performance as proxied by the ratio of public or government credit to total domestic credit  $CRGOV_t$  had also a significant impact on the level of domestic investment. This variable may also be used as a proxy for the general state of macroeconomic management. A government that extracts high seigniorage from the banking system may well be following a variety of other macroeconomic policies that impair the investment climate. (Fry, 1995)

Foreign liabilities  $FL_t$  which proxies country-specific risk premium is significant but with the opposite sign which could be due to the dominance of domestically financed investment (especially government financed) as compared to foreign direct investment from the total share of gross capital formation.

The real appreciation of the exchange rate is found to affect domestic investment significantly. In other words the devaluation/depreciation of the real exchange rate affects domestic investment negatively by making the price of intermediate imports more expensive to local producers.

Growth in real GDP also affects the level of domestic investment positively with a long run equilibrium coefficient of 9.8%.

### **6.2.2 Efficiency of Investment**

The variables in the specific function (equation 4.20) intended to estimate the impact of changes in the real deposit rate of interest on incremental output capital ratio (IOCR) were tested for their order of integration and the results are as follows: (see table 6.9)



**Table 6.9 Results of Unit Root Tests for Order of Integration of Variables in the Investment Efficiency Function.**

| Variables            | ADF test statistic           |                 |                                  |
|----------------------|------------------------------|-----------------|----------------------------------|
|                      | No Constant and Linear Trend | With a Constant | With a Constant and Linear Trend |
| IOCR <sub>t</sub>    | -0.898926                    | -5.159453*      | -5.164787*                       |
| RDI <sub>t</sub>     | 0.018081                     | -6.388944*      | -4.008137**                      |
| ΔIOCR <sub>t</sub> * | -11.31728                    | -11.11418       | -10.96429                        |
| ΔRDI <sub>t</sub> *  | -5.270956                    | -5.138209       | -5.094910                        |

\* Shows significance at 5%

\*\* Shows significance at 1%

According to the results, both variables (IOCR<sub>t</sub>, RDI<sub>t</sub> ) were found to be I(1) without a constant and a linear trend. We can test for these two variables for their cointegration. What we have to note here is, since we have only two variables the maximum number of cointegrating vector we can have is one (r=1) r<n, where n is the number of variables entering into the cointegrating space. Otherwise if we have r=n, we have full rank and hence every variable is I(0). Having this in mind, the test for cointegration shows the following results.

**Table 6.10 Results of tests for cointegration among variables using λ<sub>trace</sub> and λ<sub>max</sub> Statistics**

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Trace<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|--------------------|------------------------|---------|
| None *                       | 0.364022   | 13.26157           | 12.32090               | 0.0347  |
| At most 1                    | 0.020816   | 0.589002           | 4.129906               | 0.5044  |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Max-Eigen<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None *                       | 0.364022   | 12.67257               | 11.22480               | 0.0276  |
| At most 1                    | 0.020816   | 0.589002               | 4.129906               | 0.5044  |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Both the trace and the maximum eigen value statistics show that there is one cointegrating vector, hence we can estimate for the short-run adjustment coefficients  $\alpha$  and the long-run parameters  $\beta$  that make up the cointegrating vector. Accordingly the  $\beta$  parameters are given by:

$$\begin{bmatrix} \beta_{11} & \beta_{12} \end{bmatrix} = \begin{bmatrix} \text{IOCR}_t & \text{RDI}_t \end{bmatrix} = \begin{bmatrix} 1.000000 & -0.445224 \end{bmatrix}$$

and the  $\alpha$  coefficients are given by:

$$\begin{bmatrix} \text{IOCR}_t \\ \text{RDI}_t \end{bmatrix} = \begin{bmatrix} -0.321431 \\ 1.766579 \end{bmatrix} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \end{bmatrix}$$

After ascertaining statistically the presence of one cointegrating vector and estimating the respective short-run and long-run coefficients, we check for the weak exogeneity between the two variables by imposing a zero restriction on the  $\alpha$  coefficients. (see table 6.11 )

**Table 6.11 Test for zero restriction on  $\alpha$ - coefficients**

|                             | $\text{IOCR}_t$ | $\text{RDI}_t$ |
|-----------------------------|-----------------|----------------|
| $\alpha$ -coefficient       | -0.321431       | 1.766579       |
| LR-statistic: $\chi^2$ (~1) | 3.511722        | 9.802174       |
| P-value                     | 0.060936*       | 0.001743*      |

\* Rejection at 5% level

The zero restriction test on both short-run adjustment coefficients ( $a_{11}$  and  $a_{21}$ ) shows, we reject the case of weak exogeneity for both variables. This result clearly contradicts with our original hypothesis that in the short and medium runs the efficiency of investment is determined by the real deposit rate of interest. Nevertheless,  $a_{11}$  shows that IOCR adjusts towards the long-run steady state path without deviation with a value of 32 percentage points. Whereas the adjustment coefficient for the real deposit rate of interest indicates deviation from the long-run steady state path with a value greater than 100% which is unrealistic. Given the fact that in our country deposit rates of interest were fixed before 1992 and they were under policies of floors since 1995, and the high degree of monopoly in the financial market, we cannot expect this much adjustment value. Hence based on these facts we can estimate the long-run equilibrium relationship between IOCR and RDI to test whether the normalized value of the former and the long-run coefficient of the latter are statistically different from zero. The long-run equilibrium equation is given by:

$$\text{IOCR}_t = -0.445224 \text{ RDI}_t$$

and the zero restriction test result shows ( see table 6.12)

**Table 6.12 Test for zero restriction on  $\beta$ - coefficients**

|                                              | IOCR <sub>t</sub> | RDI <sub>t</sub> |
|----------------------------------------------|-------------------|------------------|
| <b><math>\beta</math>-coefficient</b>        | 1.00000           | -0.445224        |
| <b>LR-statistic:<math>\chi^2</math> (~1)</b> | 11.37002          | 11.81982         |
| <b>P-value</b>                               | 0.000746*         | 0.000586*        |

\* Rejection at 5% level

The zero restriction on the  $\beta$ -coefficients is rejected at the 5% significance for both variables, which assures the existence of long-run equilibrium relationship between the two variables.

### 6.3 Inflation

In order to determine the dynamics between financial variables and inflation, equation (4.29) has been used. As in the other functions, the variables entering into this function were tested for their order of integration using the ADF test statistic which showed all the variables are  $I(1)$  (see table 6.13). A test for cointegration was also run using the trace and the maximum eigen value statistic which indicated the existence of one cointegrating vector in the vector auto regression. (See table 6.14)

**Table 6.13 Results of Unit Root Tests for Order of Integration of Variables**

| Variables         | ADF test statistic           |                 |                                  |
|-------------------|------------------------------|-----------------|----------------------------------|
|                   | No Constant and Linear Trend | With a Constant | With a Constant and Linear Trend |
| $INF_t$           | -0.625127                    | -3.841408       | -4.356562                        |
| $PCMS_t$          | -0.344814                    | -7.371995       | -7.357580                        |
| $PCY_t$           | 0.173863                     | -6.004299       | -6.232832                        |
| $RDI_t$           | 0.018081                     | -6.388944*      | -4.008137**                      |
| $\Delta INF_t^*$  | -6.625804                    | -6.544823       | -6.481878                        |
| $\Delta PCMS_t^*$ | -12.80199                    | -12.57259       | -12.40039                        |
| $\Delta PCY_t^*$  | -8.235240                    | -8.072279       | -7.874853                        |
| $\Delta RDI_t^*$  | -5.270956                    | -5.138209       | -5.094910                        |

\* Shows significance at 5%

**Table 6.14 Results of tests for cointegration among variables  
using  $\lambda_{\text{trace}}$  and  $\lambda_{\text{max}}$  Statistics**

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Trace<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|--------------------|------------------------|---------|
| None *                       | 0.821241   | 62.35732           | 40.17493               | 0.0001  |
| At most 1                    | 0.284315   | 15.87089           | 24.27596               | 0.3890  |
| At most 2                    | 0.223670   | 6.838972           | 12.32090               | 0.3415  |
| At most 3                    | 0.000117   | 0.003163           | 4.129906               | 0.9630  |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Eigenvalue | Max-Eigen<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None *                       | 0.821241   | 46.48643               | 24.15921               | 0.0000  |
| At most 1                    | 0.284315   | 9.031917               | 17.79730               | 0.5908  |
| At most 2                    | 0.223670   | 6.835809               | 11.22480               | 0.2641  |
| At most 3                    | 0.000117   | 0.003163               | 4.129906               | 0.9630  |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Having statistically proved the existence of one cointegrating vector, the related short-run and long-run parameters are given by:

The  $\beta$  vector is given by:

$$\begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} \\ \text{INF}_t & \text{PCMSt} & \text{PCYt} & \text{RDIt} \end{bmatrix} = \begin{bmatrix} 1.000000 & -1.952301 & 0.726420 & 0.084739 \end{bmatrix}$$

and the  $\alpha$  vector is given by:

$$\begin{bmatrix} \text{INF}_t \\ \text{PCMSt} \\ \text{PCYt} \\ \text{RDIt} \end{bmatrix} = \begin{bmatrix} -0.229726 \\ 0.329958 \\ -0.181145 \\ -14.16475 \end{bmatrix} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{bmatrix}$$

We run then a test for weak exogeneity among the variables in the vector autoregression using a zero restriction on the  $\alpha$  coefficients. (see table 6.15 )

Table 6.15 Test for zero restriction on  $\alpha$ - coefficients

|                             | INFt      | PCMSt     | PCYt      | RDIt      |
|-----------------------------|-----------|-----------|-----------|-----------|
| $\alpha$ -coefficient       | -0.229726 | 0.329958  | -0.181145 | -14.16475 |
| LR-statistic: $\chi^2$ (~1) | 1.098671  | 10.14533  | 1.275294  | 5.863065  |
| P-value                     | 0.294558  | 0.001447* | 0.258776  | 0.015462  |

\* Rejection at 5% level

The result here indicates that we reject the zero restriction on per capita money supply  $PCMS_t$ , but not for the others at the 5% level of significance which implies that inflation in our model does not adjust at least in the short-run with the other intended explanatory financial variables. Possibly this result could be due to the strong link between inflation (Addis Ababa or country level CPI) and agricultural output prices rather than inflation being a monetary phenomenon in our country. It can be observed from the time series data on inflation in Ethiopia that most of the time both in the Derg and current government, it was swinging between single digits except in those years where there were droughts and sharp increases in agricultural prices.

### 6.4 Economic Growth

The last function to be estimated in this study is the one indicated by equation (4.30), which is intended to measure the impact of selected financial variables on economic growth in Ethiopia.

**Table 6.16 Results of Unit Root Tests for Order of Integration of Variables**

| Variables         | ADF test statistic           |                 |                                  |
|-------------------|------------------------------|-----------------|----------------------------------|
|                   | No Constant and Linear Trend | With a Constant | With a Constant and Linear Trend |
| $PCY_t$           | 0.173863                     | -6.004299       | -6.232832                        |
| $DCR_t$           | -0.370969                    | -2.926981       | -3.43290                         |
| $DCRY_t$          | -0.517539                    | -3.369033       | -2.030823                        |
| $LLY_t$           | -0.625773                    | -5.544423       | -5.674144                        |
| $\Delta PCY_t^*$  | -8.235240                    | -8.072279       | -7.874853                        |
| $\Delta DCR_t^*$  | -7.465703                    | -7.328450       | -7.210579                        |
| $\Delta DCRY_t^*$ | -7.722374                    | -7.577473       | -7.480478                        |
| $\Delta LLY_t^*$  | -6.916344                    | -6.776719       | -6.592221                        |

\* Shows significance at 5%

Similar with the other functions, a test for the order of integration of the variables was undertaken (see table 6.16) and the result shows that all the variables entering the growth function are I (1).

The Johansen cointegration test using the trace and the maximum eigen value statistic shows that there is one cointegrating vector in the unrestricted vector autoregression. (see table 6.17)

**Table 6.17   Results of tests for cointegration among variables**  
**using  $\lambda_{\text{trace}}$  and  $\lambda_{\text{max}}$  Statistics**

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Trace<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|--------------------|------------------------|---------|
| None *                       | 0.581955   | 40.18051           | 40.17493               | 0.0499  |
| At most 1                    | 0.328957   | 15.75988           | 24.27596               | 0.3972  |
| At most 2                    | 0.144089   | 4.590063           | 12.32090               | 0.6257  |
| At most 3                    | 0.008307   | 0.233571           | 4.129906               | 0.6870  |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized<br>No. of CE(s) | Eigenvalue | Max-Eigen<br>Statistic | 0.05<br>Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None *                       | 0.581955   | 24.42063               | 24.15921               | 0.0461  |
| At most 1                    | 0.328957   | 11.16982               | 17.79730               | 0.3700  |
| At most 2                    | 0.144089   | 4.356492               | 11.22480               | 0.5724  |
| At most 3                    | 0.008307   | 0.233571               | 4.129906               | 0.6870  |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

The values of the short-run and long-run coefficients that make up the cointegrating vector normalized with respect to  $PCY_t$  is given by:

The  $\beta$  vector is given by:

$$\begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} \\ \text{PCY}_t & \text{DCRY}_t & \text{DCR}_t & \text{LLY}_t \\ 1.000000 & 2.628861 & -2.707611 & -6.800727 \end{bmatrix}$$

and the  $\alpha$  coefficients are given by:

$$\begin{bmatrix} \text{PCY}_t \\ \text{DCRY}_t \\ \text{DCR}_t \\ \text{LLY}_t \end{bmatrix} = \begin{bmatrix} -0.058112 \\ -0.404122 \\ -0.391823 \\ 0.123202 \end{bmatrix} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{bmatrix}$$

We run the test for weak exogeneity and the results are given in table 6.18

**Table 6.18 Test for zero restriction on  $\alpha$ - coefficients**

|                                              | PCY <sub>t</sub> | DCRY <sub>t</sub> | DCR <sub>t</sub> | LLY <sub>t</sub> |
|----------------------------------------------|------------------|-------------------|------------------|------------------|
| <b><math>\alpha</math>-coefficient</b>       | -0.058112        | -0.404122         | -0.391823        | 0.123202         |
| <b>LR-statistic:<math>\chi^2</math> (~1)</b> | 11.59192         | 0.005059          | 0.713273         | 3.996394         |
| <b>P-value</b>                               | 0.000662*        | 0.943295          | 0.398359         | 3.996394         |

\* Rejection at 5% level

The Result here indicates that the zero restriction on the adjustment coefficient of per capita income growth  $\text{PCY}_t$  is rejected at the 5% level of significance, but not for the others. The sign and value of  $\alpha_{11} = -0.058112$  shows that per capita income growth adjusts to the long-run steady state equilibrium without deviation with a very small value of 5.8%, signifying the poor intermediation capacity of the financial sector and the very low monetization of the economy.

Having ascertained statistically the existence of one endogenous (weakly exogenous) variable in our growth function we can build the long-run equilibrium relationship as follows:

$$\text{PCY}_t = 2.628861\text{DCRY}_t + 2.707611\text{DCR}_t + 6.800727\text{LLY}_t$$



To test for the significance of each variable in the long-run equation we run a zero restriction test on each variable and the result is presented in table (6.19) below.

**Table 6.19 Test for zero restriction on  $\beta$ - coefficients**

|                                              | PCY <sub>t</sub> | DCRY <sub>t</sub> | DCR <sub>t</sub> | LLY <sub>t</sub> |
|----------------------------------------------|------------------|-------------------|------------------|------------------|
| <b><math>\beta</math>-coefficient</b>        | 1.000000         | 2.628861          | 2.707611         | 6.800727         |
| <b>LR-statistic:<math>\chi^2</math> (~1)</b> | 8.276186         | 0.068904          | 2.21E-06         | 11.40599         |
| <b>P-value</b>                               | 0.004017*        | 0.792940          | 0.998814         | 0.000732*        |

\* Rejection at 5% level

The significance test on the long-run parameters shows that growth in per capita income PCY<sub>t</sub> and growth in liquid liabilities LLY<sub>t</sub> (which is the ratio of M2 to GDP) are significantly different from zero but both credit availability ratios to the private sector-DCRY<sub>t</sub> and DCR<sub>t</sub>, where the former is scaled by GDP and the latter by aggregate domestic credit, were found to be insignificantly different from zero.

In all the functions, the various diagnostic tests i.e the Breush-Pagan test of higher order serial correlation up two lags, the autoregressive conditional heteroscedastic test, the test for normality based on skewness and kurtosis, the White test of heteroscedasticity, and the Ramsey’s RESET test of functional form were conducted and detect no statistical problems.

## **CHAPTER SEVEN**

### **Conclusion, Policy Implications & Recommendations**

Ethiopia with a population of 69 million is the second most populous country in Sub-Saharan Africa next to Nigeria. In the past four decades despite the fact there were three different kinds of governments in power, the people of Ethiopia is not lucky enough to gain any discernible changes in its standard of living. The structure of the economy hasn't changed much in these decades (agriculture still contributes 50% of the GDP, 90% of exports and 85% of employment), the average per capita income growth has never been able to cope with the ever increasing population growth and as a result more than 40% of the population lives under the poverty line marked by the World Bank.

As an economist specializing in economic policy analysis, I was obliged to ask myself "what policies and strategies, at the macro-level, could at least in the short and medium-runs be effective in this country?" The approach followed by both the Derg and the current government, which focused on the agricultural sector as the driving force of the economy, has taken us nowhere as to my understanding. However my personal experience from Ghana and Kenya who have relatively stronger and more liberalized financial sectors and have better per capita income growth rates and living standards as compared to Ethiopia, has urged me to look into the relationship between financial variables and key macroeconomic variables like saving, investment, inflation and ultimately the growth of the economy in Ethiopia.

To this end, I have used an annual time series data, which ranges from 1974/75-2003/04 from different sources. The Johansen Maximum likelihood estimation technique has been used to assess the short and long-run dynamics of the variables. Before looking into the cointegrating relationships of each function, the variables were tested for their order of

integration using the ADF test statistic and all the variables were found to be  $I(1)$ . The  $\lambda_{\text{trace}}$  and  $\lambda_{\text{max}}$  test Statistics were employed to assess the number of cointegrating vectors present in each function and accordingly the null of no cointegration was rejected for all cases and the presence of one cointegrating vector was supported statistically at the 5% level of significance. The short-run adjustment coefficients for the saving, investment (volume) and growth functions were found to be statistically significant, applying the zero restriction test, and with the expected signs. Whereas the adjustment coefficients for the investment efficiency function showed rejection of the zero restriction for both the supposed to be endogenous (IOCR) and the explanatory (RDI) variables; the coefficient for the former one was with the expected sign and value but the for the latter the value was unrealistic (more than 100%) and the sign was positive indicating deviation from the steady-state path. The adjustment coefficients for the inflation function showed that the zero restriction for the variable inflation was insignificant indicating that inflation is more explained by other factors (possibly agricultural prices and production) other than the classical proposition that inflation is determined explicitly by the difference between the growth in per capita stock of money supply and income in the case of Ethiopia.

The long-run parameters were also tested for their significance in all the functions except the inflation function (in this case, since the short adjustment coefficient could not be rejected, it was not possible to continue to the next step) using the zero restriction test. The variables in the saving function were found to be statistically significant except the credit availability variable. The real deposit rate of interest and growth in real GDP were found to affect the national saving ratio significantly and positively, supporting the Mckinnon-Shaw hypothesis, whereas rural population per bank branch and dependency ratio affected it significantly and negatively. The unexpected negative result of rural population per bank branch could be attributed to the high degree of fragmentation of the financial market

especially in rural areas and the very low per capita income growth, which transmits to an almost insignificant marginal propensity to save.

The long-term parameters in the investment function were found to be statistically significant. The credit availability and foreign liability variables were in the opposite direction from their expected signs but the other variables i.e net credit to government, the real exchange rate and output growth were, with their expected signs; reflecting the ill-effects of government crowding out and currency depreciation on domestic private investment and the positive impact of growth in output on capital formation supporting the classical Harrod-Domar growth model.

In the growth function the long-run parameters for the two domestic credit availability variables,  $DCRY_t$  and  $DCR_t$ , were found to be insignificant in affecting per capita income growth, which is consistent with our finding that credit availability didn't affect the national saving ratio. Liquid liabilities of the financial sector had a positive impact on per capita income growth, showing the positive correlation between monetization and income growth.

### **Policy Implications and Recommendations**

The immediate policy implications from the results of this study are the following:

- 1) The government needs to take special attention in minimizing structural rigidities, fragmentation, and the high degree of monopoly in the financial market so that financial asset prices could play their allocative mechanism of resources to their best alternative uses.
- 2) It is clear that, the development of the financial sector is directly related with the development of the real economy. Hence infrastructural development, commercialization of the agriculture, development of the industrial sector (especially agro-industries) and expansion of domestic and foreign direct investment are mandatory

for the effectiveness of the financial sector in mobilizing saving and contribute to the growth of the economy.

- 3) In order to realize results of financial market liberalization, liberalization should first be effectively implemented in other sectors of the economy.
- 4) In Ethiopia, economic agents have limited opportunity to diversify their financial asset portfolios due to absence of secondary markets, specialized banks and capital markets. Hence the government should give due consideration in permitting entry of foreign banks which have the capacity to introduce new technology, diversification and competition in the banking sector while enhancing the autonomy and prudential regulation capacity of the National Bank of Ethiopia to avoid bank-runs and financial crises.

## Reference

- Aghveli, Bijan B., and Moshin S. Khan. (1977) "Inflationary Finance and the Dynamics of Inflation: Indonesia, 1951-72" *American Economic Review*.
- Arestis, Philip, and Panicos O. Demetriades (1993) "Financial Liberalization and Economic Development: A Critical Exposition." In *Money and Banking: Issues for the Twentieth Century. Essays in Honor of Stephen F. Frowen*. Edited by Philip Arestis. Basingstoke: Macmillan.
- Barro, Robert J. (1991) "Economic Growth in A Cross-Section of Countries." *Quarterly Journal of Economics*.
- Bencivenga, Valerie R, and Bruce d. Smith. (1991) "Financial Intermediation and Endogenous Growth." *review of Economic Studies*.
- Bentham, Jeremy. (1787) *Defence of Usury*. London: T. Payne & Sons.
- Blejer, Mario I., and Moshin S. Khan. (1984) "Government Policy and Private Investment in Developing Countries." *International Monetary Fund Staff Papers*.
- Blinder, Alan S., and Joseph E. Stiglitz (1983) "Money Credit Constraints, and Economic Activity." *American Economic Review*.
- Boskin, Michael J. 1978. "Taxation, Saving, and the Rate of Interest." *Journal of Political Economy*
- Buffie, Edward F. (1984) "Financial Repression, the New Structuralists, and Stabilization Policy in Semi-Industrialized economies." *Journal of Development Economics*.
- Celasun, Merih, and Aysit, Tansel (1993) "Distributional Effects and Saving Investment Behavior in a Liberalizing Economy: The Case of Turkey." *METU Studies in Development*.
- Cole, David C., and Hugh T. Patrick. (1986) "Financial Development in the Pacific Basin Market Economies." In *Pacific Growth and Financial Interdependence*. Edited by Augustine H. H. Tan and Basant Kapur. Sydney: Allen and Unwin.
- De Gregorio, Jose, and and Pablo E. Guidotti (1993) "Financial development and Economic Growth." Washington D.C.: International Monetary Fund, July.
- De Gregorio, Jose. (1993) "Inflation, Taxation and Long-Run Growth." *Journal of Monetary Economics*.
- De Melo, Jamie and James R. Tybout (1986) "The Effects of Financial Liberalization on Savings and Investment in Uruguay." *Economic Development and Cultural Change*.
- Demetriades, Panicos O., and Michael P. Devereux (1992) "Investment and Financial Repression: Theory and Evidence from 63 Developing Countries." Keele: University of Keele, Department of Economics, Working Paper 92-16, December.
- Dornbusch, Rudiger, and Alejandro Reynoso. (1989) "Financial Factors in Economic Development." *American Economic Review*.

- Dooley, Michael P. (1986) "Country-Specific Risk Premiums, Capital Flight and Net Investment Income Payments in Selected Developing Countries." Washington, D.C. :International Monetary Fund, DM/86/17, March.
- Drazen, Alan. (1981b) "Inflation and Capital Accumulation under a Finite Horizon." *Journal of Monetary Economics*: 247-260
- Economic Commission for Africa (2003) *Annual Report on African Economies*, Vol I, Addis Ababa, Ethiopia.
- Edwards, Sebastain (1986) "The Pricing of Bonds and Bank Loans in International Markets: An empirical Analysis of Developing Countries' Foreign Borrowing." *European Economic Review*.
- Enders, Walter. (1995). "Applied Econometric Time Series." *Wiley Series in Probability and Mathematical Statistics*, Iowa State University
- Engle, R.F. and C.W.J. Granger (1987) "Cointegration and Error-Correction: Representations, Estimation and Testing." *Econometrica*, 55, 252-276
- Ethiopian Economic Association (1999/00), "Annual Report on the Ethiopian Economy" Vol. I
- Ethiopian Economic Association (2003/04) "Annual Report on the Ethiopian Economy: Industrialization in Ethiopia " Vol. I
- Fischer, Stanley. (1979b) "Capital Accumulation on the Transition Path in A Monetary Optimizing Model." *Econometrica*.
- Fry, Maxwell J(1978a) "Alternative Stabilization Strategies from a Model of Short Run price and Output Fluctuations in Turkey." *METU Studies in Development*, No.19
- Fry, Maxwell J, (1979a.) "The Cost of Financial Repression in Turkey." *Savings and Development*, vol. 3 No. 2
- Fry, Maxwell J. (1980a) "Saving, Investment, Growth and the Cost of Financial Repression." *World Development*, Vol. 8, No. 4
- Fry, Maxwell J. (1988) "Money Supply Responses to Exogenous Shocks in Turkey." In *liberalization and the Turkish Economy*. Westport, Conn: Green woods Press.
- Fry, Maxwell J. (1991a) "Domestic Resource Mobilization in Developing Asia: Four Policy Issues." *Asian Development Review*. 15-39
- Fry, Maxwell J. (1995) "Money, Interest, and Banking in Economic Development" 2nd ed, The Johns Hopkins University Press.
- Fry, Maxwell J., and Andrew Mason. (1982) "The Variable Rate-of-Growth Effect in the Life- Cycle Saving Model: Children, Capital Inflows, Interest and Growth in a New Specification of the Life-Cycle Model Applied to Seven Asian Developing Countries." *Economic Enquiry*.
- G.S. Madalla and In-Moo Kim (1998) "Unit Roots, Cointegration, and Structural Change" Cambridge University Press.

- Galbis, Vincente (1979) "Inflation and Interest Rate Policies in Latin America, 1967-79." International Monetary Fund Staff Papers:334-366
- Galbis, Vincente. (1977). "Financial Intermediation and Economic Growth in Less-Developed Countries: A Theoretical Approach." *Journal of Development Studies*.
- Gebrehiwot Ageba (1997) "An Analysis of Financial Sector and Credit Policies During the Derg Period and Post-Derg Reforms", *Ethiopian Journal of Economics*, Vol VI, No.1
- Gelb, Alan H. (1989) "Financial Policies, Growth, and Efficiency." Washington D.C.: World Bank, Country Economics Department, PPR Working Paper WPS 202, June.
- Ghani, Ejaz. (1992) "How Financial Markets Affect Long-Run Growth: A Cross-Country Study." Washington D.C.: World Bank, Country Operations, PR Working Paper WPS 843, January.
- Granger, Clive and P. Newbold. (1974) "Spurious Regressions in Econometrics." *Journal of Econometrics*.
- Greene, Joshua, and Delano Villanueva (1991) "Private Investment in Developing Countries: An Empirical Analysis." *International Monetary Fund Staff Papers*.
- Hamilton, James D., and Marjorie A. Flavin (1986) "On the Limitations of Government Borrowing: A Framework for Empirical Testing." *American Economic Review*.
- Hermes, Neils, and Robert Lensink. (1993) "The Financial Sector and Its Influence on Economic Growth; Evidence from 14 Latin American Countries, 1963-1989." Groningen: University of Groningen, Institute of Economic Research, Research Memorandum 531, June.
- Hoff, Karla, and Joseph E. Stiglitz. (1990) "Introduction: Imperfect Information and Rural Credit Markets-Puzzles and Policy Perspectives." *World Economic Review*. International Monetary Fund, Washington D.C
- Johansen, S. (1991) "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models" *Econometrica*.
- Johansen, S. (1992b) "Determination of Cointegration Rank in the Presence of a Linear Trend" *Oxford Bulletin of Economics and Statistics*
- Johansen, S. (1988) "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control*.
- Kapur, Basant K (1974) "Monetary Growth Models of Less Developed Economies", Stanford: Stanford University, PH. D. thesis.
- Kapur, Basant K (1986) *Studies in Inflationary Dynamics: Financial Repression and Financial Liberalization in Less Developed Countries*. Singapore: Singapore University Press
- Kapur, Basant K. (1976b) "Two Approaches to Ending inflation" in Ronald I. McKinnon (ed), *Money and Finance in Economic Growth and Development: essays in honor of Edward S. Shaw*. New York: Marcel Dekker.
- Keller, Peter M. (1980) "Implications of Credit Policies for Output and Balance of Payments." *International Monetary Fund Staff Papers*.



- Keynes, J. Maynard. 1936. "The General Theory of Employment Interest and Money. London: Macmillan.
- Khan, Moshin S., and Carmen M. Reinhart. (1990) Private Investment and Economic Growth in Developing Countries." World Development.
- Khan, Moshin S., and Delano Villanueva. (1991) "Macroeconomic Policies and Long-Term Growth: A Conceptual and Empirical Review." Washington D.C.: International Monetary Fund, WP/92/28.
- King, Robert G., and Ross Levine (1993b) "Finance, Entrepreneurship, and Growth: Theory and evidence." Journal of Monetary Economics.
- King, Robert G., and Ross Levine (1993c) "Financial Intermediation and Economic Growth." In capital Markets and Financial Intermediation. Edited by Colin Mayer and Xavier Vives. Cambridge University Press for the Centre for Economic Policy Research.
- King, Robert G., and Ross Levine. (1993a) "Finance and Growth: Schumpeter Might be Right." Quarterly Journal of Economics
- Kohsaka, Akira. (1984) "the high Interest Rate Policy under Financial Repression." Developing Economies: 419-452
- Leulseged Lemma (2004) "The Impact of Financial Sector Liberalization on The Environment: The Case of Plastic Waste Disposal." MSc Thesis, Addis Ababa University.
- Locke, John. (1965) Further Considerations Concerning Raising the Value of Money, 2nd ed. London: A. & J. Churchill.
- Long, Millard. (1983) "Review of Financial Sector Work." Washington, D.C.: World Bank, Industry Department Financial Development Unit, October.
- Mason, Andrew (1981) "An Extension of the Life-Cycle Model and Its Application to Population Growth and Aggregate Saving." Honolulu: East-West Center, January.
- Mason, Andrew (1987). "National Saving Rates and Population Growth: A New Model and New Evidence." In Population Growth and Economic Development: Issues and Evidence. Edited by D.Gale Johnson and Ronald D. Lee. Madison: University of Wisconsin Pres for National Academy of Sciences.
- Mathieson, Donald J. (1980a) "Financial Reform and Stabilization Policy in a Developing Economy." Journal of Development Economics, Vol.7 No. 3
- Mathieson, Donald J. (1980b.) " Interest Rates and monetary Aggregates During financial Reform."
- Mathieson, Donald J. (1983a). "Estimating Models of financial Market Behavior during Periods of extensive Structural Reform: the experience of Chile." International Monetary fund Staff Papers.
- Mathieson, Donald J.(1981) "Inflation, interest rates and the Balance of Payments During a Financial Reform: the Case of Argentina." Washington D.C: International Monetary Fund, DM/81/47

- Mckinnon, Ronald I. (1973) "Money and Capital in Economic Development." Washington, D.C. Brookings Institution.
- Mckinnon, Ronald I. (1991) "The Order of Economic Liberalization: Financial Control in the Transition To a Market Economy." The Johns Hopkins University Press.
- Modigliani, Franco. (1986) "Life Cycle, Individual Thrift, and the wealth of Nations." American Economic Review.
- Molho, Lazaros E. (1986a) "Interest Rates, Saving, and Investment in Developing Countries: A Re-examination of the Mckinnon-Shaw Hypothesis." International Monetary Fund Staff Papers.
- National Bank of Ethiopia (2001/02), Annual Report. Addis Ababa
- Negarit Gazeta (1975d), Addis Bank Establishment Proclamation No. 69/1975. Addis Ababa.
- Negarit Gazeta (1992a), A proclamation to Provide for the Encouragement, Expansion and Coordination of Investment No. 15/1992 (May 25). Addis Ababa.
- Negarit Gazeta. (1976b), Monetary and Banking Proclamation No. 99/1976 (21september), Addis Ababa
- Olson, Mancur, and Martin J. Bailey. (1981) "Positive Time Preference." Journal of Political Economy: 1-25
- Rama, Martin. (1990) "Empirical Investment Equations in Developing Countries." Washington, D. C.: World Bank, PRE Working Paper WPS 563, December.
- Rittenberg, Libby (1988) "Financial Liberalization and Savings in Turkey ." In Liberalization and the Turkish Economy. Edited by Tevfik F. Nas and Mehmet Odekon. Westport, Conn.: Green Wood Press.
- Roubini, Nouriel, and Xavier Sala-i-Martin. (1991) "Financial Development, the Trade Regime, and Economic Growth." Cambridge Mass.: National Bureau of Economic Research, NBER Working Paper No. 3876, October.
- Schumpeter, Joseph A. (1912). "The Theory of Economic Development; An Enquiry into Profits, Capital, Credit, Interest, and the Business Cycle." Translated by Redvers Opie. Cambridge, Mass.: Harvard University Press.
- Shaw, Edward S. (1973) "Financial Deepening in Economic Development." New York: Oxford University Press.
- Sidrauski, Miguel. (1966) "Inflation and Economic Growth." Journal of Political Economy.
- Smith, Adam (1776) An enquiry into the Nature and Causes of the Wealth of Nations. London: W. Strahan & T. Cadell .
- Stiglitz, Joseph E. (1994) "The Role of the State in Financial Markets." In Proceedings of the World Bank Annual Bank Conference on Development Economics 1993. Edited by Michael Bruno and Boris Pleskovich. Washington, D.C.: World Bank, 19-52.
- Stock, J.H. and M.W. Watson (1988) "Testing for Common Trends" Journal of the American Statistical Association.

- Taylor, Lance (1983) *Structuralist Macroeconomics: Applicable Models for the Third World*. New York: Basic Books.
- Tobin, James. (1965) "Money and Economic Growth." *Econometrica*.
- Van Wijnbergen, Sweder (1983a) "Interest Rate Management in LDCs." *Journal of Monetary Economics*.
- Van Wijnbergen, Sweder (1983b) "Credit Policy, Inflation and Growth in a Financially Repressed Economy." *Journal of Development Economics*.
- Van Wijnbergen, Sweder. (1982) "Stagflationary Effects of Monetary Stabilization Policies: A Quantitative Analysis of South Korea." *Journal of Development Economics*.

## **Declaration**

I, the undersigned, declare that this thesis is my original work and it has never been presented in any other university. All sources of materials used for this thesis have been duly acknowledged.

Name:

Menelik Solomon

Signature:

