

Financial Liberalisation and Saving: Empirical Evidence from Rwanda

By

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DECLARATION

This is my original work and has never been presented for any degree award in any other university.

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Approval

This research paper has been submitted with our approval as university supervisors.

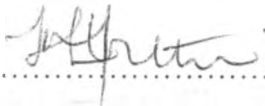
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May God bless you all.

DEDICATION

To my mother, my father and my sisters.

ABSTRACT

In the last two decades, Rwanda has liberalized its financial sector through different programs to reduce the financial repression and encourage market determined prices of financial services especially interest rates. The shared belief was that higher real interest rates lead to higher volume of domestic savings and, given this supply-side effect, private investment would increase and set in a virtuous circle of higher growth and more savings for investment. Whether financial liberalisation has impacted positively savings in Rwanda is an empirical issue.

In this study, we estimate a private saving and a financial saving function in Rwanda using a sample for 1970-2008 period. We investigate the effect of financial liberalisation on both equations, especially the effect of real deposit rate on savings. Based on the literature review an inter-temporal choice saving model was developed so as to yield testable hypothesis about the relationship between savings and its determinants. Using OLS for the first and Engle-Granger two step procedures for the second, the results seems to reject the McKinnon and Shaw hypothesis of positive effect of interest rate on both aggregates. Private saving is driven by growth rate in income and foreign saving while financial saving is a function of real income. Therefore, policies that spur development are an indirect but effective way to raise savings. Tight fiscal and monetary policies are also required to control inflation.

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ACRONYMS

2SLS	: Two Stage Least Squares
ADF	: Augmented Dickey Fuller
ADL	: Autoregressive Distributed lags
BCR	: <i>Banque Commercial du Rwanda</i>
BK	: Bank of Kigali
CHR	: <i>Caisse Hypothecaire du Rwanda</i>
ECM	: Error Correction Model
FSDP	: Financial Sector Development Program
GDP	: Gross Domestic Product
GNP	: Gross National Product
ICOR	: Incremental Capital Output Ratio
IFS	: International Finance Statistics
IMF	: International Monetary Fund
LCH	: Life Cycle Hypothesis
LDCs	: Least Developed countries
MFI	: Micro Finance Institutions
NBR	: National Bank of Rwanda
OLS	: Ordinary Least Squares
PIH	: Permanent Income Hypothesis
PP	: Phillips-Perron
RIH	: Relative Income Hypothesis
SSA	: Sub-Saharan Africa
SSFR	: Social Security Fund of Rwanda
UBPR	: <i>Union des Banques Populaire du Rwanda</i>
USD	: United States Dollars

CHAPTER I

1.0 Introduction

For sustainable economic growth, a higher proportion of GDP must be allocated to investment. This capital formation can be financed from domestic resources or foreign resources but in most countries national saving provides the bulk of resources for investment, hence saving behaviors are crucial elements of the process of economic growth (Fry, 1995).

National savings, which can be decomposed into private and public savings mostly flow to domestic investment via government appropriation, self finance and financial intermediation both formal and informal sector. Interest rates also plays a crucial role determining how saving will flow in developed and developing countries (Mikesel et al., 1973).

Policy makers in developing countries understand the need to raise savings and have embarked on several programs of economic reform specially as a result of implementing a structural adjustment program imposed by the IMF and the World Bank. Rwanda is one of those developing countries and since November 1990, several economic reforms were put in place. With regards to the financial sector, Rwanda followed a policy prescription of the financial liberalisation hypothesis, which holds that a well functioning financial sector stimulates investment through its impact on the growth of saving and the ability to ensure efficient transformation of the mobilized savings into real capital by liberalizing its financial system. To understand the rationale and the process mechanism behind this, we need a background of the Rwandese economy.

1.1 Background of the economy

Rwanda is a small land-locked country with a population of about 8.4 million. With its agrarian based economy, around 60% of the populations are poor. The current composition of GDP is made up by agriculture 46%, services 36% and industry 18%. In 1994, the economy was devastated by a genocide which halved the GDP and plunged into poverty eight percent of the

population. Currently the economy is characterized by internal and external macroeconomic disequilibria, low saving and investment rates and high unemployment rate. The banking system is generally prosperous with liberalized foreign exchange controls. Despite many structural constraints, continued improvement in security after the genocide and strong government commitment to reforms led to strong economic growth. In this study, the focus is on the 1970-2008 period.

1.1.1 Macroeconomic background

The first decade (1970-1980) was characterized by a high growth. On average real GNP grew at 5%. The following decade sustained the previous growth, ranging from an average annual growth rate of about 3.5% during 1980-1985 to 2.7% during 1985-1990. Failed rains during this period led to a decline in agricultural output. GNP grew at a much lower rate than in previous years in the following decade. The war during the first half of the 1990s caused the destruction of infrastructure and the displacement of the population, and thereby considerably disrupting the whole production system. If one excludes the year 1994 during which the real GNP tumbled by about 58%, the average growth rate of the real GNP was about 7% during the 1990-2000 period; the growth rate has remained at an average of more than 7% since 2000 (World Bank, 2010). This growth, coupled with low and stable inflation, made Rwanda one of the best performer in sub-Saharan Africa.

The fiscal deficit remained very high at 10.5% partly due to high transitional and social spending. While agriculture and construction were the main sources of growth, by end 2003, neither manufacturing nor commerce had regained its 1993 level. The Rwandan population is expected to double to around 16 million by 2020. Given that the major aspiration of Vision 2020 (a program aiming to transform Rwanda into middle income country by 2020) is to raise income from 290 USD now to 900 USD per capita per year, this will require an annual growth rate of at least 7%. This will only be possible with a higher level of saving and investment thereby reducing the country's dependence on external aid. Based on the incremental capital output ratio (ICOR) approach, the country needs to annually invest 30% of GDP in order to achieve the targeted economic growth rate of 7% (Republic of Rwanda, 2000).

Statistics indicate that as a country, Rwanda has had low saving for long. On average, the domestic saving rate as a percentage of GNP was 14%, 11%, 8% and 14% for the last four decades respectively (World Bank, 2010). This is below the African average savings rate of approximately 18%. Economic theory holds that, for a country to accumulate sufficient savings to induce growth and thus development, these have to be above 23% of the GNP (Turtelboom, 1991). This indicates the monumental task Rwanda has to overcome as a nation.

Given the low saving rate for some time now, the recent impressive growth rates achieved, can only be attributed to other factors both endogenous and exogenous, especially a combination of prudent economic management and foreign savings, foreign direct investments, and more so, efficient and effective utilization of these resources and the ability of human capital to spur growth. But such reliance on donor funds and external resources are not reliable in the long run especially when these foreign resource inflows come largely in the form of official development assistance rather than private capital inflows.

On the external sector, humanitarian aid inflow of post-war period financed considerably the current account, but this did not last long, the increase in imports especially due to import of oil to supplement the energy in Rwanda have worsened the current deficit this last 5 years requiring considerable aid inflows.

1.1.2 The financial system in Rwanda

As in most developing economies, the financial system in Rwanda is dominated by commercial banks. Development finance institutions in agriculture are also small compared with commercial banks. Prior to 1995, Rwanda had 3 commercial banks and currently the financial services sector is composed of seven commercial banks (with 40 branches) and three financial institutions, regulated by an independent Central Bank. Banking services operations date back in early 1960s, originating from the oldest *Banque Commerciale du Rwanda* (BCR) and Bank of Kigali (BK). Recently, most commercial banks have centered their operations on trade finance as opposed to long-term debt financing.

There is a network of cooperative and credit unions, *Union de Banque Populaire du Rwanda*, (UBPR), with a nation-wide outreach of 133 savings and credit outlets, as well as other microfinance institutions (MFI) accounted for 90% of customers but only 25% of total deposits. Credit to the economy remains concentrated in Kigali and to a small number of sectors. Loans go mainly into trade, tourism, property development, and manufacturing. Maturities tend to be short, generally not exceeding three months for deposits and one year for loans.

The nonbank financial sector is small. The insurance sector is very small, with four companies (one state-owned and three private). The pension system is restricted to Social Security Fund of Rwanda (SSFR) which provides mandatory coverage to public and private sector workers in the formal sector. Housing finance is limited due to lack of long-term lending, the level of interest rates, some market distortions and the legacy of a real estate bubble, which contributed to *Caisse Hypothecaire du Rwanda* (CHR) insolvency.

With only 14% of the adult population having an account in the formal banking sector, Rwanda faces greater challenges compared to the East African countries. In terms of the proportion of the adult population being financially included, Rwanda (47%) lies second with only Kenya (57%) illustrating higher financial inclusion¹. This illustrates the role of the informal financial system in Rwanda which represents 52% and serves as an active user base for formal institutions to consider according to Finscope report (2008). The same report suggests that over half the adult population (54%) claim to be saving in Rwanda. Most (70.3%) of those who claim to be saving keep cash at home in a secret hiding place and are not using any formal or informal financial product for the purpose of saving. 39% of adults who save are members of *ikimina*, a small microfinance institution that can group from 10 to 20 local households. However their reasons for belonging to *ikimina* tend to be social rather than financially related (to exchange ideas or to socialize).

Making finance available to the poor in rural areas remains a major challenge in Rwanda. In 2002, only 2 per cent of bank credit went to the agricultural sector. Given the primary role that the agricultural sector must play in growth and poverty reduction and that this can only be achieved through the commercialization of agricultural activities, it is of paramount importance

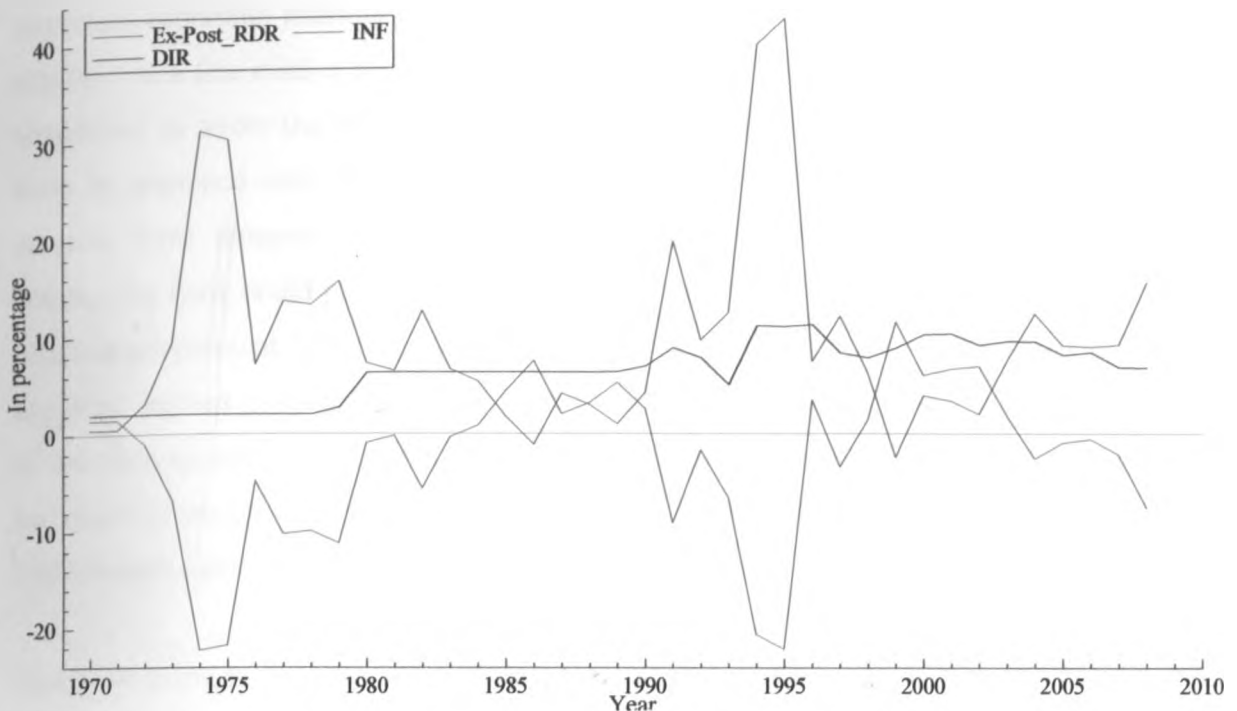
that an effective system of rural credit be introduced that supports the decisions made by rural farmers concerning choice of crop, use of inputs such as fertilizers and where and how to market output. Efforts were made in 1986 and the UBPR was created to inject capital into rural areas but take-up has remained low, in part due to the virtually non-existent level of savings. Until now, the rural areas remain dominated by non-monetised informal agricultural activities. In addition, the UBPR and the local cooperatives suffered great physical, financial and human loss during the genocide and the civil war of 1994, and have not fully recovered yet.

Elsewhere, the high cost of borrowing (currently in the region of about 17%) and the practice of banks of requiring 100 per cent collateral in the form of land and buildings severely constrain the crucial role of the financial sector stimulating trade and growth. Significant progress has been made in developing Rwanda's financial sector. The number of people accessing formal financial services has increased. In line with the objective of the government to increase access to financial services to the population, the Central Bank licensed two additional commercial banks in 2008. These are *Banque Populaire du Rwanda* which was upgraded from a microfinance institution and the Kenya Commercial Bank Rwanda. In addition, the National Bank of Rwanda (NBR) permitted the establishment of 23 new microfinance institutions. The total number of beneficiaries of formal financial services has increased by 29.5% from 2007 to 2008.

1.1.3 The financial sector liberalisation

In this study, we restrict the definition of financial liberalisation to domestic financial sector liberalisation; we don't include the analysis of exchange rate regimes or free capital movements. Rwanda has pursued a low interest rate policy for long. Prior to 1990, the National Bank of Rwanda determined the total volume of credit, as well as how it would be shared out by bank and by sector, while other types of funding sources were subject to a prior agreement. Except for few sectors where each bank could negotiate with its customers, interest rates were also closely monitored and remained almost the same for three decades. From 1962 to 1980, they were only reviewed three times: in 1967, 1979 and 1987. Afterward they remained constant as described in Figure 1 where RDR represents real deposit rate, DIR represents nominal deposit rate and INF represents inflation rate.

Figure 1: Nominal and ex-post real deposit rate of interest in Rwanda.



Source: own graph from the W.B. African Development Indicators statistics (2010).

As it can be seen from the above graph, the real interest rate was positive in the early 1970s but started to decline in 1973 and remained almost negative until 1983. It became positive in 1984 especially due to lower inflation policy that was undertaken by the National Bank of Rwanda (NBR). This did not last long, the situation worsened again in the early 1990s due to war and high inflation pressure that pulled the real interest rate to negative again. It was only in 1996, with full liberalisation of interest rate that the real interest rate became positive.

The above situation suggests a highly controlled state of the financial sector and the concomitant interest rate distortions in the pre-reform era. The financial system could not mobilize the necessary funds. As a consequence, investment could not increase to the desired level. This ultimately stifled economic growth in Rwanda. McKinnon and Shaw (1973) termed this state of affair as “financial repression”. They strongly advocated for the liberalisation of financial sector so as to make it a catalyst in the growth process of the economy. With the support of international institutions, Rwanda started liberalizing its financial system in the early 1990s, with a view to making the financial sector more efficient.

The post 1990 period was first marked by a war that lasted four years (1990–1994), then by the genocide and the collapse of the Rwandan economy. But it was also a period characterized by important economic reforms that enabled the country to make a progressive transition from a regulated to a free market economy. Direct control of prices and the interest rates were gradually abandoned to allow the determination of prices by market forces. Financial liberalisation was done in sequence with the following fundamental features: In April 1992, bank and credit controls were removed and the required preliminary authorization from the NBR before commercial bank could provide loans to their customers was abandoned. This resulted in a more efficient government financing because government could not finance its expenditure using NBR anymore, instead government had to issue treasury bills and other negotiable securities in order to mobilize necessary domestic resources. With the new regulation, the rediscount window was no longer as essential as in the past. Monetary policy had to be conducted through indirect tools. Interest rates were fully liberalized in 1996.

The NBR managed to keep inflation at low levels for several years, it used to fluctuate between 4% and 6% before 1990. The war worsened the situation and the inflation rate reached its highest level in 1994 (50%). Afterward it was kept in reasonable figures due to appropriate monetary measures. For other reforms, the government privatized most of its state-owned companies; this program is still in progress. The NBR started using indirect control instruments; tools like the required reserve ratio were gradually lowered.

Recently, Rwanda has launched the Financial Sector Development Program (FSDP) in the context of addressing the weaknesses in the financial sector. The FSDP overall vision is to develop a deep and broad financial sector and allocate resources to address the developmental needs of the economy (National Bank of Rwanda, 2008). Mainly the FSDP will try to solve problems like access to finance, capital market development, regulation of non bank institutions and the payment system which are the major weaknesses in the financial sector in Rwanda. So far, the capital market in Rwanda is operational and grounds are being prepared to join the East African integrated regional stock market.

1.2 Problem statement

Like many countries in sub-Saharan Africa, Rwanda has liberalized its economy in the last two decades. This was done through different programs to reduce the financial repression and encourage market determined prices of financial services especially interest rate. However despite all the reforms, saving is still at a very low level compared to what is needed to achieve sustainable growth. Twenty years have elapsed since the liberalisation programs through structural adjustment program by the IMF were implemented in Rwanda. There is a need to evaluate the role played by the financial liberalisation in mobilizing saving in Rwanda.

In theory, the main argument for the above financial reforms is that regulated nominal interest rates result in very low and even negative real interest rates, which, among other things, undermine efficiency in financial intermediation, and, as a result, cause fragmented financial markets, dependence on foreign aid and poor economic growth (Bwire et al., 2006). According to the financial liberalisation hypothesis, the interest rate elasticity of savings is positive, elastic and significant. Following this notion, financial reforms have been practiced in a number of Sub-Saharan African (SSA) countries since the 1980s. The shared belief is that higher real interest rates would elicit a higher volume of domestic savings and, given this supply-side effect, private investment would increase and set in a virtuous circle of higher growth and more savings for investment. Economic theory however, postulates two effects of real interest rate on saving, the substitution effect and income effect, the first is positive as higher interest lead to more saving and the second is negative as more income trigger more consumption reducing saving. This issue can only be resolved empirically (Mwega et al., 1990).

Unfortunately, the nature of interest rate elasticity of savings in LDCs is still controversial. While there are empirical studies which have established a significant positive relationship between savings and real interest rate (Demelo and Tybout, 1986; and Azam, 1996), many of the remaining studies have concluded that the real interest rate has very little or no effect on the savings behaviour in LDCs (Mwega et al., 1990; Clarke, 1996). With particular reference to Rwanda, there is a vacuum of empirical evidence. One study by Charles (2007) on determinant of savings in Rwanda didn't use interest rate as one of the explanatory variable. There is a need

to adequately clarify this issue and inform where Rwanda fits in the existing controversy over the role of real interest rates in savings. This study will evaluate the effect of financial liberalisation on aggregate private saving and financial savings in Rwanda.

1.3 Objectives of the study

The general objective of this study is to investigate the effect of financial liberalisation on saving in Rwanda and assess whether the dramatic switch from a regulated system did produce the intended benefit predicted by the literature. Specifically, the study intends to:

1. Empirically estimate the private and financial saving functions in Rwanda.
2. Investigate the effect of financial reforms on saving before and after financial liberalisation.

1.4 Significance of the study

This study is expected to contribute to an understanding of the impact of financial liberalisation on savings mobilization in Rwanda. Given the problem of low levels of saving that Rwanda faces, the government has to undertake appropriate policy action to stimulate saving. The immediate issue is to identify the kind of policies that has to be undertaken and how they should be undertaken. Unfortunately, policy decision making in most LDCs are based on untested theories, rules of thumb and at best experience of technocrats (Soyibo, 1992). Received theories are not always compatible with the host economy because they are based on some key assumptions that need to be fulfilled for them to work. The applicability of those theories is a function of different factors and how economic agents respond to them. There is a need to study periodically the response of economic agents to this policy prescription received from various theories to ensure the successful implementation of these policies and suggestion of various modifications to fit developing country reality.

CHAPTER II

2.0 Literature review

2.1 Theoretical literature review

2.1.1 Financial liberalisation theory

A minimum level of regulation is required for efficient operation of the financial sector, but when the regulation becomes stringent it leads to financial repression and impedes development of the financial sector. Such stringent controls may include restriction on interest rates, liquidity, entry, lending and sources of funds. Most of the developing countries have been practicing such stringent controls, especially a policy of low interest rate.

The prevalence of low interest rate has a number of economic rationales. The first is the Keynesian liquidity preference theory. With its liquidity trap, it can be used to rationalize taxing money holding so that full employment can be attained (Keynes, 1936). The second is the Tobin's monetary growth model. The Tobin's portfolio allocation model shows that capital/labor ratio and per capita incomes may be raised through financial repression that reduces the attractiveness of holding money vis à vis productive capital (Tobin, 1965). Development planning models based on fixed input-output model coefficients constitute another economic rationale. Many developing countries use or have used selective directed credit policies to implement planned sectoral investment programs derived from an input-output matrix. In particular, loan rate ceilings have been used in conjunction with import restrictions to encourage industrialization through import substitution (Fry, 1995).

In practice however, the predominant rationale for financial repression lies in its fiscal implications. Interpreted as a discriminatory tax on the financial system, financial repression comprises high inflation, high reserve requirements and interest rate ceilings. Given the disadvantage of high inflation and high reserve requirements, the government may turn to interest rate ceilings. Government deficit can be financed at a lower inflation rate and a lower

required reserve ratio the more the private sector is hindered from competing for available funds (Nichols, 1974). The consequences of this repression could be seen in low and even negative real interest rates, small and oligopolistic financial sectors, a dual economy with capital-intensive modern sectors served by cheap foreign exchange and low-interest finance and labor-intensive traditional sectors left to be served by informal finance.

Liberal attitudes to finance can be traced back at least to the seventeenth century. Among the earlier writers who stressed the need for liberal finance sector were John Lock, Adam Smith, Jeremy Bentham and Joseph Schumpeter (Fry, 1995, p. 22). But the main intellectual basis for financial sector analysis and policy advice over the past 37 years lies in the work of McKinnon (1973) and Shaw (1973). They both developed models of economic development in which financial liberalisation and development accelerate the rate of economic growth. They also highlight some of the deleterious effects of financial repression. Mackinnon and Shaw rejected the Keynesian monetary models and structuralists ideas. They both argue that crucial assumptions in these paradigms are erroneous in the context of developing countries. They challenged the case for low interest rates and financial repression and advocated financial liberalisation and development as growth enhancing economic policies.

The economy analyzed by McKinnon is financially repressed with interest rate ceiling, credit allocation, restriction of competition in the banking sector, among others. The only saving instruments available are limited to cash, time deposits and demand deposits. Raising interest rates may increase this saving by shifting out the informal saving to the formal sector which in turn should increase the quantity and the quality of investment leading to economic growth.

Mackinnon produces a model in which real money balances are complements rather than substitutes for tangible investment. He uses outside money in his formal analysis but inside money elsewhere (Fry, 1995). The model is based on the following assumptions: (i) all economic units are confined to self-finance or outside money implying no loans; (ii) investment is indivisible (lump-sum); and (iii) potential investors therefore need to save or accumulate money balances to enable them undertake the lumpy investment and that the incentive to do this comes from relatively low opportunity cost of accumulating money balances. These assumptions imply

that savings and investment move together in the same direction (complementary behavior) as shown below:

$$M/P = f\left(Y, \frac{I}{Y}, i - \pi^e\right) \quad (1)$$

and

$$\frac{I}{Y} = f(\bar{r}, i - \pi^e) \quad (2)$$

Where:

$\frac{M}{P}$: Real money balances (savings, broadly defined to include saving deposits, time deposits, demand deposits and currency in circulation, or M2),

Y: The level of economic activity,

$\frac{I}{Y}$: Investment ratio (investment/GNP),

$(i - \pi^e)$: Real deposit rate of interest,

\bar{r} : Average rate of return on physical assets and

P : is the price level.

The complementarity is indicated by the derivatives; $\frac{\partial(M/P)}{\partial(I/Y)} > 0$ and $\frac{\partial(I/Y)}{\partial(i - \pi^e)} > 0$ Whereas

$\frac{\partial(M/P)}{\partial(I/Y)} > 0$ indicates that savings and investment move in the same direction (complementary),

$\frac{\partial(I/Y)}{\partial(i - \pi^e)} > 0$ indicates that real deposit rate and investment move in the same direction. It follows that real deposit rate, saving and investment all move in the same direction.

Shaw (1973), on the other hand, constructs a monetary model in which money is backed by productive investment loans to the private sector. This is termed as debt-intermediation. Shaw argues that financial deregulation encourages savings and investment. This is justified by the fact that savers earn higher interest rate while investors are able to satisfy investment needs from increased accumulation of funds which hitherto could not be satisfied due to relatively high cost of searching for funds. What is saved is given out as loans, which implies equilibrium model as shown below;

$$M/P = f(Y, V, i - \pi^e) \quad (3)$$

$$\text{and } \frac{\partial(M/P)}{\partial(i - \pi^e)} > 0$$

Where;

M/p = real money balance (savings/investments loans),

Y = level of economic activity,

v = a vector of other opportunity costs in real terms of holding money,

$i - \pi^e$ = real deposit rate of interest.

Though originally focusing on interest rates, the financial repression approach also incorporated the adverse affects of high reserve ratios and government directed credit programs, which together contributed to low savings, credit rationing and low investment.

In connection to the above, Lewis (1992) holds the view that raising interest rates on deposits held in the banking sector have two beneficial effects, the savings effect and the portfolio effect. First, raising the real return available to income-earners cause consumption to fall and the supply of savings to increase. This savings effect alleviates the chronic shortage of investment resources. An increase in the rate of return to deposits relative to returns on other assets will elicit a portfolio response as wealth holder's move out of other assets into deposits in the banking system. This is in line with the neo-classical growth theory, which reveals that an increase in the savings rate raises the long-run level of capital and output per capita.

McKinnon (1973) adds that the prerequisite for achieving such success is fiscal discipline, because government deficit are financed by an inflationary tax that may increase the opportunity cost of holding money balances. The pre-requisite for success according to Shaw (1973) is free entry and competition in the banking sector so that interest rates can adjust to equilibrate saving and investment. For a successful financial deregulation, there are some other pre-conditions which include a political commitment as shown by compatible macroeconomic policies, awareness campaigns to carry the population along, capacity building for effective supervision and monitoring of the process, availability of technical support from multilateral institution and developed countries, a framework for deregulation in a reasonable time frame and sequencing of actions.

Economic theory suggests that in the relationship between savings and interest rates, there are two opposing effects. First, an increase in real interest rates will shift the balance between

consumption and savings in favor of the latter. Postponing consumption now in order to consume later becomes less costly (substitution effect). However, an increase in real interest rates raises income, which will increase consumption (income effect). Thus the net effect of increased interest rates on savings, both financial and nonfinancial, is ambiguous.

A switch from negative to positive real deposit rates, however, will affect the composition of savings. With consistently negative interest rates, households will hedge against inflation by investing in real estate, consumer durables, or foreign assets. In that case, an interest rate liberalisation, which generates positive real interest rates, can have important effects on financial savings. It is important to note that institutional factors may dampen the impact of increases in interest rates on savings, particularly when the bulk of savings are in the form of mandatory contributions to pension funds or social security contributions. McKinnon and Shaw (1973) argue that in developing country, the substitution effect is greater than the income effect and this lead to an increase in saving.

We may also highlight the effect of financial intermediation on saving as developed by the new growth literature, this effect is unambiguously positive (Agenor and Montiel, 2008). The development of financial markets offers households the possibility of diversifying their portfolios and increases their borrowing options, affecting, therefore, the proportion of agents subject to liquidity constraints, which may in turn affect the saving rate (Jappelli and Pagano, 1994). Financial development tends to reduce the overall level, and to modify the structure of interest rates by reducing the spread between the rate paid by borrowers and that paid to lenders. Although these factors are bound to affect saving behavior, in each case the effect is ambiguous. For instance, an increase in the overall level of interest rates may have a positive or negative effect on the saving rate. The net effect depends, in particular, on banks and portfolio holder's attitude toward risk. We also have to consider other dimensions of financial liberalisation, such as increased household access to consumer credit or housing finance, which might work to reduce private savings rather than increasing them (Muellbauer and Murphy, 1990).

2.1.2 Aggregate private saving and financial saving.

A distinction need to be made between private savings and financial savings. Warman and Thirwall (1994) argue that the financial liberalisation hypothesis makes no distinction between the two variables and yet in LDCs a significant portion of domestic savings may be held in the form of real asset (real asset, land, gold, livestock, etc.). Another portion can be constituted by the underground economy and the market for foreign exchange or it can be exported in the form of capital flight. This can be modeled as follow, if we decompose the gross national saving into public and private saving we have the following equations where:

$$\text{GNS}=\text{GS}+\text{PS} \quad (4)$$

Where GNS represent Gross national saving, GS, Government saving and PS, private saving. The flow of private saving can be divided into two major components: private financial saving which comprise the portion of private saving that is kept in the form of financial assets in the formal financial sector (PFS) and private saving residue which comprises the portion of private saving which is kept in non-financial forms or put into other uses (PSR). That is:

$$\text{PS} = \text{PFS} + \text{PSR} \quad (5)$$

The flows of total financial saving comprise public financial saving and private financial saving on the assumption that all government saving is kept in the form of financial assets we have:

$$\text{PSR}=\text{GNS} - \text{GFS} - \text{PFS} \quad (6)$$

Where GFS is the government financial saving. Total financial saving (TFS) will then be given by :

$$\text{TFS}=\text{GNS}-\text{PSR} \quad (7)$$

Dividing equation (7) by GNS, we obtain:

$$\text{TFS}/\text{GNS} = 1 - r \quad (8)$$

Where, $r = \text{PSR}/\text{GNS}$, which measures the proportion of total saving that is leaked out of, or not captured by the formal financial sector. Financial deepening of a given economy can be measured by equation (8) with a smaller r , the higher will be the degree of financial deepening. Increases in r imply an increase in the process of financial shallowing. Analyzing further, the leakages of saving outside the formal financial sector , the private saving residue may be divided into the following main components: the portion which is kept in the form of real assets including livestock and gold (R); the portion which is claimed by the informal financial sector

(N), the proportion which is claimed by the underground economy including the black market for foreign exchange (U), the portion which goes into capital flight (C) (this is usually kept abroad in the form of foreign currency deposit accounts, financial assets or physical assets) and the portion which is hoarded by households in the form of domestic or foreign currency holdings (H). Using these definitions in equation (7), we obtain:

$$\text{TFS} = \text{GNS} - (\text{R} + \text{N} + \text{U} + \text{C} + \text{H}) \quad (9)$$

Equation (9) show us other way of increasing the financial saving, that is if GNS is stagnant, financial saving can still be increased by reducing the stock of saving which is kept in real assets, by reversing the process of capital flight, by attracting the resources of the informal sector into the formal sector or by reducing the amount of saving claimed by the underground economy and by encouraging dishoarding of foreign and domestic currency by households. On the other hand large additions to total saving might not increase financial saving if they are offset by an equal increase in any of the components of the leakages. Also substitution among the component of the leakages might occur without affecting financial saving.

Equation (9) allows us to reinterpret the controversy between the proponents of McKinnon-Shaw financial liberalisation theory and their opponents from the New Structuralist School. In the context of our study, this controversy concentrates mainly on the interactions between financial saving and the components of the leakages shown by the equation. According to McKinnon (1973), in most developing countries, a significant proportion of working capital for the financing of inventories, goods in process, trade credit and advances to workers is obtained through bank financing. The supply of bank credit determines the level of available working capital, and thus of net output. An increase in deposit interest rates is thus expected to increase holdings of financial assets (broad money) and hence working capital and output. This increase in financial saving will occur through the reduction in the leakage.

For the new structuralist, an increase in deposit rates is likely to result in increased holdings of financial assets, but the outcome will not necessarily be a positive increase in working capital and output. This depends on which component of the leakage is reduced and on whether the reduced component will cause an offsetting reduction in output.

In an influential article, Wijnbergen (1983a) criticized the McKinnon-Shaw model. He claims that the informal financial sector may actually be providing more loans because it is not constrained by reserve requirements and other regulations applicable in the formal sector. If the higher interest rate leads to substitution of informal sector deposits for that of the formal sector, this may reduce the level of financial intermediation and economic growth.

Modeling national saving can be traced back as early as 1930. Different researchers have tried to model the behavior of saving. They are four basic theories of consumption and saving, these two variables move together because one is the mirror image of the other.

The pioneer behind one of this theory is Keynes (1936). He argues that the marginal propensity to consume is between zero and one. That is, when a person earns an extra dollar, he typically spends some of it and saves some of it. According to Keynes, income is the primary determinant of saving and interest rate does not have an important role. Average propensity to consume falls as income rises. Because saving is equal to income minus consumption, the average propensity to save will increase as income rise. He believed that saving was a luxury, so he expected the rich to save a higher proportion of their income than the poor. This conjecture stood in stark contrast to the beliefs of the classical economists who preceded him. The classical economists held the view that a higher interest rate encourages saving and discourages consumption. Keynes admitted that the interest rate could influence consumption as a matter of theory.

The second theory is the relative income hypothesis (RIH) developed by Duesenberry (1949). This theory relates consumption and saving to the income of an individual relative to that of the rest of the society. Household having a relatively lower income and living in society of higher incomes tend to spend a higher proportion of their income than the households with higher incomes, thus an individual maximizes utility subject to a weighted average of the population consumption and saving. This results in consumption being dependent on individual's position in income stream. In what he called the ratchet effect, he further argue that when households face a decrease in income, their consumption falls less than proportionately because they are used to a standard of living. The relation is such that consumption, hence saving, is not only a function of

present relative income but also a function of the levels of consumption attained in previous periods.

The life cycle hypothesis (LCH) developed by Ando and Modigliani (1963) has gained greater popularity in recent years. They theorize that income varies over a person's life. Most people plan to stop working at a certain age, and they expect their incomes to fall when they retire. Yet they do not want a large drop in their standard of living, as measured by their consumption. To maintain consumption after retirement, people must save during their working years. They suggest that the propensities of an individual to consume out of disposable income and out of wealth depend on person's age. It implies that saving is high when income is high relative to lifetime average income. It also suggests that aggregate saving depends on the growth rate of the economy and such variables as the age distribution of the population.

Another theory is the permanent income hypothesis (PIH) developed by Friedman (1957). He asserts that consumption hence saving is related not to current income but to a longer-term estimate of income, which he calls permanent income. Consumers spend their permanent income and save their transitory income.

The PIH and LCH share the same view that saving is related to some measures of long term-income. The life-cycle hypothesis pays more attention to the motives for saving than the permanent income hypothesis does, and it provides convincing reasons to include wealth as well as income in the saving function. Modern theories of saving combine the expectations emphasis of the permanent income hypothesis with the emphasis on wealth and demographic variable suggested by the lifecycle hypothesis (Dornbusch and Fischer, 1985).

In this study, we also combine the above theories when modeling households saving but modeling saving in the context of developing countries like Rwanda raises some issues. The PIH and LCH assume that household can smooth consumption and this depends on access to unconstrained borrowing and lending.

Saving behavior is very different from the developed country to developing countries and various reasons explain this phenomena as suggested by Deaton (1989, 1992a). First, households in developing countries tend to have different demographic structures and families tend to be large with different generations living together sharing resources. If this is so, this changes the saving behavior as described by the PIH and the LCH. As resources are shared there is no need for elders to save for retirement since the young will provide and serve as insurance against uncertainty and diversify risk for them removing the precautionary motive for saving. Second, households in developing countries are more uncertain due to different adverse macroeconomics shocks that they may experience like rain fail which can disturb agriculture income which constitutes the source of the revenue for a large number of households. Even the resource pooling cannot get rid of this risk; this suggests indeed the relative importance of precautionary saving (Deaton, 1989). Thirdly, due to low income in LDCs, households operate at near subsistence income levels. A sudden drop in income may be catastrophic, justifying the motive for consumption smoothing. To be able to transfer resources across time, households need to be able to borrow and lend. Borrowing constraint may restrict them and financial repressions discourage them to save.

2.2 Empirical literature review

The debate over the interest rate sensitivity of saving in developing and industrialized countries is still unsettled and continues to generate more heat than light. The financial liberalisation theory hypothesizes that there is a positive effect of interest rates on savings. The World Bank (1987) cited evidence from several developing countries where interest rate deregulation generated increased savings. However, subsequent studies do not support this finding. Most of the empirical studies have reported the interest rate effect on savings to be either inconclusive or negative. Fry (1995) demonstrated that when real deposit interest rates have any significant effect on national savings ratios, the magnitude was of no great policy significance. He argued that only in countries where the real deposit rate was negative by a considerable margin could there be much scope for increasing savings directly by raising the deposit rate.

Looking at key studies in semi-industrialized countries, they seem to support the financial liberalisation hypothesis. Athukorala and Rajapatirana (1993) estimate an interest rate elasticity of private saving of 1.11 in Sri Lanka over the period 1960-1987 using the natural logarithm of real private saving as the dependent variable. Celasun and Tansel (1993) also detect a positive rate and significant effect of real deposit rate interest on private saving in Turkey over the period 1972-1988. De Melo and Tybout (1986) find that the real interest rate exerted a significant positive effect on saving ratio in Uruguay over the period 1962-1973.

The above results become stronger in developed countries. Bayoumi (1993) investigates the interaction between financial deregulation and household saving's behavior using regional data for the United Kingdom in the 1980s. He concluded that financial deregulation was responsible for increasing the equilibrium level of saving by roughly 2.25 percent per year and making saving more dependent on changes in wealth, income and interest rates. Also, deregulation increases the sensitivity of saving to wealth, current income and real interest rates.

Most studies that have rejected the influence of interest rate on saving were done using panel data including some African countries. Bandiera et al. (2000) examined the effects of various financial liberalisation measures in eight selected countries which are Chile, Ghana, Indonesia,

Korea, Malaysia, Mexico, Turkey and Zimbabwe using a sample for 1970-1994 period. They found that there was no evidence of positive effect of the real interest rate on savings. In most cases the relationship was negative. They constructed an index of financial liberalisation on the basis of eight different components: interest rates; reserve requirement; direct credit; bank ownership; prudential regulation; securities market deregulation and capital account liberalisation.

Loayza et al. (2000) also documented that the real interest rate had a negative impact on the private saving rate. They used a sample of 150 countries with data spanning from 1965 to 1994. They found that a 1% increase in the real interest rate reduced the private saving rates by 0.25% in the short run. Reinhart and Tokatlidis (2001) used data of 50 countries consisting of 14 developed and 36 developing ones over the period 1970-1998. They found that in the majority of cases higher real interest rates were associated with reduced savings in the sampled countries. Similarly, Schmidt-Hebbel and Serven (2002) argued that the sign of the interest rate elasticity of savings was ambiguous, both theoretically and empirically. Higher interest rates increased savings through the substitution effect, but could ultimately reduce the savings rate if the associated income and wealth effects were sufficiently strong. This theoretical ambiguity has not been resolved as yet, and the direction of the response of aggregate savings to an exogenous increase in the interest rate still remains vastly controversial.

Explaining the above difference, Ogaki et al: (1995) claim that interest elasticity of private savings is higher in middle and high income countries due to subsistence consumption which is less dominant than in the case with poor countries. There are however, additional reason why savings may be less responsive to changes in real interest rates in low-income than in middle income countries.

In another study of the real interest rate in Nigeria, Soyibo and Adekanye (1992) used a dummy variable to capture the effect of financial liberalisation and their results seem to support the financial liberalisation hypothesis. Lamberte et al. (1992) also detect a significant positive, but miniscule, time deposit rate coefficient in an estimate of the private saving ratio in Philippines over the period 1972-1988.

Mwega et al. (1990) tested the hypothesis that real interest rates have a significant positive impact on the financial and non financial saving in Kenya. They specified an aggregate private saving function and a financial saving function and used a two stage least squares method to run their regression. They rejected the McKinnon-Shaw hypothesis. The interest rate was not significant in both the private saving and the money demand functions.

In another study by Oshiyoka (1992), he examined the impact of financial liberalisation through increased real deposit rates on savings, financial intermediation, investment and economic growth in Kenya using the ratio of domestic saving to GDP as the dependent variable. The coefficient of real deposit was also negative and insignificant for the sample period of 1970-1989. But during the sub-period (1980-1989) the estimated results indicate a positive correlation between saving rate and the real deposit rate. Azam (2000) documented that the real interest rate had a positive impact on national savings rate in Kenya. With data spanning from 1967 to 1990, he found that interest rate made a positive contribution to the saving rate when it had a high value.

In a study by Charles (2007), he estimated a national saving function, a private saving function and a current account function in Rwanda. He used an inter-temporal current account model developed by Maurice Obstfeld and Kenneth Rogoff where real interest rate was not among the explanatory variable. Using simple ordinary least square (OLS), he found potential investment coefficient to be highly significant for the national saving. For the private saving, only a variable captured by difference between current and permanent income was found to be significant. All other variable were irrelevant. Though his model may have suffered from simultaneity bias and endogeneity problem due to simple OLS, he did not test for the stationarity of the variable which suggests that his results may be spurious. We may take his conclusion with precaution.

2.2.1 Overview of the empirical literature

As postulated in our hypothesis, higher interest rates following a financial liberalisation should increase saving as postulated by the financial repression hypothesis. The empirical literature review survey above is mixed, 3 studies find a positive relationship (Athukorala and Sarath,

1993, Celasun and Tansel, 1993, Jaime and Tybout, 1986) while 5 other studies were ambiguous or the interest rate coefficient was not statistically significant (Fry, 1988, Bayoumi, 1993, Bandiera et al., 2000, Loayza et al., 2000, Schmidt and Serven, 2002). We also have two studies which reported a negative interest rate effect on saving (Loayza et al., 2000, Reinhart and Tokatlidis, 2001). All the above results suggest that this issue is far from being clear. Mainly, the disagreement comes from different econometric techniques, different measures of saving, different measures of interest rates and different sample periods. The only study on saving in Rwanda did not use interest rate as an explanatory variable.

Our study will be different from this in the sense that we include real interest rate as one of the variables and run the model using the advanced econometric technique, that is the 2SLS and cointegration technique. To my knowledge, no one has ever attempted to elicit the financial liberalisation issue in the Rwandan context using the same method. This study is the first doing so. The following chapter will introduce the methodology that will be used in this study.

CHAPTER III

3.0 Methodology

Various measures were implemented at different times under the financial liberalisation process in Rwanda. However, in this study we concentrate mainly on the interest rate effects on savings in Rwanda. We draw a distinction between the aggregate private saving and financial savings and estimate separate functions with special emphasis on the role of the real interest rate in the determination of each category of saving. It is difficult to assess the impact of financial liberalisation given that the long-term effect of liberalisation on saving may differ substantially from the impact effect. This is one reason why, where necessary and justified, we use the cointegration econometric technique.

3.1 Theoretical foundation of the model

We analyze how rational, forward-looking consumers make inter-temporal choices by taking into consideration the constraints consumers face, the preference they have and how the interaction of these preferences and constraints determine their choice about saving following a model by Romer (1996). When deciding on how much to spend and thereby how much to save, economic agents face an inter-temporal budget constraint which measures the total resources available for consumption today and in future. This budget constraint can be modeled as:

$$\sum_{t=0}^T \frac{c_t}{(1+r)^t} \leq \beta_0 + \sum_{t=0}^T \frac{y_t}{(1+r)^t} \quad (10)$$

Where:

β_0 : is the household's initial wealth

y_t : Real disposable income

r : Real interest rate

c_t : Real consumption.

In the above budget constraint, the individual household has an initial wealth β_0 and labor income of $y_1, y_2, y_3, \dots, y_T$ in the T period of his/her lifetime. This equation requires that the present value of lifetime consumption cannot exceed initial wealth plus the present value of life

time real income. Future consumption and future income are discounted by a factor $1+r$. This discounting arises from the interest earned on savings.

If we allow additive separable utility and no uncertainty, the representative household lifetime utility function if he lives for T period is given by:

$$U = \sum_{t=0}^T \frac{u(c_t)}{(1+\alpha)^t} \quad (11)$$

Where α is the rate of time preference and $u(\cdot)$ is a concave period consumption utility function, $U'(\cdot) > 0$ and $U''(\cdot) < 0$,

The marginal utility function is positive; our representative household satisfies the budget constraint with the equality in equation (10).

For the optimum condition, a typical household will maximize his lifetime utility function (11) subject to the inter-temporal budget constraint (10).

The Lagrangian utility function is given by:

$$\mathcal{L} = \sum_{t=0}^T \frac{u(c_t)}{(1+\alpha)^t} + \lambda \left[\beta_0 + \sum_{t=0}^T \frac{y_t}{(1+r)^t} - \sum_{t=0}^T \frac{c_t}{(1+r)^t} \right] \quad (12)$$

Optimizing the above function we get the first order conditions for c_t and λ given by:

$$\frac{\partial \mathcal{L}}{\partial c_t} = \frac{1}{(1+\alpha)^t} u'(c_t) - \lambda \frac{1}{(1+r)^t} = 0 \quad (13)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = \beta_0 + \sum_{t=0}^T \frac{y_t}{(1+r)^t} - \sum_{t=0}^T \frac{c_t}{(1+r)^t} = 0 \quad (14)$$

From equation (13)

$$u'(c_t) = \lambda \frac{(1+\alpha)^t}{(1+r)^t} \quad (15)$$

In the special case where the interest rate is equal to the rate of time preference equation (15) becomes:

$$u'(c_t) = \lambda \quad (16)$$

Which implies that the marginal utility of consumption is the same in every period. The utility function is only function of consumption, this require consumption to be the same also in all periods, thus the concept of consumption smoothing. If we allow $r \neq \alpha$, and conduct an experiment where we decrease consumption in period t , and increase consumption in the next period by $1+r$ times the amount of the decrease, optimization requires that a marginal change of this type has no effect on lifetime utility.

$$\frac{1}{(1+\alpha)^t} u'(c_t) = (1+r) \frac{1}{(1+\alpha)^{t+1}} u'(c_{t+1}) \quad (17)$$

Rearranging these terms gives:

$$\frac{u'(c_{t+1})}{u'(c_t)} = \frac{1+\alpha}{1+r} \quad t = 1 \dots \dots \dots T - 1. \quad (18)$$

The consumer chooses the consumption pattern so as the marginal rate of substitution between two periods is equal to the ratio $\frac{1+\alpha}{1+r}$. An extra unit of consumption would make the same contribution to lifetime utility no matter to what period it is allotted. In this case consumption is rising if $r > \alpha$ and falling if $r < \alpha$. Variations in the real interest rate lead to variations in consumption with an increase in real interest rate causing the path of consumption to be more steeply sloped, but this doesn't necessarily increase saving due to two competing effects, the income and substitution effects.

To bring in the saving function, from equation (16), we know that consumption is constant in all periods, that is $C_1 = C_2 = \dots = C_T$. This implies the fact that $\sum_{t=0}^T c_t = Tc_t$, assuming that there is no interest rate or discount rate. (The inclusion of interest rate in the above equation will not change the interpretation). Substituting this in equation (15), we get:

$$C_t = \frac{1}{T} [\beta_0 + \sum_{t=0}^T y_t] \quad (19)$$

This individual household divides its lifetime resources equally among each period of life. This analysis implies that this agent's consumption is determined not by current income that period, but by income over her lifetime or permanent income as postulated by Friedman (1957) in the PIH and in the LCH by Modigliani (1963). From equation (19), we can derive our saving function as follows:

$$s_t = y_t - c_t \quad (20)$$

Equation (19) in (20) gives:

$$s_t = y_t - \frac{1}{T} [\beta_0 + \sum_{t=0}^T y_t] \quad (21)$$

The higher the transition income, the higher the saving and vice versa. This analysis makes three important predictions about household saving. First, the inter-temporal budget constraint suggests that households will tend to smooth consumption. Second, the model predicts that the effect of changes in income on saving depends whether this change is permanent or transitional. Thirdly, the model makes no prediction about the effects of changes in the interest rate on the consumption behavior of households that are net savers in the current period. An increase in interest rate has two effects, the substitution effect and the income effect, hence the overall

effect of interest rate on saving is an empirical issue. Saving function is then a function of interest rate and deviation from the permanent income.

The above model can be criticized on the ground that individuals face high interest rates for borrowing; they may choose not to borrow to smooth their consumption when their current resources are low. And if they cannot borrow at all, they have no choice but to have low consumption when their current resources are low. Thus liquidity constraints can cause current income to be more important to consumption and saving than is predicted by the above model especially in the context of Rwandan economy. This justifies the inclusion of income variable in our model specification.

So far, we have been assuming no uncertainty and a closed economy. Extending the model to a national level and relaxing those assumptions, we can include inflation in our model as a proxy for uncertainty and allow foreign saving to open the economy. Again, changes in saving do not occur instantaneously but gradually with time (Duesenberry, 1949). According to Mwega et al. (1990), inertia, habit persistence or customs may delay saving to adjust fully to an exogenous shock in one period. That is why dynamics adjustment will be considered in our econometrics regression.

The above model concerns the household's savings. But household data are unavailable in most developing countries, especially in Rwanda for the sake of this study. We examine household saving indirectly through private saving, which is an aggregate saving that comprises household saving and firms saving. In the following section we specify our empirical models.

3.2 Models specification

The financial liberalisation theory postulates that saving is positively related to the real interest rate. The theory, however, does not make clear distinction between total savings and financial savings. Total domestic savings consists of private and public savings of which financial savings is a part. Financial savings is the portion of total savings that is channeled through financial assets which comprise short and long-term banking instruments, non-bank financial instruments

such as treasury bills and other government bonds and commercial paper. It is prudent, therefore, for a country study to examine the role of the real interest rate in the determination of both private saving and financial savings. To this end, two equations for private saving and financial savings are specified.

3.2.1 Aggregate private saving

For the aggregate private saving, we specify a model that is inspired by the theoretical foundation in the previous section, a model already specified by Mwege et al. (1990) and others. The model is specified as follow:

$$PSR_t = \beta_0 + \beta_1 LRealGNP_PC_t + \beta_2 RDR_t + \beta_3 FSR_t + \beta_4 GR_t + \beta_5 INF_t + \beta_6 D_{1990} + \beta_7 D_{1994} + \varepsilon_t$$

(22)

Where:

PSR: Private Saving Ratio

LRealGNP_PC: The Log of Real GNP per capita

RDR: Real deposit rate of interest

FSR: Foreign Saving Ratio

GR: Growth rate of Real GNP

INF: Inflation

The model predicts that the private saving ratio in %, PSR (measured as the ratio of private savings to GNP) is determined by the Log of Real GNP per capita (measured by the log of Real GNP over population), the real deposit rate of interest, RDR (measured using a formula that will be described below), foreign saving ratio in %, FSR (measured as minus current account deficit over GNP), the growth rate of real GNP and inflation (measured as the percentage change in the CPI).

Since the focus of this study is to test whether financial liberalisation enhances private savings mobilization, a regression analysis is adopted in an attempt to investigate if there were any structural changes between the two periods, that is, the pre-financial liberalisation period (1970-

1990) and the rest of the period (1990-2008). A dummy variable D_{1990} , which assumed values of zero (0) before 1990 and one (1) after, is included in the model. However, cognisance should be noted of the fact that most clear cut cases of financial liberalisation were accompanied by other economic reforms (fiscal and trade). Thus, in such circumstances, it is difficult to isolate the effects of the financial components of the reform package. We also introduce another dummy variable D_{1994} , to capture the effect of the 1994 war. The dummy takes the value of 0 before the war (1994) and 1 for the rest of the period.

The choice of the variables and their expected signs are motivated by the theoretical foundation and literature review, let us examine these variables one by one. The coefficient of per capita real income β_1 , is expected to be positive, this follow from the theoretical belief that high income will increase saving in the Keynesian framework. However, for those consumers whose borrowing constraints are binding, they consume less than they would otherwise consume. An increase in income may increase their consumption lowering saving. The sign is ambiguous.

The real interest coefficient β_2 is supposed to be positive as postulated by the McKinnon-Show (1973) financial liberalisation hypothesis. But this hypothesis is based on financial savings and the above model use the aggregate private savings. Such effect may be obscured and reflect the substitution and income effect as postulated by the theoretical model. This sign is not precise.

The coefficient of the foreign savings inflow ratio β_3 , can not be predicted apriori as foreign savings complement the existing domestic savings in the economy and may "crowd out" domestic savings by allowing residents to consume more at any given rate of capital accumulation.

The growth rate of income (β_4), which proxies the deviations from permanent income captures the PIH and the LCH as discussed in the theoretical foundation of our model. This coefficient is expected to be positive as saving respond positively to transitional income. But as suggested by Tobin (1965), if economic agents expect that their income will grow in the future, they should want to consume more today, reducing saving. This sign is also ambiguous.

β_5 , the coefficient of inflation is supposed to be positive, higher inflation increase uncertainty rising precautionary savings. Finally, β_6 is also expected to be positive and β_7 negative.

3.2.2 Financial saving

For financial savings, we specify a model suggested by McKinnon in his complementarity hypothesis originally specified as follow:

$$M/P = f\left(Y, \frac{I}{Y}, i - \pi^e\right)$$

For the purpose of this study, the model is specified as follow:

$$LRealM2_t = a_0 + a_1 LRealGNP_t + a_2 RDR_t + a_3 NSR_t + a_4 D_{1990} + a_5 D_{1994} + \mu_t \quad (23)$$

Where:

LRealM2: The Log of Real M2

LRealGNP: The Log of Real GNP

RDR: Real Deposit Rate

NSR: National Saving Ratio

In the above model, the log of financial saving, measured as real money balances represented by real M2 is determined by the log of real Gross National Product, the real interest rate and investment output ratio proxied by saving output ratio (measured as National saving over GNP in %) on the ground that investment is equal to saving in the saving-investment complementarity hypothesis of McKinnon.

As before, a dummy variable D_{1990} , is included to capture the effect of financial liberalisation which take the value 0 before 1990 and 1 otherwise. Another dummy D_{1994} is also included to capture the effect of the war. It takes the value of 0 before the war and 1 for the rest of the period. All coefficients, except for the 1994 dummy, are expected to have a positive sign as postulated by McKinnon and Shaw (1973) and explained in the theoretical literature review. The analysis of this theory while extraordinarily insightful, was entirely verbal and intuitive and not derived from a mathematical model by McKinnon and Shaw.

3.3 Sources and type of data

Annual time series data on the selected variables as discussed in our models for the period 1970-2008 are used. When dealing with poor data from an African country like Rwanda, the greater the number of observations, the higher is the probability of detecting significant statistical relationships. Quarterly data (which would have increased the number of observation and reduced the measurement error that may rise in data inaccuracies) were not available constraining us to use annual data. We could have used the method of general interpolation to generate quarterly data, but this method requires having at least the dependent variable in quarters which was not the case.

We used the data mainly from the World Bank Africa Development Indicators (2010) and the International Monetary Fund (IMF) statistics, the International Finance Statistics (IFS) database. These data were complemented by various other documents published by the National Bank of Rwanda (NBR) and Ministry of Finance. The gross private savings is calculated as gross national savings less government savings the later approximated as current government revenue minus general government expenditure in local currency. We used the ex-ante real interest rate usually computed as $(r = i - \pi^e)$, but this formula is an approximation and will be misleading especially when you have fluctuation in the variables exceeding 20% (Mankiw,2002). Indeed, for the period analyzed, inflation in Rwanda exceeded 20% more than four times. Instead, we use a more accurate formula used by Nugent and Glezakos (1979) computed as follow:

$$RDR = \left[\left(\frac{1+i/100}{1+INF^e/100} \right) - 1 \right] \times 100 \quad (24)$$

Where i is the 12 month nominal interest rate paid by commercials banks for demand, time, or savings deposits and INF^e is the expected inflation representing the percentage change in consumer price index calculated using the Laspeyres formula, base year 2005. For the expected inflation we adopt the adaptive expectation in its simplest form where $CPI^e = CPI_{t-1}$, assuming in the Rwandan context economic agent form their expectation on current inflation based only on last year inflation. Note that this is a working hypothesis that serves only as a proxy for a more complex expectation formulation mechanism.

We use Real GNP instead of Real GDP to include net factor income from abroad due to recent rise in workers remittances that affect saving variables. For the current account balance, there were 6 missing values from 1970 to 1975 that had to be filled by linear interpolation. Not doing so would have reduced our degrees of freedom leading to more serious problem of insufficient data due to subsequent lags requirement in the dynamic modeling. For financial savings, we used Real M2 which was computed as the sum of currency outside banks, demand deposits other than those of the central government, and the time and savings of resident sectors other than the central government deflated by the CPI.

The findings of this study are more likely to be limited due to the quality of the data used. We used different data sources and they give different data for the same variables. As an example, for the aggregate M2, the World Bank African Development Indicators has different data from the National Bank of Rwanda. In this study we used the latter but this suggest a problem of data inconsistency for other variables. The method of direct linear interpolation used to generate some missing value data tends to impose a linear trend on the data. This problem is likely to reduce the precision of the parameter estimates. However, it is hoped that these limitations are not of great significance to invalidate the results of the analysis.

CHAPTER IV

4.0 Empirical results

4.1 Descriptive statistics for the series in levels

Most of the variables satisfy the normality test in levels, except for the private saving rate (PSR), the national saving rate (NSR), the log of Real money balance (LRealM2), and the log Real GNP (LRealGNP). This can be attributed to structural changes in the data and certain outliers due to the war and different shocks that affected these macroeconomics variables. The outliers can individually or collectively be responsible for the residual non-normality problem. This emphasises the use of pulse dummies to improve the chances of error normality as specified in our model. Table 1 report a summary statistics of all the variables.

Table 1: Descriptive statistics for variables in levels

	INF	GR	LRealGNP	LRealM2	RDR
Observations	38	38	38	38	38
Mean	10.354	4.2787	27.528	25.664	-2.4667
Std.Dev.	10.132	14.776	0.29343	0.3463	8.2643
Skewness	1.7007	-1.0248	-0.30555	0.50197	-0.98577
Excess Kurtosis	2.5712	8.0993	0.40322	-0.16483	0.64078
Minimum	-2.4059	-58.175	26.767	25.059	-22.19
Maximum	42.361	45.058	28.198	26.503	12.824
Asymptotic test	28.786***	110.51***	0.8487	1.6388	6.8045**
Normality test	29.564***	48.929***	2.2164	2.0663	8.1322**

	PSR	NSR	LRealGNP_PC	FSR
Observations	38	38	38	38
Mean	14.834	12.094	11.885	2.3697
Std.Dev.	5.3911	4.7691	0.16839	4.3522
Skewness	0.023759	-0.05406	-1.5451	-1.461
Excess Kurtosis	-0.83404	-0.2379	3.4217	2.3392
Minimum	3.5323	2.682	11.239	-13.223
Maximum	24.994	22.766	12.108	7.7835
Asymptotic test	1.105	0.10812	33.657***	22.183***
Normality test	0.7174	0.19965	13.358***	15.223***

Source: Computed by the author

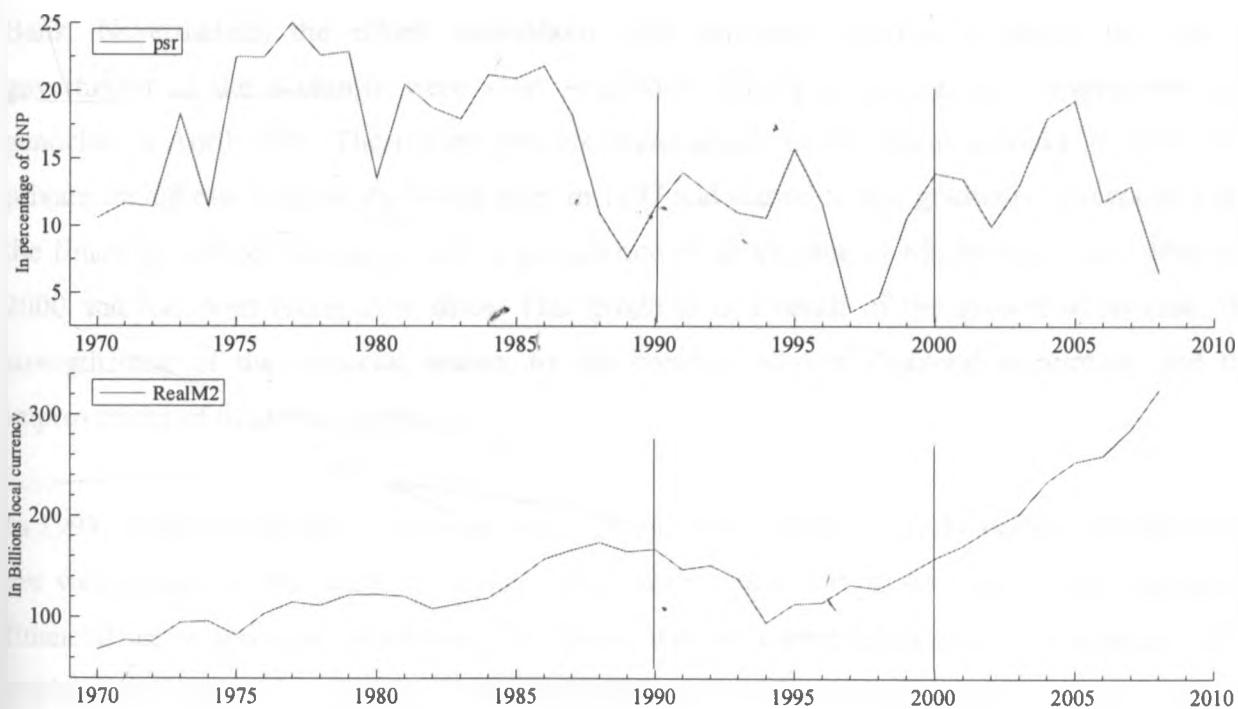
i) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

We confirmed this by analyzing the graphs of these variables in levels. This helped in the choice of relevant arguments to include in the test for unit root, checking whether a variable has a trend or a drift. Except for the LRealM2 and LrealGNP which seem to have a trend, all other variables should be analyzed including only a constant as it can be seen from Figures 3 and 4 included in the appendix.

4.2 Savings in Rwanda: a graphical assessment of the dependent variables

In this study, we restrict the definition of financial liberalisation to domestic financial sector liberalisation and in Rwanda financial liberalisation policies started to be implemented in the early 1990. In this graphical analysis, we divided the sample period in 3 periods, a repressed finance period from 1970 up to 1990, a transitional period from 1990 to 2000 and a regime of mostly liberalized finance from 2000 onward. Figure 2 represents private saving rate and real M2 divided into 3 periods as explained above.

Figure 2: Private saving rate and real M2 in Rwanda



Source: own graph using the WB African Development Indicators and the NBR statistics (2010).

Examining the performance of private saving ratio suggests that the nature of the variation in performance across the three regimes is far from clear. Despite the increasingly interventionist approaches in the early 1970, private saving in Rwanda experienced steady improvement up to the advent of the first oil crisis in 1974. From a very low average of just over 10% in 1970, average private saving rates had exceeded 18% by 1973. Similarly financial savings was also increasing and was only stopped by the first oil crisis. That crisis, in all likelihood, was the cause of the substantial fall in the average private saving rates and real money balances.

The second oil crisis (1979-1981) saw a similar and larger contraction. By 1980, the average gross private saving rate in Rwanda had fallen well below 14%. Savings recovered somewhat in the first half of the 1980 and started to decline in mid-1980. Similarly, financial savings declined in 1978 but it has been rising until 1988.

The transition period (from repressed to liberalized finance) was marked by a decline in all aggregates. Starting in the early 1988, the private saving rate started to fall. This was probably due the economic effect associated with the rumor of the war that started in 1990. This period coincide with the implementation of a structural adjustment programs by the IMF and the World Bank. Nevertheless, the efforts undertaken with structural reforms to reduce the role of government in the economy were soon suspended following the war that degenerated into genocide in April 1994. The reform process began again; to the extent it could, in 1995. The private saving rate reached its lowest level in 1997 and started to rise gradually. Except in 1994, the financial savings aggregate, saw a growth rate of an average of 8% between the 1990s and 2000 and has been rising ever since. This progress is a result of the growth of income, the strengthening of the financial system by the creation of new financial institutions and the improvement of financial conditions.

In 1998, Rwanda launched a financial sector development program in the context of addressing the weaknesses in the financial sector. The overall vision was to develop a deep and broad financial sector and allocate resources to address the developmental needs of the economy. This explains the recent rise of the private saving rate and real money balance in the third period starting in 1998 onward.

Clearly, the evolution of private saving and financial savings does not exhibit patterns that suggest clear differences across financial policy regimes. The most pronounced and consistent growth in private saving occurred during the period of financial repression and during the liberalized period for financial savings. However, we noticed a decline in both aggregates during financial liberalisation period.

It is evident that the story of domestic resource mobilization in Rwanda is more nuanced than a simple story of financial repression and correction through liberalized finance. This issue can only be resolved empirically. In the next section we examine this issue using econometrics techniques, assessing the effect of financial liberalisation on these aggregates.

4.3 Time series properties of the variables

Owing to the fact that the data we used are time series, some of the variables may be spuriously related. To overcome this problem, stationary tests using the Augmented Dickey Fuller (ADF) unit root testing procedure (Dickey and Fuller, 1979) and Phillips-Perron (1988) test (PP) for each of the variables in equation (22) and (23) are used.

We suspect the presence of structural breaks due to various economic reforms that have affected our variables in the early 1990s which may bias the Dickey-Fuller and Phillips-Perron tests toward the non rejection of a unit root. A truly stationary variable with some structural breaks may be labeled to be non stationary. Perron (1992) in his seminal paper on this issue argues that conventional unit root tests used by researchers do not consider that possible known structural breaks in the trend function may tend too often not to reject the null hypothesis of a unit root in the time series when in fact the series is stationary around a one time structural break. He also warned against selecting the date of structural break because this date may not coincide with the dates chosen exogenously.

To address this issue, we used another widely applied unit root test developed by Clemente et al. (1998) that allows the data to indicate two breakpoints. The tests allow for two events within the observed history of a time series, either additive outliers (the AO model, which captures a sudden change in a series) or innovational outliers (the IO model, allowing for a gradual shift in

the mean of the series). In this study, we used both and compared their respective outcomes. Getting the time series property of the variables right is crucial because all econometrics techniques that will be applied depend on this crucial step.

4.3.1 Tests for unit root

Test of unit root for the all our variables using the Augmented Dickey-Fuller (ADF) and the Philips-Peron (PP) test were performed. By default, for all the variables, we included a constant because we don't know the true mean of the data generation process. We also allow a trend variable to enter the regression model used to test unit root for the series where it was statistically significant. Not doing so may lead to over rejection of the null hypothesis. For the ADF test lags order selection, we set the maximum lags at 9 and selected the model that minimizes the Schwarz Information Criteria (SIC). Table 2 reports the test results.

Table 2: Testing for unit root in levels using ADF and PP

Variables	Trend	Lag	ADF	PP	Decision
PSR	yes	0	-3.346292 * (0.0742)	-3.151346 (0.1096)	Reject ² I(0)
NSR	no	0	-3.062576** (0.0381)	-2.987915** (0.0451)	Reject I(0)
GR	no	0	-6.942624*** (0.0000)	-7.437615** (0.0000)	Reject I(0)
LrealGNP_PC	no	0	-3.249809** (0.0247)	-3.249809** (0.0247)	Reject I(0)
FSR	yes	0	-4.434612*** (0.0058)	-4.423017*** (0.0060)	Reject I(0)
RDR	no	3	-2.838667* (0.0635)	-3.129765** (0.0329)	Reject I(0)
LRealM2	no	0	-0.442498 (0.8914)	-0.558399 (0.8680)	Accept I(1)
LrealGNP	yes	0	-2.250619 (0.4494)	-2.250619 (0.4494)	Accept I(1)
INF	no	0	-3.504489** (0.0132)	-3.504489** (0.0132)	Reject I(0)

i) (...) p-values

ii) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

Table 3: Testing for unit root in first difference using ADF and PP test

Variables	Trend	lag	ADF	PP	Decision
Δ PSR	no	0	-7.153581*** (0.0000)	-8.561484*** (0.0000)	Reject I(0)
Δ NSR	no	1	-5.861579*** (0.0000)	-11.62672** (0.0000)	Reject I(0)
Δ GR	no	0	-7.228203*** (0.0000)	-41.13845** (0.0001)	Reject I(0)
Δ LrealGNP_PC	no	0	-7.749082*** (0.0000)	-10.65645*** (0.0000)	Reject I(0)
Δ FSR	no	0	-8.962676*** (0.0000)	-14.10155** (0.0000)	Reject I(0)
Δ RDR	no	2	-3.172442** (0.0306)	-6.575590*** (0.0000)	Reject I(0)
Δ LRealM2	no	0	-6.058378*** (0.0000)	-6.072795*** (0.0000)	Reject I(0)
Δ LrealGNP	yes	0	-6.804775*** (0.0000)	-7.053564*** (0.0000)	Reject I(0)
Δ INF	no	1	-6.683106*** (0.0000)	-6.821091*** (0.0000)	Reject I(0)

i) Δ is the first difference. And in (...) are p-values

ii) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

From the tables above, except for LrealM2 and LRealGNP, the ADF and the PP test for unit root reject the null hypothesis of unit root in levels, suggesting that most variables are stationary in levels. The non-stationary variables become stationary when we difference them once. But this test does not take into consideration structural breaks. The above test confuse structural breaks with non-stationarity. That is why we complement them with the Clemente-Montañés-Reyes unit-root test as described in section 4.3 but only for the non-stationary I(1) variables. Table 4 reports the Clemente-Montañés-Reyes unit-root test results.

Table 4: Testing for unit root using Clemente-Montañés-Reyes test

Additive outlier				
Variables	Du1	Du2	tstat rho -1	lags
LRealM2	1980***	2001***	-3.1	0
Δ LrealM2	1989	1992	-1.949	4
LrealGNP	1972**	1992	-0.049	2
Δ LrealGNP	1973	1992	1.725	7
Innovative outlier				
Variables	Du1	Du2	tstat rho -1	lags
LRealM2	1974	2000***	-2.641	0
Δ LrealM2	1987**	1993***	-10.173*	0
LrealGNP	1973**	1993***	-4.053	1
Δ LrealGNP	1974***	1993***	-16.089*	2

- Estimation with 0.15 trimmed. Tstat is the minimum t-statistic calculated.
- 5% critical values – two breaks: -5.49
- *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

Clemente-Montanes-Reyes unit root tests should provide evidence of significant additive or innovational outliers in the time series for them to be considered and this was the case. The LRealM2 and LRealGNP are not level stationary, confirming the previous ADF and PP tests. Even taking into consideration the structural breaks, the above series remain non-stationary. Considering this outcome, it appear that we have a mixture of I(0) and I(1) variables.

From the variables included in equation (22), all the variables are stationary in levels. For equation (23), LrealM2 and LrealGNP are not stationary I(1) while RDR and NSR are stationary I(0). This suggests that the two equations will be estimated using different econometric techniques to handle their time series properties. For equation (22), we use two stages least squares (2SLS) to handle potential feed back effect between endogenous variables and for equation (23) we use a cointegration technique developed by Engel-Granger (1987). The choice of the second technique calls for some clarifications. Owing to the fact that only two variables were I(1), there can exist only one cointegration relationships between this two variables and this justify the choice of the Engel-Granger (1987) two step procedure over another multivariate cointegration technique developed in Johansen (1988) and applied in Johansen and Juselius (1990) that handle up to (n-1) cointegration relationships.

4.4 Regression results

4.4.1 The private saving function

As discussed before, all variables in the private saving function are levels stationary. For the first stage we estimate this function using simple Ordinary Least Square (OLS). To take into consideration the dynamic adjustment, we considered an autoregressive distributed lags (ADL) model in its general form given by:

$$A(L) y_t = B(L)x_t + \mu_t \quad (25)$$

Where $A(L)$ is polynomial lag operator $1 - \rho_1 L - \rho_2 L^2 - \dots - \rho_p L^p$, $B(L)$ is also a polynomial lag operator $\beta_0 + \beta_1 L + \beta_2 L^2 + \dots + \beta_q L^q$, x_t is a vector of weakly exogenous variables and $\mu_t \sim N(0, \sigma_\mu^2)$. This model states that the dependent variable y_t is generated by its own past values together with the current and past values of x_t .

Using a log likelihood test, the optimal lag was set at 3. This lag length was the one that minimize Schwarz Information Criteria. We reported Newey–West standard errors to take into consideration serial correlation due to lagged dependent variable included in our model. These heteroscedasticity and autocorrelation-consistent standard errors are also useful when we have doubts about some of the explanatory variables being strictly exogenous. In this case, methods such as Cochrane-Orcutt are not even consistent (Maddala, 2005).

Owing to the fact that some of the variables are endogenous³, mainly $LRealGNP_PC$ and RDR , they may be correlated with the disturbance term in the private saving equation creating a simultaneity bias that make OLS estimates inconsistent. To overcome this problem, we used two stage least square (2SLS) estimation technique. It is hard to find instruments though. They need to be uncorrelated with the error term, yet help to predict $LrealGNP_PC$ and RDR . $LrealGNP$ was instrumented by the log of capital labor ratio⁴ and the log of fertilizer consumption. Similarly, RDR was instrumented by the log of the nominal exchange rate. We tested the validity of the above instruments by performing the Sargan–Hansen test of over identification which

regresses the residuals from 2SLS regression on all instruments under the null hypothesis that all instruments are uncorrelated with the error term. The test scored a $\chi^2(1)$ of 0.019026 with a p value of (0.8903) confirming the independence of our instruments from the error process. Table 5 reports OLS and 2SLS results.

Table 5: OLS and 2SLS estimates of private saving function

PSR	OLS		2SLS _a	
	Coefficients	P value	Coefficients	P value
CONSTANT	302.4067	0.282	320.1812	0.250
LREALGNP_PC	-17.3256	0.670	-106.8217	0.108
RDR	0.994286	0.381	-2.701788	0.293
PSR_1	0.716259*	0.076	0.8272065***	0.000
PSR_2	-0.38501	0.415	-0.499409	0.154
PSR_3	0.140044	0.674	0.2989937	0.406
LREALGNP_PC_1	111.8251**	0.017	171.1142**	0.014
LREALGNP_PC_2	-83.7217*	0.076	-98.67478	0.022
LREALGNP_PC_3	-35.6218	0.386	7.912833	0.812
RDR_1	1.129423	0.347	3.476726**	0.038
RDR_2	-1.54104	0.112	-2.607443***	0.007
RDR_3	-0.21571	0.371	-0.0465107	0.795
GR	0.481101	0.291	1.305436*	0.055
GR_1	-1.01155***	0.007	-0.896024***	0.009
GR_2	-0.08258	0.867	0.1509416	0.691
GR_3	0.313083**	0.026	0.3466493***	0.006
FSR	-0.71866	0.155	-0.4888863	0.196
FSR_1	0.305372	0.589	0.4581255	0.421
FSR_2	0.14775	0.726	0.6468308	0.231
FSR_3	0.677371	0.191	1.043756***	0.009
INF	-0.00537	0.984	-0.0333306	0.874
INF_1	0.622503	0.472	-2.384485	0.274
INF_2	1.256112	0.223	3.30646**	0.026
INF_3	-1.21825*	0.095	-1.940143***	0.004
D1990	-6.8969	0.268	4.710566	0.563
D1994	-3.92898	0.567	-9.543351	0.128
R ²	0.88		0.66	

- i) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%
 ii) 2SLSa: Considering both LREALGNP_PC and RDR endogenous.

Using 2SLS when there is no simultaneity bias produce estimators that are consistent but not efficient (Gujarati, 2004). Indeed, in the absence of a simultaneity bias, OLS produce efficient and consistent estimators. There is a need to test for this and we used two tests: the first one is the Hausman test (Hausman, 1978). The null hypothesis is that the OLS estimators are efficient. If accepted, we probably would prefer to use OLS instead of 2SLS. This test requires running

both models first. The test failed to reject the null hypothesis when comparing OLS and 2SLS estimates considering both $LrealGNP_PC$ and RDR endogenous. The χ^2 of 1.41 with a p value of (0.2350) rejected the consistency of 2SLS providing support for using simple OLS.

We used a second test to confirm the first, the Wu (1973) version of the Hausman test to test whether $LrealGNP_PC$ and RDR are truly endogenous. The t values of 1.13 (0.289) and -1.02 (0.334) respectively point to the confirmation that the two variables may not be endogenous in the private saving equation confirming the use of OLS to estimate it.

However, with the ADL model, there is a high likelihood of correlation between current and lagged values of variables included in the model and this may result in a problem of multicollinearity. To handle this, we used the Hendry (1996) general to specific approach which involves eliminating insignificant variables from the estimated model. We reported a parsimonious model where all non significant coefficients (t value less than 1 in absolute terms) were dropped in the need to maximize the goodness of fit. Table 6 reports those results:

Table 6: OLS estimates of the preferred model

PSR	Coefficient	P values	Diagnostics and post estimation tests	
PSR_1	0.505734***	0.008	R ²	0.764638
LREALGNP_PC_1	11.7753	0.19	DW	2.05
LREALGNP_PC_3	-18.2774**	0.037	F(13,21) =	5.248 [0.000]***
RDR	0.834864	0.132	AR 1-2 test: F(2,19) =	0.36439 [0.6994]
RDR_2	-0.83903*	0.058	ARCH 1-1 test: F(1,19) =	0.63450 [0.4355]
GR	0.156307*	0.085	Normality test: $\chi^2(2)$ =	1.7725 [0.4122]
GR_3	0.123307**	0.048	hetero test: $\chi^2(24)$ =	23.628 [0.4830]
FSR	-0.47992*	0.09	RESET test: F(1,20) =	0.94910 [0.3416]
FSR_3	0.537498*	0.066		
INF_1	0.631784	0.169		
INF_3	-0.60249*	0.083		
D1990	-2.43894	0.395		
D1994	-2.69718	0.315		
CONSTANT	85.2802	0.519		

i) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

Considering the above results, the R^2 of 76% is satisfactory. The joint hypothesis that all the regressors coefficients are not different from zero was rejected at 1%. The DW of 2.05 is not valid in this case due to the presence of the lag of the dependent variable. It is biased against

discovering serial correlation. We used Breusch–Godfrey test, also known as the Lagrange multiplier test which is more powerful than the usual h test when you have small sample. With 3 lags, the χ^2 of 1.636 with a p value of 0.6513 failed to reject the null hypothesis of no serial correlation. The residuals generated herein were subjected to normality tests and proved to be white. Moreover, the Ramsey RESET test for specification error yielded an F-statistic of 0.94910 [0.3416] a statistical result that justifies the model is not misspecified.

The above results assume parameter stability in the sample period. If the coefficients are unstable the results will be unreliable. There is need to check this and we used the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals square (CUSUMSQ) tests proposed by Brown et al. (1975). The null hypothesis is that all coefficients are stable. If the plot of the CUSUM and CUSUMSQ stays within the 5 percent critical bounds, the null hypothesis cannot be rejected. The plot of CUSUM and CUSUMSQ stability tests as shown in Figure 5 reported in the appendix indicate that all the coefficients are stable over the study period as they fall within the critical bounds. Since all the variables in the model are of stationary form, statistical inferences using standard t and F tests are valid.

4.4.1.1 Interpretation of the results

The coefficient of the real deposit rate is statistically insignificant on impact. It is only significant in the second period and it is negative. On impact, the positive substitution effect is canceled out by the negative income effect. Our findings seem to agree with the conclusions reached by the majority of past studies. These studies have reported the interest rate effects on private savings to be either inconclusive or negative (Oshiyoka, 1992; Mwegu et al., 1990). This can also be explained by the nature of majority savers in Rwanda. They mainly save to acquire a physical asset due to high credit constraints and such savings are pushed by the desire to have the asset rather than the deposit rate. Again, a substantial proportion of households have income near the subsistence level according to Fin scope report (2008). In this case the intertemporal elasticity of substitution will approach zero and the private saving rate will not be sensitive to the real rate of interest. The second lag of RDR coefficient is negative but statistically significant. Indeed, an increase in 1% in real deposit rate reduces the private saving ratio by 0.83%. This means that the

negative income effect is greater than the positive substitution effect of an increase in real interest rate after two years.

The analysis seems to support our theoretical model hypothesis of positive effect of transitional income proxied by GR due to the positive effect of GR on private saving rate. An increase in 1% in the growth rate of Real GNP increases the saving rate by 0.15% in the same period and 0.12% in the third period. This suggests that in Rwanda, as economic agents income grows faster they tend to save more. This also confirms the Modigliani (1986) hypothesis where higher growth rate would raise private saving because it would increase the aggregate income of those working relative to those not earning labor incomes. In a study by Carroll and Weil (1994), they confirmed that lagged values of increase in income growth seem to explain higher saving rates.

Real income per capita is not significant, but its third lag become significant at 5% and it is negative. Foreign saving has a negative effect on private saving and crowd out the latter as an increase in 1% in foreign saving ratio decrease the private saving ratio by 0.47%.

At 1% level of significance, the first lag of private saving ratio is significant and positive. A coefficient of 0.5 shows a large degree of adjustment toward the desired levels and confirms how the past levels of saving are important in current saving behavior. The third lag of inflation is also significant but does not have the expected sign. An increase in inflation rate by 1% reduce private saving rate by 0.6%. As inflation rate increase, economic agent in Rwanda substitute money for storable goods due to high cost of holding money. This kind of saving is not well counted in the private saving measure and translates into a negative effect of inflation on private saving.

There is no evidence of the positive effect of financial liberalisation as the negatively signed 1990 dummy variable is not significant. This suggests that financial liberalisation did not have a significant impact on private saving. Finally, the 1994 dummy variable, measuring the economic effects of the political events at that time, was not significant.

4.4.2 Financial saving function

The unit root tests have indicated that one independent variable (LRealGNP) together with the dependent variable in the financial saving function (LRealM2) are not stationary. Applying the classical regression technique to these variables may lead to spurious results. We use the Engle-Granger (1987) two-step procedure as a useful tool in the analysis of both economic theory relating to the long-run relationship between the variables and short-run disequilibrium.

Considering a static model where:

$$y_t = \beta X_t + \varepsilon_t \quad (26)$$

If X_t and y_t are both integrated of order $I(1)$ and ε_t is $I(0)$, Engle and Granger define the two series to be cointegrated of order $CI(1,1)$. Testing the null hypothesis that X_t and Y_t are not cointegrated amounts, in the Engle-Granger framework, to directly testing whether the ε_t is $I(1)$ against the alternative that ε_t is $I(0)$. Engle and Granger (1987) advocated the ADF and PP tests and that is what is used in this study. Therefore, when estimating the long run relationship between Y_t and X_t , it is necessary to estimate the static model using OLS. In fact when the variables are cointegrated, OLS has a super consistency property and all dynamics, spurious and endogeneity issues can be ignored asymptotically (Harris, 1995).

Running LRealM2 against LRealGNP, we obtained the first estimates and checked the consistency of the parameters. The model was suffering from the non normality problem probably due to the presence of structural breaks that introduce outliers. They are mainly due to exogenous shocks like the 1994 war and the financial liberalisation. In this case the long run coefficients are not valid. To improve on this, we introduce our two dummy in the long run equation to capture those events. The residuals from the model were subjected to the ADF and PP test of unit root. We suppressed the constant in the unit root regression model as the residual has a zero mean. The test results are reported in table 7.

Table 7: Cointegration test using ADF and PP

	lag	ADF	PP	Decision
Residuals	0	-4.129*** (0.0006)	-4.124*** (0.0006)	Reject, I(0)

i) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

The ADF and the PP tests rejected the null hypothesis of unit root suggesting that the residuals are stationary and our variables are cointegrated. The long run relationship is represented in the following equation.

$$LRealM2 = -1.5007 + 0.9832LogRealGNP + 0.0099D_{1990} - 0.2241D_{1994} \quad (27)$$

(0.4460) (0.0000) (0.8870) (0.0020)

$$R^2 = 0.89 \quad DW = 1.11$$

The goodness of fit is satisfactory. 89% of the variations in the financial saving function are explained by the regressors. Real GNP is significant and it influences positively the financial savings as an increase in Real GNP by 1% increase financial saving by 0.98%. This in line with the transaction motive for holding real money balance hence saving. The higher the economic activities, the more money people will save in Rwanda.

4.4.2.1 The error correction model

If the variables are cointegrated, then the relationship can be expressed as an error correction models (ECM) to reconcile the short run behavior with its long run behavior. We used this to capture the short run and long run effects of financial liberalisation on financial savings. The error correction as specified in the Granger Representation Theorem takes the following general form for our financial saving function.

$$DLRealM2_t = \beta_0 + \sum_{i=1}^p \beta_i DLRealM2_{t-i} + \sum_{i=0}^p \beta_i DLRealGNP_{t-i} + \sum_{i=0}^p \beta_i DRDR_{t-i} + \sum_{i=0}^p \beta_i DNSR_{t-i} + \rho_1 ECT_{t-1} + \sigma D_{1990} + \tau D_{1994} + \mu_{2t} \quad (28)$$

Where the terms using the summation sign represent the short run dynamics relationship and ECT_1 is the error correction term generated from the long run cointegrating equation (27) but lagged one period with ρ_1 as a measure of the adjustment mechanism. We proceeded by estimating a single equation error correction by OLS. We constructed a parsimonious model where non significant coefficients were dropped leaving a simplified model represented in table 8.

Table 8: The ECM

	Coefficients	P value	Diagnostics and post estimation tests	
DLREALM2_3	0.175214	0.14	R ²	0.647749
CONSTANT	0.014437	0.472	DW	2.31
DLREALGNP	0.429286***	0.000	F(7,27) =	7.093 [0.0000]***
DRDR	0.002033	0.298	AR 1-2 test: F(2,25) =	1.4054 [0.2640]
DNSR_1	0.004502	0.133	ARCH 1-1 test: F(1,25) =	0.064138 [0.8021]
ECT_1	-0.2926**	0.033	Normality test: Chi ² (2) =	2.3146 [0.3143]
D1990	-0.04722	0.274	Hetero test: F(12,14) =	0.87493 [0.5873]
D1994	0.064621	0.139	RESET test: F(1,26) =	0.075121 [0.7862]

i) *: indicate significance at 10%, **: indicate significance at 5% and *** indicate significance at 1%

The model passed all tests successfully and the R² of 64 % is satisfactory. The plot of CUSUM and CUSUMSQ stability tests as shown in Figure 6 reported in the appendix also indicate that all the coefficients are stable.

In short run, the above estimates seems to reject the applicability of Mackinnon and Shaw financial intermediation hypothesis in Rwanda as the real deposit rate is not statistically different from zero. Though it is only significant at 29%, its contribution is negligible, an increase in 1% hardly increase saving by 0.2%⁵, a very small percentage indeed. This may be a reflection of another fact, the source of financial savings in Rwanda. In fact, a large portion of financial savings is in form of employees salaries which are deposited in the employees savings and currents account. This kind of deposits which are automatically counted as savings with financial institutions will be more determined by institutional arrangements rather than real deposits rate. This is also confirmed by the non-significance of the negatively signed 1990 dummy variable (Dummy1990), a variable that captured the impact of financial liberalisation on financial savings mobilization. This implies that the changes brought about by the liberalisation in the financial sector did not have a significant impact on financial savings in Rwanda in short run as suggested by the financial intermediation literature.

Indeed, financial savings seems to be driven by real GNP. As economic agent in Rwanda get richer their financial saving increase in short run. An increase in 1% in real GNP raises financial savings by 0.43%. The national saving ratio which is a proxy for investment ratio is also not significant, contradicting the Mackinnon and Shaw complementarity hypothesis that saving and investment move in the same direction when investors rely mainly on self finance. The error

correction term has the right sign and it is statistically significant confirming the earlier results that the variables are cointegrated. The coefficient value of -0.29 implies that, in each year, the level of financial savings adjusts by about 29 percent of the gap between the current level and the long run equilibrium level. The war dummy is also insignificant, suggesting that the war did not have a significant impact on financial savings.

4.5 Summary

In this chapter, we estimated a private saving and a financial saving function. Using OLS, results suggest that private saving is mainly driven by the growth rate of income and foreign savings. The past level of private saving rate, real income per capita and inflation are also significant but real income per capita and inflation do not have the correct signs. The real interest rate as postulated in our hypothesis is not significant but its second lag is significant but negative. This rejects the crux of the Mckinnon and Shaw (1973) hypothesis of positive effect of real interest on saving. Our findings seem to agree with the conclusions reached by the majority of past studies. These studies have reported the interest rate effects on savings to be either inconclusive or negative (Fry 1988; Lewis 1992; Bayoumi 1993; Morriset 1993; Bascom 1994; Bandiera et al. 2000; Loayza et al. 2000; Reinhart and Tokatlidis 2001; Schmidt-Hebbel and Serven 2002; Mweha et al. 1990). We estimated the financial saving function using the Engle-Granger two steps procedure and the results suggests that financial savings are driven by real income. Contrary to the financial liberalisation hypothesis, real interest rate is also not significant in the financial saving function. Similarly, a dummy variable that capture the effect of financial liberalisation was not significant in both models suggesting that the recent financial reforms did not have a significant impact on savings.

CHAPTER V

5.0 Conclusions and policy recommendations

5.1 Conclusions

In the last two decades, Rwanda has liberalized its economy by implementing financial liberalisation programs in an effort to improve the mobilization of savings. With regards to financial sector, direct control of prices and interest rates were gradually abandoned, bank and credit controls were removed and interest rates were later on fully liberalized.

In this study, we were concerned with the overall effect of this financial liberalisation on both private and financial savings using a sample period from 1970 to 2008. The shared belief was that higher real interest rates would elicit a higher volume of private saving and financial savings. This issue was argued to be of relevance to policymakers because the investment and growth effects of financial liberalisation will depend on how responsive savings is to changes in real interest rate.

In Chapter 2, we reviewed the theoretical and empirical literatures used to analyze the relationship between savings and its determinants. In Chapter 3, based on the above literatures, we developed a theoretical model that yielded testable hypothesis. Private saving rate was hypothesized to be a function of real deposit rate, real income per capita, growth rate of income, foreign savings and inflation. Financial savings was determined by real income, real deposit rate and investment output ratio. Two dummy variables were included in both models to capture the effect of financial liberalisation and the 1994 war respectively.

Specific objectives of this study were to:

1. Investigate the effect of financial reforms on saving before and after financial liberalisation.
2. Empirically estimate the private and financial saving functions in Rwanda.

An initial visual impression from the figures of private saving and financial savings suggested that the financial reforms efforts have not produced the intended benefits predicted by the literature. Graphically, we found an increasing trend of private savings rates in the pre-reform period but no such trend after financial liberalisation. Although financial saving seems to have increased significantly after the financial liberalisation, this conclusion needed to be confirmed by regression results.

Empirically, the McKinnon and Shaw (1973) hypothesis of significant positive real interest rate elasticity of saving is not supported. Instead, private saving seems to be driven by the growth rate of income, foreign saving, inflation and real income per capita. Financial saving is only driven by real income. A dummy variable that captured the effect of financial liberalisation on saving was not significant suggesting that the financial reforms did not have any significant impact on both aggregates.

The absence of a positive effect of financial liberalisation on savings does not mean that the process is useless. For one thing, liberalisation can increase the inflow of capital, including the return of flight capital (Bartolini and Drazen, 1997). Again, it can strengthen the market discipline and increasing the autonomy of banks and other financial institutions, the various elements of the reform process can have the effect of eliminating less productive uses of loanable funds.

5.2 Policy implications

In terms of policy, the findings of this study show that goods macroeconomics conditions matter in the mobilization of private saving and financial savings in Rwanda. Promoting economic growth must be a cornerstone of the efforts towards saving mobilization in Rwanda. Higher income and income growth have been found to be the driving force of both private and financial saving in Rwanda. The overall implication is that policies that spur development are an indirect but effective way to raise private saving rates and financial savings.

It has been observed that in our sample period, real deposit rate was mainly negative due to high inflation rate. The current experiences of high inflation should be put in check if the savers are to realize value for their savings. The main policy issue on interest rate liberalisation is the need to implement it in a stable and less inflationary environment. Tight fiscal and monetary policies are needed to control inflation for a smooth transition to a liberalized finance.

There is a need also to control the current account deficit and reverse the process as foreign saving inflow undermines the national efforts to raise private saving. More imports without exports widen the current account deficit. A diversification of export products base can enhance export and lead to strong growth in exports.

With respect to financial reforms, the failure of the financial liberalisation to mobilize sufficient savings that can spur growth calls for alternatives policies. Gerschenkron (1962) argued that the banking sector alone will not be able to mobilize the necessary fund due large technological and institutional gaps as well as a shortage of entrepreneurial talents. According to him, there is a need for special institutional factor to help the banking sector to raise the necessary fund. One policy would be the active government involvement in the industrialization process, including savings mobilization.

In this study, financial liberalisation were restricted to domestic finance only, further studies that will extend liberalisation to external finance and examine the effect of different exchange rates regimes and capital movement effect on saving will be welcomed.

NOTES

1. By financial inclusion, we refer to all those people who use formal and informal financial products.
2. Uniform outcomes of ADF and PP tests are necessary for the final conclusion about the stationarity properties of each series but for this we chose to reject the null even if for the PP test it was only significant at 11%.
3. Note that all lagged variables are considered exogenous because their values are known at time t . They can influence the future, but the future can not influence the past.
4. The capital labour ratio was extracted from a study by Coulibaly et al. (2008).
5. Considering a semi log model given by $\ln y_t = \beta_0 + \beta_1 X_t + \varepsilon$ it can be shown that

$$\beta_1 = \frac{\partial \ln y}{\partial x} = \frac{\partial y/y}{\partial x} \text{ If we multiply both sides by a 100, we get } 100 \beta_1 =$$

$$\frac{\partial y/y}{\partial x} 100 = \frac{\text{Percentage change in } y}{\text{absolute change in } x}, \text{ in our case } X \text{ is also in percentage form, this will be}$$

interpreted as % change in Y due to 1 % change in X.

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APPENDIX

Figure 3: Graphs of the all variables in levels for the private saving function

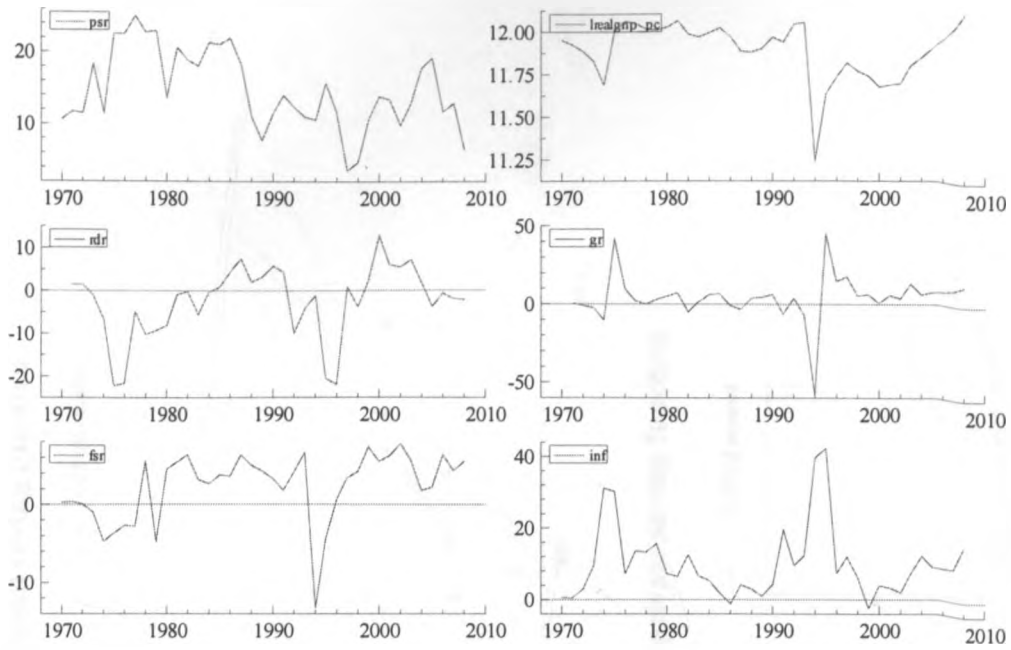


Figure 4: Graphs of the all variables in levels for the financial saving function

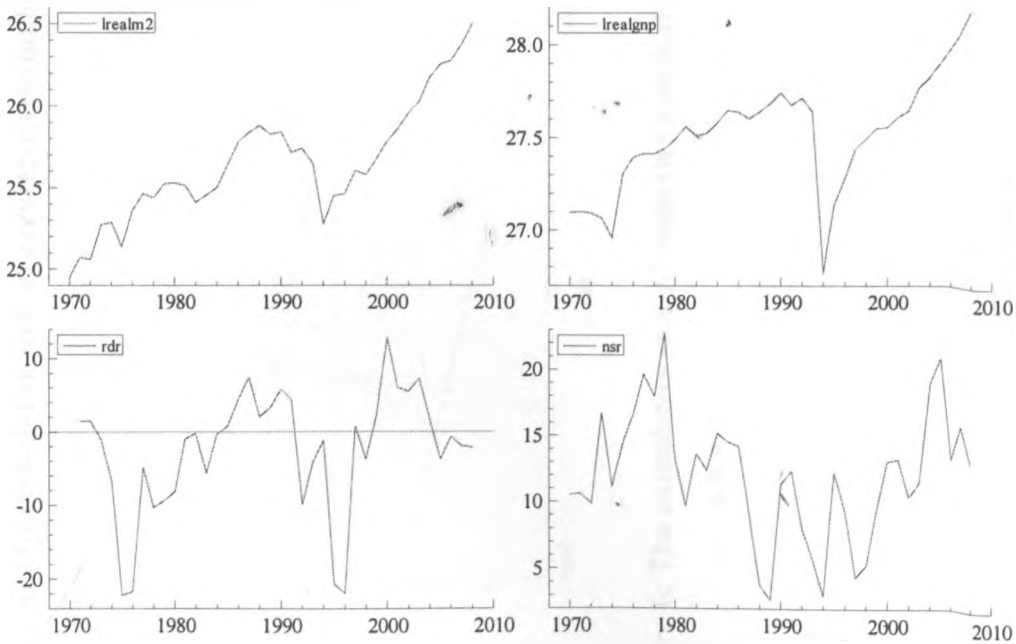


Figure 5: The cumulative sum of recursive residuals test for financial saving function

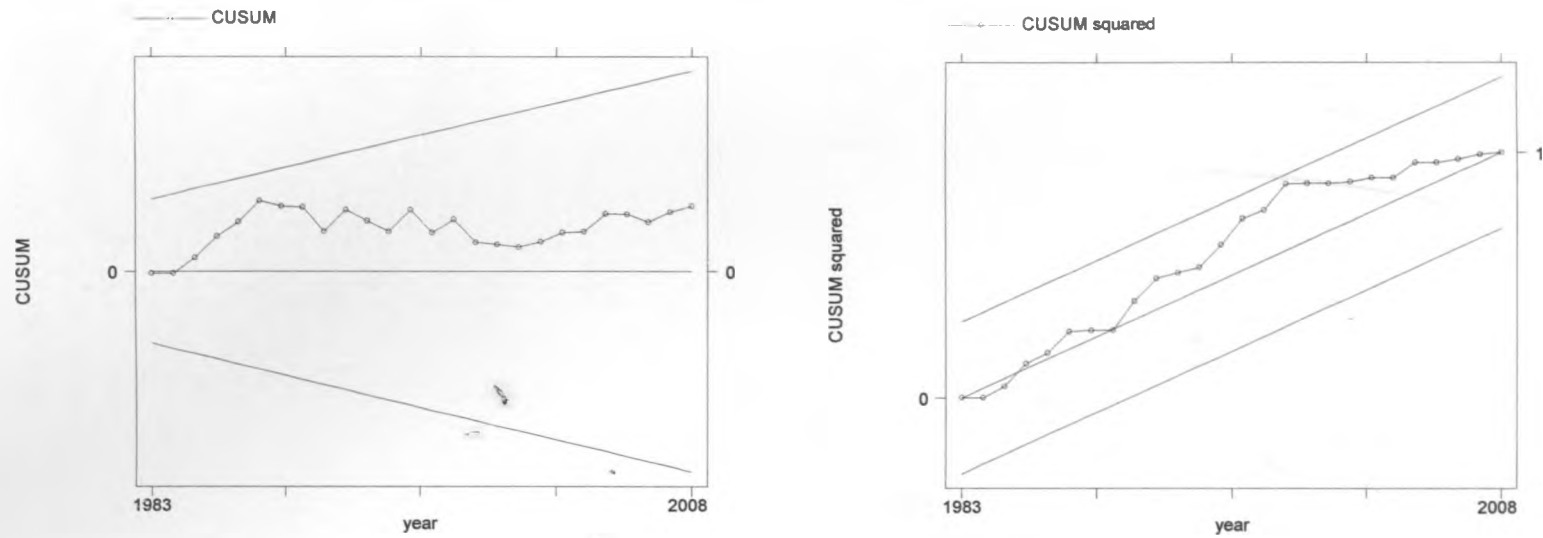


Figure 6: The cumulative sum of recursive residuals test for the private saving function

