DEREGULATION, FINANCIAL DEEPENING AND SAVINGS PERFORMANCE IN ZAMBIA: 1978-2006

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Abstract

This paper attempts to review the impact of financial reforms largely undertaken in the early 1990s on the financial sector of Zambia. In particular, it investigates the influence of the reforms on the depth of the financial sector. This analysis is made by means of simple monetary and financial ratios. The paper further seeks to explore the behavour of financial savings in relation to real GDP, financial deepening, inflation, and real interest rate using an error correction model over two sample periods, with one period representing the pre-liberalisation period and the other representing the post-liberalisation period. The paper finds that there has not been any significant growth in the depth of the financial sector. With regard to the behaviour of financial savings, the empirical results show that financial savings respond more positively to an increase in financial depth and an increase in real deposit rate for the post-liberalisation period.

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1. INTRODUCTION

The financial sector has been identified as a critical sector in determining the level of growth in an economy. Several empirical studies have established the significance of the financial sector in the growth equation (King and Levine 1993a; Barro 1991; Levine, Loayza and Beck 2006)[1]. The financial sector plays a critical role in mobilizing and channeling resources to productive areas resulting in the growth of the economy. It has, however, been argued that the effectiveness of the financial system largely depends on how it is managed, that is whether it is allowed to operate freely or whether it is restricted through government intervention. Government intervention in the financial system has been associated with inefficiencies and distortions that are said to result in low financial development and inefficient credit allocation resulting in the low levels of development. It is against this background that several countries and the international community at large began to change their view of role of the financial system in the economy and focusing on ways to improve its management.

Based on the view that a liberalised financial system was the best way of enhancing development, financial sector reforms geared towards de-regulation became central to the stabilization policies under the World Bank/IMF recommended Structural Adjustment Programs implemented in many African Countries including Zambia. Structural Adjustment Programs consisted of a number of macroeconomic adjustments that were intended to reverse the economic decline that faced the country at the end of the 1980s decade. It is still debatable as to whether financial reforms have yielded the intended results. Empirical evidence shows that financial reforms have yielded different results in different countries.

The purpose of this paper is to carry out an assessment of the response of financial savings to financial deregulation in Zambia. The focus of this assessment will be twofold. In the first part, an analysis of the deepening of Zambia's financial sector is made. This analysis is made by means of simple monetary and financial ratios. The latter part of the paper attempts to determine the impact of financial deepening and interest rates on financial saving in Zambia both before

[1] The studies add financial variables such as liquid liabilities or the ratio of claims on the private sector to GDP to the standard growth regression. They find a robust positive and statistically significance relationship between initial financial conditions and subsequent growth in real per capita incomes for a cross section study of 80 countries.

and after financial liberalisation. This also serves as an assessment of the impact of the financial reforms on the mobilisation of savings in Zambia. The study is therefore aimed at answering several critical questions among them: What is the impact of the financial sector on the overall deepening of the Zambian financial system? Is there a significant difference in financial deepening in the financial system between the period before the introduction of the financial reforms and the period after the financial reforms? How does financial deepening affect the level of financial savings in Zambia? Are financial savings sensitive to changes in interest rates in Zambia?

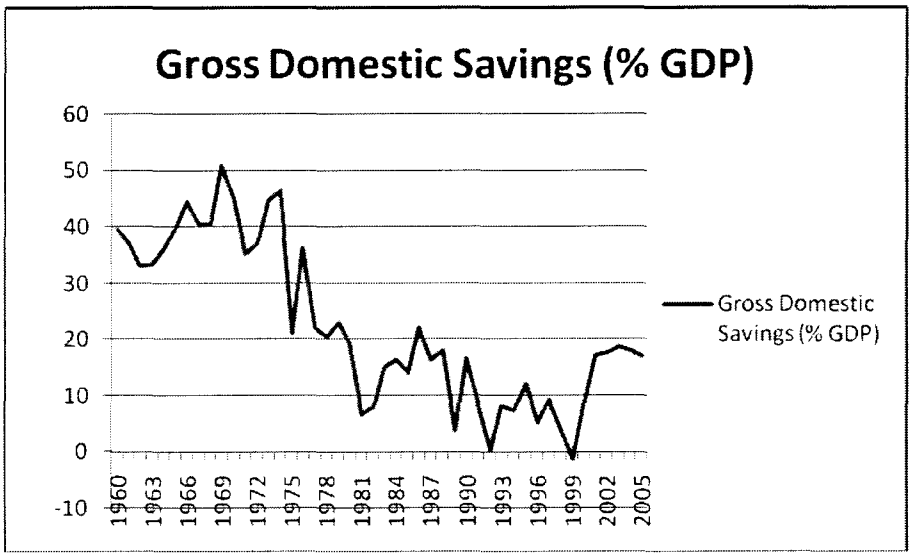
The motivation for this study springs from the view that mobilization of savings is the first step in the enhancement of investment and thus an integral part of the investment-growth process. In this regard, the goal of financial liberalisation is to enhance the growth of savings and investments and ultimately economic growth. Enhancing domestic resource mobilisation through increased savings is critical in the light of the adverse repercussions of foreign commercial borrowing and the limitations on the availability of foreign concessionary funding that developing countries such as Zambia are currently facing. Further, in spite of the many policy changes made to attract foreign direct investment, African countries have not been able to attract a significant portion of it. Statistics show that although Foreign Direct Investment to developing and emerging countries has been on the increase, the major destination has been the economies in Asia. The Global Monitoring Report, (2007) further cast doubt on the realization of the commitment made by the donor community to double aid to Africa by 2010, although it noted that some donor countries such as France had improved their aid delivery.

The performance of domestic savings in Zambia has not improved since independence and has been in decline in the last three decades. The level of savings in the 2005 (17 percent of GDP) was less than half of that recorded in 1969 (59 percent of GDP). Simmons (1992) argues that a ratio of gross domestic savings to GDP above 20 percent should be taken as the target for savings. Figure 1 shows the trend in domestic savings in Zambia from 1960 to 2005 and clearly portrays a situation that needs to be addressed.

While domestic savings alone cannot meet the investment requirement for growth, they form an integral part of the economy and may be preferred because they are reliable and not subject to

conditionalities as compared to external sources of financing. It is therefore important to consider ways of increasing the level of domestic savings along side other sources of financing.

Figure 1: Gross Domestic Savings in Zambia (1960-2005)



Source: World Perspective-University of Sherbrooke

Following the introduction, the paper proceeds as follows: section two provides the theoretical foundations of the arguments for and against financial liberalisation and gives a brief account of some empirical literature in this area; section three provides an overview of the financial liberalisation program as it was carried out in Zambia while section four provides an analysis of the impact of the reforms on financial depth. A savings function for Zambia is presented in section five and this is followed by a presentation and discussion of the empirical results. Section six provides the conclusion of the study.

It is important to state from the outset that this analysis will focus on financial savings as distinguished from other non-financial savings such as inventories and physical assets. The basis of this discrimination is that the financial savings are more readily available for investment and further are more affected by financial deepening and changes in interest, the channels through which financial liberalisation is intended to work.

2. SURVEY OF LITERATURE ON FINANCIAL LIBERALISATION

2.1 THEORETICAL LITERATURE

The financial system is considered as an integral part of economy with a significant role to play in the development of a country. Crucial elements for the effectiveness of the financial system are the existence of a well developed financial market and the well functioning intermediaries such as commercial banks. Financial institutions work to encourage investment by way of providing savers the means to easily and quickly convert their claims into cash whenever they need it. Financial institutions further provide the safe and legal instruments that enable savers to invest in a cost effective manner. The financial system is therefore one important channel for capital formation as it allows a way of channeling savings into investment. However, there are arguments that the nature of the financial regime, that is, whether it is market driven or government driven will have an influence on the process of financial intermediation and ultimately on the investment-growth process of an economy.

The works of McKinnon (1973) and Shaw (1973) have had a significant influence on the body of literature on financial liberalisation. Shaw stressed that the financial sector was as important as the real sector in determining the level of development. In their earlier collaborated contribution, Gurley and Shaw (1955) pointed out that "....it [development] is accompanied by the instutionalisation of savings and investment that diversifies channels for the flow of loanable funds and multiplies varieties of financial claim...it [development] also implies as a cause or effect, change in the market price of financial claims and loans". Shaw saw financial development as almost a natural association of economic development. He attributed the shallow levels of financial development in developing countries to the overall development strategy that these countries followed. The central argument made by Shaw was that the practice of imposing controls on interest rate and exchange rate resulted in the creation of excess demand for savings and foreign exchange. The result of the excess demand would be an increase in the interest rate and cost of capital. In this situation, governments would resort to credit rationing as a way to contain the excess demand.

McKinnon (1973) followed a similar argument made by Shaw of attributing the slow growth of least developed countries to government intervention. In a review of the work of McKinnon, Caves (1993) writes that "He [McKinnon] argued that imperfect capital markets play a key role

in impeding the growth of less developed countries and that the fragmentation of their economies due to both institutions and policy measures discourage the effective mobilization of resources". Government intervention in the financial sector has, however, been advanced for a number of reasons. Like most other interventions, the premise for government intervention in the financial sector is that of improving the allocation of resources and encouraging development. For most developing countries particularly in Africa, at the time of independence, the development strategy was framed in socialist philosophies and as such the role of the State was seen as being very critical. It is argued that government intervention was there to limit concentrations of wealth and monopoly power and also to generate fiscal resources and ensure that credit allocation was more supportive of the developmental strategies of government (Gerald, Hanson and Honohan, 2001). In recent years with the experience of financial crises, the need for government intervention has also been attributed to the need to protect the public from unexpected losses and to ensure that there is stability in the economy (Gerald, Hanson and Honohan, 2001).

Both McKinnon and Shaw argued that financial repression contrary to improving allocation of resources distorts the free working of market forces resulting in the inefficient allocation of finances and consequently hampers development by reducing the levels of investment in an economy. Specifically the repression of interest rates to low or negative values works as a disincentive for saving and intermediation by banks thereby reducing loanable funds needed for investment. The policy recommendation from the two scholars is that of financial liberalisation, a process involving the elimination of various restrictions on the financial sector, removal of portfolio restrictions on the banking sector and the changing of the institutional framework of monetary policy. The intended outcome of these reforms is the achievement of positive real interest rates that will increase the level of financial assets (Shaw's "Debt-Intermediation effect") and enhance the efficient allocation of financial resources (McKinnon's "Conduit effect").

Molho (1986) using a three-period life cycle model of consumption made an attempt to formally illustrate the essence of the McKinnon-Shaw hypothesis. His aim was to test the complementary hypothesis made by McKinnon. The model is based on the assumption that the consumer has more than one asset with different returns and no bequests. The consumer is expected to live three periods and has a utility function that depends on consumption in each period. Further, the consumer earns income only in the first two periods and saves a portion of the earnings for

consumption in the third period. The model further assumes that the desired savings and borrowing possibilities are insufficient to make investment in capital investment possible and thus implies that first period assets be financed out of borrowing and current saving, and second period assets out of the previously accumulated wealth plus new savings and borrowings. In a financially repressed economy with borrowing constraints capital investment in the first period is made impossible illustrating the lumpy nature of investments in developing countries.

The model shows that deposits and physical capital in the second period may be substitutes while deposits and physical capital in the first period are complementary. The result follows from the inter-temporal nature of capital accumulation in that all investment in physical capital takes place in the second period while the accumulation of the resources necessary for this investment takes place in the first period. Molho's model thereby demonstrates both the McKinnon conduit role of deposits in the process of capital accumulation and the possibility of complimentarity of deposits and physical capital. He further shows that that the effect of changes in the deposit rate have an unambiguous effect on second-period demand for capital and second-period savings. The effect of deposit rate on first period savings are however ambiguous being subject to income and substitution effects with the net income depending on which of these effects is stronger.

It is precisely because of the ambiguous effect of deposit rate that some scholars have not entirely supported the hypothesis proposed by McKinnon and Shaw. Attempts have been made to theoretically demonstrate that the financial liberalisation would not necessarily result in increased resources and that financial savings would actually reduce following financial liberalisation. The criticism is largely based on the arguments of liquidity constraints and subsistence nature of consumption patterns in developing countries. Campbell and Mankiw (1990) modeled an economy with two types of households, the one with liquidity constraints and thus consuming out of current income and the other with access to borrowing possibilities. With liquidity constraints, consumers are not able to borrow and are thus unable to smooth their consumption over time. In an earlier study Campbell and Mankiw (1989) showed that with the presence of the "rule-of-thumb" consumers the inter-temporal elasticity of substitution is close to zero. The argument is that financial liberalisation would result in an enhancement in the provision of credit and thereby result in a consumption boom for individuals that were previously liquidity constrained. Ogaki, Ostry and Reinhart (1996) also argued that the intertemporal

elasticity of substitution in most developing countries was close to zero. Their argument is based on the premise that the income of a significant proportion of the households in developing countries was near subsistence levels and as such a rise in real interest rates following financial liberalisation would actually result in an initial fall in private savings. The intertemporal elasticity of consumption determines the extent to which consumers are willing to forgo present consumption for future consumption. In other words, it determines the marginal propensity to save. The finding that the intertemporal substitution is close to zero in most developing countries implies that the marginal propensity to save in these countries is very low.

Other scholars have argued that financial liberalisation could be detrimental to the growth of the economy and therefore that government has beneficial and significant role to play in financial markets. Periods of financial crisis in Latin America and East Asia have been associated with the financial reforms that have taken place in those countries. A notable contribution is that of Stiglitz (1994) who spoke strongly for the role of government in financial markets. He pointed out that financial markets were more prone to market failures thereby providing the rationale for government intervention. While acknowledging that inappropriate policies and misguided incentives were some of the causes of financial market inefficiency, he argued that some form of government intervention was beneficial to enable the financial markets perform better and improve the performance of the economy. Stiglitz (1994) proposed a number of roles for the government ranging from the setting of prudential standards and regulatory rules to interest rate restriction and directed credit. He cited the success of the government intervention in East Asian economies which had been more active in creating and regulating financial systems and directing credit.

2.2 EMPIRICAL LITERATURE

There are a number of studies that have been carried out to empirically test the effects of financial liberalisation/repression on the economy. It is notable that while most of the studies have been able to empirically establish the significance of effect of financial liberalisation on growth, the effect on savings mobilization remains unsettled. Giovannini (1983) tested the significance of the role real interest rates in the determining the magnitude of savings in Less Developed Countries using a Keynesian-type savings equation. In a sample of developing countries mostly from Asia (only Kenya was sampled from Africa), Giovannini (1983), found

that there was little evidence to support the hypothesis that savings respond positively to changes in the real interest rate. He further established that the intertemporal substitution elasticity was very small. A study more focused on sub-Saharan Africa carried out by Reinhart and Tokaylidis (2000), also established that the realization of positive real interest rates did not have a significant impact on either savings or investment in most of these countries. Reinhart and Tokaylidis (2000), highlighted that there was a markedly difference in the manner that the middle- income and low-income (mostly highly-indebted) countries benefitted from the financial reforms. The study highlighted that while there was some level of financial deepening in middle-income as measured by monetary aggregates, this was not the case for low-income countries. Bandera et.al (2000) construct 25-year time series indices of financial liberalisation for eight developing countries representing Latin America, Africa, and Asia with the aim of assessing the total effect of financial reforms on aggregate private savings. In general, they found that there was no evidence of positive effect of the real interest rate on private savings.

Only a limited number of studies exist on the impact of the financial reforms on the Zambian financial sector. The central argument in these studies has been that despite the financial reforms, there has not been a significant change in the number of people able to have access to financial services. One such study is that done by Martinez (2001) on the impact of financial reforms on access of financial services in Zambia. Martinez argued that despite the financial sector reforms, Zambia had not reaped the expected benefits of establishing a market-based financial system. His study revealed that at the end of 2005, only 6.2 percent of the people aged 18 and above had a bank account making Zambia one of the most under banked countries in Sub-Saharan Africa.

Chiumya (2003) in his study sought to explore how Government liberalization policy for the financial sector has resulted in decreased access to financial services to low-income households and the rural poor. Amongst the reasons, he notes that the removal of the requirement to open a rural branch for every urban branch opened has contributed to the reduction in the proportion of rural branches to urban branches from 50 percent in 1990 to 43 percent in 2004. Maimbo and Mavrotas (2003) carried out a study focused on the impact of the reforms on the savings mobilizations in Zambia. In their study, Maimbo and Mavrotas (2003) attributed the low savings to various factors including the poor financial state of the economy, the 1995 and 1997/8 bank closures, increased investment in real estate and the absence of rural financial saving institutions.

3. STRUCTURAL ADJUSTMENT AND FINANCIAL DEREGULATION IN ZAMBIA

By the late 1980s, Zambia like other Sub-Saharan countries had experienced a reversal of economic fortune. From being one of the wealthiest countries in Sub-Saharan Africa at the time of independence in 1964, the economic profile of the country had by the late 1970s changed to that of social and economic retardation characterized by high budget deficits, unsustainable debt levels, high inflation and poor physical and social infrastructure among others. The decline in economic performance is attributed to a combination of foreign and domestic factors. At the time of independence, Zambia was enjoying high revenues accruing from copper production, when copper prices were at their peak and was therefore able to finance a number of developmental projects. Mining directly accounted for over 20 percent of GDP and about 90 percent of the country's foreign exchange earnings (Debt Sustainability Report 2004). Many of the development projects were designed to improve domestic industry and infrastructure rather than to boost export production directly. These expansionist policies soon met some serious challenges with the oil price shocks during 1973-74 and 1979-80 and the subsequent depression in non-oil commodities markets during the 1980s. This turn of events created a mismatch between revenues and expenditures resulting in high budget deficits and external debt levels.

The government heavily regulated the Zambian economy and the financial sector was characterized by financial repression, as was the case with most other developing countries. The government played a significant role in the management of the financial system. After independence, the government began to assert itself in the financial sector by establishing the Zambia National Commercial Bank in 1969 and later on in 1972 the National Savings and Credit Bank to operate alongside the other three foreign-owned commercial banks, the Barclays Bank, Standard Chartered Bank and the Grindlays Bank (Simatele and Ndulo, 1998). The government also established specialized banks such as the LIMA Bank, the Development Bank of Zambia and the Cooperative Bank with the aim of directing financial resources to priority projects and sectors that were perceived to be underserved by the foreign-owned banks. The government-owned banks were also used to direct credit to preferred sectors under its developmental programmes such as the import-substitution programme. Further, the government through the Central Bank controlled the interest rates and maintained them at low levels in order to provide cheap credit and make it more accessible. The objective of the government, however, was not

entirely achieved. In most cases, the credit programmes lacked proper project appraisal systems resulting in funding allocation to unprofitable projects. The credit facilities were also subject to abuse by politicians who in most cases defaulted on the loans. This resulted in huge losses and led to the insolvency and closure of banks such as the LIMA Bank and the Cooperative Bank. The non-performing loans also almost led to closure of the Development Bank of Zambia had it not been for the intervention of government which assumed the bad loans and further recapitalised the Bank.

In addition to controlling interest rates, Government also exerted its control in the determination of the exchange rate and regulated the trade of foreign currency. With the decline in copper earnings, the country suffered from a shortage of foreign currency and the situation was exacerbated by government's creation of state-owned enterprises. Most of state-owned enterprises were not only loss-making but also heavily subsidised by the government. The expansionist policies embarked on by government, led to high fiscal deficits that also had negative impact on the economy. The government borrowed heavily from the central bank resulting in the crowding out of the private sector. With overall economic decline, the government turned to the international community for assistance. A number of agreements were signed with the IMF programmes to address the economic decline in Zambia but most were not followed through. It was only after a change in political regime that lasting commitment was made to the realization of the programmes. A new political party by the name of the Movement for Multi-Party Democracy (MMD) was elected in 1991 and it is this party that has been credited with a serious commitment to addressing the economic decline of the economy. An integral part of the stabilization programs was financial reforms.

There was a range of measures that were undertaken under the financial reforms both internally and externally. With regard to reversing interest rate controls, the target was the achievement of positive real interest rates by 1991(Jones, 1994). However, the real drive to attain positive interest rate was shown by the government in 1990 when administered rates were increased. Government relinquished its hold on interest rates in mid-1992 by the freeing of Bank deposit rates and lending rates. An increase in nominal (general) interest rates from 25 percent to 35 percent was recorded (Jones, 1994). Further, direct Credit programs were relaxed at the same time as the interest rate liberalisation in late 1992 and early 1993.In the terms of external sector

adjustment and abolishment of capital account controls, the target was to attain a market clearing exchange rate by mid-1992. Government abolished exchange rate controls in December 1993, thereby effectively lifting all restrictions on capital transactions. It is now legally possible to repatriate after tax profits, dividends, and capital up to 100 per cent without restrictions. In order to improve the regulatory environment, Government also established a number of regulatory agencies notably the Securities and Exchange Commission (SEC) and the Pension and Insurance Authority (PIA) to complement the supervisory role of the Central Bank in the financial sector.

4. FINANCIAL DEREGULATION AND FINANCIAL DEEPENING

One of the objectives of financial liberalisation is the enhancement of the financial depth of the economy. Financial deepening involves expanding the scope of the financial system or the increase in the size and role that the financial system plays in the economy. Cook (2003) adopting a structuralist view of the relationship between financial deepening and savings quotes that this view posits that "the savings in LDCs are below levels that could be otherwise realized because of the absence of widespread network of formal financial intermediaries capable of creating an array of (secondary) financial instruments that would have great appeal to potential savings than the primary instruments issued directly by borrowers or the sterile hoarding".

Frimpong-Ansah (1992) points also out that it is through the financial system that an optimal structure of savings can be obtained and argues that the mobilization of savings requires a proper set of financial institutions to among other things take deposits and lend money for short and long periods. The preceding arguments therefore point to the need to explore the impact of financial deregulation on financial deepening.

Financial deepening is often measured by quantitative indicators of financial variables such as the ratio of broad money to GDP, the ratio of private sector credit to GDP or the ratio of assets of commercial banks to assets of the Central Bank.[2] The ratio of broad money to GDP and the ratio of real private sector to GDP indicate the level of monetization in the economy while ratio of assets of commercial banks to assets of central bank reflects the role of commercial banks in

[2] Gelberd and Leite (1999) have pointed out the shortcomings of monetary aggregates as a measure of financial deepening and have advocated measuring market structure and competitiveness of the financial system: degree of integration with international foreign markets. These measures which require interviews and maybe subjective are however outside the scope of this study.

allocating funds and also their capacity to grow. Monetisation plays a significant role in development as it eliminates the need for a barter system and also facilitates capital formation. Monetisation as measured by the ratio of broad money to GDP also reflects the extent of financial services provided by the financial system.

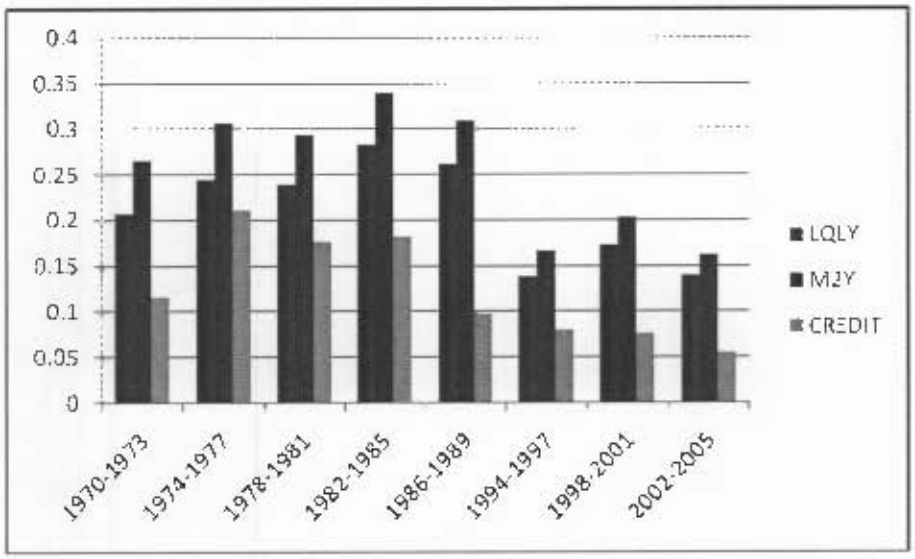
In rest of this section, we seek to explore and understand Zambia's experience in financial deepening since the introduction of structural reforms in the financial sector. We primarily use financial and monetary aggregates highlighted above as measures of financial depth. We then analyse the changes in efficiency that have taken place in the banking sector since financial deregulation.

Using data from the International Financial Statistics (IMF) data bank, we created the variables LQLY measuring the ratio of the liquid assets of the commercial bank to GDP; M2Y, the ratio of broad money to GDP and CREDIT measuring the ratio of private credit to GDP.

Figure 2, depicts the evolution of the financial sector using the above variables measured over four-year intervals over the period 1970 to 2005. The figure indicates that given all our measures of financial deepening, the growth of the financial sector has not been encouraging. All the measures have dipped over the period particularly after the financial reforms.

What we see from the graph is that the quantity of money supply as a ratio of GDP, M2Y grew steadily over the period 1970 to 1985 reaching a peak over the four-year period of 1982-1985. The period average for 1974-1979 grew to 21 percent from the previous period average of 11 percent and remained high till the end of 1985.However, M2Y began to drop in 1994, the period following the introduction of the financial reforms. The levels for the period 2002-2005 seem to be lowest for the overall period after the financial reforms. The other measures of financial deepening follow a similar trend to M2Y. The levels have fallen for periods both before and after the financial reforms. For instance, the ratio of private credit to GDP, CREDIT has been low at 8 per cent for the three four-year periods to 2005.

Figure 2: Indicators of Financial Deepening in Zambia (1970-2005)



Source: International Financial Statistics (International Monetary Fund)

However, a closer examination of the series of each of these variables indicates a steady growth of all the variables over the period 1970-2006 implying that what accounts for the fall is that this growth has been slower than the growth in GDP. Therefore relative to the growth in GDP, growth of monetary aggregates has not been proportional. This indicates that the level of financial intermediation is low compared to the level of economic activity. To summarise, there is indication that there has been relatively little improvement in the depth of the financial sector in Zambia particularly as far as the monetary aggregates are considered.

We now turn to look at the efficiency of the financial system. The financial sector in Zambia like most other developing countries is still largely underdeveloped. Comprising the Central Bank, commercial banks, non-bank financial institutions (building societies bureau de changes), insurance companies, pension funds and capitals markets, the financial system is largely dominated by commercial banks. According to the Financial Sector Development Plan (FSDP) 2004-2009, 90 percent of the financial systems assets are held by the commercial banks. Insurance companies have also grown since liberalisation with three notable entries expanding the insurance services to the public and providing the much needed competition to the government owned Zambia State Insurance Corporation. The only stock exchange, established in

1994, the Lusaka Stock Exchange (LUSE) remains immature with very few listed companies despite its ten-year existence. The stock market capitalization relative to GDP remains lower than the African average of 27 percent (World Bank Development Indicators).

An expected result of financial liberalisation is the increase in the intermediation efficiency of the banking sector. One measure of the intermediation efficiency is the evolution of the interest rate spreads and margins. The hypothesis is that interest rate spreads are supposed to converge towards those in developed countries after liberalisation. Countries with higher spread and interest margins are associated with low levels of efficiency in intermediation. Ramful (2001) argues that large spreads contribute to financial disintermediation by discouraging savings and limiting the amount of funds available for investment. The World Bank shows that the interest spreads in Zambia have increased over the period from 1970 to 2005 from single to double digit. The average interest rate spread for the period 1971 to 1980 was 3.5 percent and grew to 6.5 percent for the period 1981 to 1990. After liberalisation, specifically after 1994 the interest rate spread has been above 12 percent with the ten-year average for the period 1994 to 2003 standing at 18.5 percent. South Africa, a relatively developed country has had an interest rate spread in the region of 5 percent with the year average for the period 1994 to 2003 standing at 4.8 percent. In other more financially developed countries such as South Korea and Canada the average interest rate spread stands at around 2 percent.

Clearly the evidence is that the interest rate spreads in Zambia stand far from converging towards those in financially developed economies. While this is a crude measure, it does reveal that the cost of intermediation is quite high. The evolution of the spreads does suggest that the level of efficiency as well as the competition in the Zambian financial sector is still very low. The high spreads of interest rate has implication on economic growth as it serves to not only reduce the amount of funds that are available for investment but also increases the cost of these funds. There are a number of reasons that have been highlighted in empirical research for the widening interest rate spreads. These include the degree of market power enjoyed by the commercial banks; high reserve ratios and the level of development in the banking sector or the financial sector.

Fry (1995) argues that reserve and liquidity requirements act as a tax on financial intermediation as it widens the spread between deposit and loan interest rate and thereby reduces the size of the

financial system. The Central bank has significantly reduced the reserve ratio requirements over the last decade and has thereby increased the ability of banks to extend credit. This has been a positive development in the financial sector. However, there is need to investigate the extent of the market power enjoyed by commercial banks and assess its impact on financial deepening.

5. MODELLING A FINANCIAL SAVING FUNCTION IN ZAMBIA

The link between financial liberalisation and savings comes from the realisation of positive interest rates that attract agents to move from other forms of savings to financial savings. As highlighted above due to availability of data on private savings, the test is restricted to financial savings, which are channeled into the formal sector of the economy and in particular the banking sector. Further to enhancing financial depth, removal of interest rate ceilings is posited to eliminate credit rationing.

There are a number of theoretical models that have been used in estimating the savings function of which the standard are Life Cycle theory due largely to Franco Modigliani and the Permanent Income theory of Milton Friedman. Under the Permanent Income hypothesis, consumption is related to longer-term estimate of income rather than to current income (Dornbush et al., 2004). In this model agents are assumed to be able to save and borrow in order to smooth consumption over their life cycle. The Permanent Income theory stresses that what matters for consumption and hence savings are the persistent changes to their income rather than transitory fluctuations. In the Life cycle theory individuals are viewed to plan their consumption and savings behavior over long periods with the intention of allocating their consumption in the best possible way over their lifetime. Due to the similarities of the two theories, they are commonly referred to as the Life-Cycle-Permanent Income hypothesis. However, because of lack of data required to separate the transitory and permanent components of income, the two theories have not been widely applied to developing countries.

There are other motivations that have been advanced to explain the determinants of domestic savings. These motivations affect both the capacity to save as well as the willingness to save. These include the level of per capita income, the growth rate of income, the interest rate, the prevalence of financial intermediaries and the range of financial assets, inflation rate, government taxation and the terms of trade.

As pointed out by Fry (1997), commercial banks are the key institutions involved in savings-investment intermediation that would be most affected by financial liberalisation. This is attributed to the low development of other financial sectors that is characteristic of most developing countries (as noted above). Therefore, in terms of financial savings, commercial banks are the most important institutions in the mobilisation of private savings. In this regard deposits held by the bank can be taken as an indication of the performance of savings. This study only uses real GDP, Financial depth, interest rate, and inflation as explanatory variables for financial savings. This is done to save on the degrees of freedom, as the sample size is small.

The savings model is therefore represented as:

$$\text{LnRDEP} = \alpha_1 + \alpha_2 \text{Lnrgdp} + \alpha_3 \text{Findex} + \alpha_4 \text{Infl} + \alpha_5 \text{realdr} + \varepsilon_t \quad (1)$$

where:

LnRDEP represents financial savings as measured by the log of real deposits; Lnrgdp is the log of Real Gross Domestic Product represents the level of income; Findex is the measure of financial deepening obtained from the ratio of the sum of Broad Money Supply (M2) and Credit to the Private Sector to GDP; Infl is the inflation rate; while realdr is the real rate of interest on deposits. [3]

According to the financial liberalization hypothesis, the coefficients on the variables are expected to carry the following signs:

- Lnrgdp is positive; economic growth by increasing the level of income results in increased savings
- Findex is positive; financial depth enhances intermediation resulting in increased savings
- Infl is negative; Inflation represents macroeconomic instability and thus is a disincentive for savings mobilisation.
- realdr is positive ; higher interests rates deposits encourages financial savings

[3] Real interest rate is calculated as r = [(100 + R)/(100 + i) - 1]*100: where r = real interest rate (in %); R = nominal interest rate (in %); i = actual or expected inflation rate (in %)

This study estimates the relationship between financial liberalisation and savings by testing the significance of the relationship between financial depth and savings and the relationship between real interest rate and savings. The test takes a dynamic approach by using an error correction model. This is done in order to analyse both the short and long run dynamics of the variables in the system.

5.1 EMPIRICAL RESULTS

5.1.1 DATA

Quarterly data of the variables in the model is obtained from the IMF International Financial Statistics and the World Bank Indicators. The approach taken in this paper is to test the savings function prior to the liberalisation process, that is, the period from 1978 – 1991 and the period after the liberalisation 1994-2006. This approach has been adopted for this study due to lack of data for the variables being tested for the years 1992 and 1993 when the major financial reforms were implemented. Further, data for periods before 1978 is not complete for some variables in the study and therefore this period has not been included in the study.

The model estimation involves three steps. We begin with a univariate analysis of the data to be used in the estimation. In particular we carry out tests for unit roots to establish whether the variable are stationary or non-stationary and thereby establish the order of integration of the variables. Because the means and variances of non-stationary variables change over time, their use in estimation may result in spurious regression. However if a series is differenced it becomes stationary. If a series is differenced d times before it becomes stationary, then it is said to be integrated of order d, and denoted as I(d).The second test in the estimation process is to test for cointegration among the variables to establish whether an error correcting model is appropriate. The Johansen Maximum likelihood is used for the test of cointegration. It is important to point out that in terms of the Johansen Maximum Likelihood technique, the sample size is small.

5.1.2 UNIT ROOT TESTS AND INTEGRATION

The most common method used for unit root test is the Augmented Dickey Fuller (ADF) test. The null hypothesis of the test is that the variable is non-stationary implying that it has a unit root. A significant statistic would reject the null hypothesis and suggest that the variable is

stationary. Results of the ADF tests carried out for our study are presented in table 1.1 for the sample period 1978 to 1991 while that of the sample period 1994 to 2006 are presented in table 1.2 respectively.

Table 1: ADF Results (1978-1992)

Variable	Levels		Difference		Order of Integration
	With trend	Without trend	With trend	Without trend	
RGDP	-1.882	-0. 72	-3.659**	-3.775**	I(1)
Real Total Deposits	-1.540	-1.740	-3.614 **	-3.689***	I(1)
Real Deposit Rate	-3.240	-1.430	-2.873	-2.982**	I(1)
Inflation	-1.409	-1.483	-7.041***	-5.904***	I(1)
Financial Deepening	-1.544	-0.472	-3.832***	-3.778***	I(1)

** denotes significance at 5% *** denotes significance at 1%

Table 2 ADF Results (1994-2006)

Variable	Levels		Difference		Order of Integration
	With trend	Without trend	With trend	Without trend	
RGDP	-0.533	2.162	-7.204***	-6.051***	I(1)
Real Total Deposits	-3.178	-0.803	-4.915***	-4.986***	I(1)
Real Deposit Rate	-3.860	-3.068	-4.816**	-4.175***	I(1)
Inflation	-2.615	-2.794	-3.797**	-3.692**	I(1)
Financial Deepening	-3.487	-2.849	-4.762 ***	-4.817***	I(1)

** denotes significance at 5% *** denotes significance at 1%

The results indicated in the tables above suggest that the variables are non stationary for both sample periods but become stationary after differencing them once. Therefore the variables are integrated of order one, that is, they are I (1).

5.1.3 TEST FOR CO- INTEGRATION

We now test for the long run relationship amongst the variables total deposits, real GDP, inflation, growth rate of real GDP, the deposit rate and the measure for financial deepening using co-integration analysis. Co-integration refers to a linear combination of non stationary variables.

Given that the variables in our study are all integrated of the same order there is suggestion that the variables may be co-integrated. There are two common methods that can be applied for co-integration analysis. These are the Engle-Granger two step method and the Johansen Maximum likelihood method. Engle and Granger (1987) have shown that even if economic series are non stationary in their levels, there may exists some linear combination of the variables such that the variables converge to a long run relationship over time. Variable with such a characteristic are said to be co-integrated. For the purpose of this study, we use the Johansen Maximum Likelihood method. Johansen (1988) suggests a maximum likelihood method for estimating the co-integration relationships that may exist within a set of variables and for constructing a range of statistical tests.

The Johansen methodology is based on a general Vector Autoregressive, VAR model and can be illustrated as follows:

Assuming a VAR model with N variables, X, and K lags,

For k lags on a vector of n =1.....N variables X_t which are integrated of order one, I(1) with m deterministic terms D_t (may contain a linear trend, a constant, seasonal and intervention dummies). It is assumed that a VAR (K) representation of X_t exists and is of the form:

$$X_t = \sum_{i=1}^{K} \prod_i X_{t-i} + \Theta D_t + \varepsilon_t \qquad (2)$$

Where $\prod_i \ldots, \prod_k$ are n x n autoregressive parameters, Θ is the n x m matrix of coefficients for the m deterministic variables and ε_t are innovations which are n-dimensional, independent and identically distributed, with mean zero and positive definite covariance matrix Ω i.e ε_t is $N(0,\Omega)$.

The error correcting representation of (2) is of the following form:

$$\Delta X_t = \sum_{i=1}^{K-1} \Gamma_i \Delta X_t + \prod X_{t-i} + \Theta D_t + \varepsilon_t \qquad (3)$$

Where Δ denotes the first difference operator, $\Gamma_i = -\sum_{j=i+1}^{K} \prod_i$ and $\prod = -[I_n - \sum_{i=1}^{K} \prod_i]$

If we consider the characteristic polynomial:

$\prod(z) = I_n - \prod_1 (Z) - \ldots\ldots - \prod_k Z^k$ where I_n is an identity matrix. The properties of this polynomial determine the process. Specifically, given the determinant of the $\prod(z)$, if the roots of the $|\prod(z)|=0$ are outside the unit circle, then X_t is non-stationary.

According to Theorem 4.2 of Johansen (1995), if the rank ($\prod$)=r<n, then $\prod$ can be decomposed as :

$$\prod = \alpha\beta' \qquad (4)$$

where α and β are n x r matrices of full rank. Thus X_t is a cointegrated I(1) process with cointegrating vectors β. This implies that there are r<n stationary linear combinations of X_t. The matrix α contains adjustment parameters measuring how deviations from long-run equilibrium feed back into the system. By Inserting (4) into (3) the error correction representation can be rewritten as follows:

$$\Delta X_t = \sum_{i=1}^{K-1} \Gamma_i \Delta X_t + \alpha\beta' X_{t-i} + \Theta D_t + \varepsilon_t \qquad (5)$$

Equations (1) to (5) form the basis for empirical analysis in this study.

5.2 MODEL ESTIMATION: 1978 To 1992

The first step in the estimation of the unrestricted VAR model is the determination of the number of lags for estimation. For the period 1978 – 1992, a lag length of 4 is recommended based on the AIC and HQIC and 3 based on the SBIC while for the period 1994 – 2006, the lag length of 3 was chosen based on the AIC, HQIC, and the SBIC method. . However, because more lags mean more parameters to estimate, we reduced the lag specification for the VAR model for both periods to 2 lags given the sample size. Moreover in comparison, the estimations come out better with the reduced lag specification. The only down side is that we have first order serial correlation in the residuals. However, the cost is little compared to the increase in power of estimation. The output for this test is presented in the annex of this paper.

Rank Determination (Testing for Cointegration)

The Johansen (1995) likelihood ratio (LR) approach is used and the following sequence of hypothesis tests is considered:

H_0 (i)= rank ($\prod$) =i, versus $H_1(i)$ = rank ($\prod$) >i for i=0,.....K-1

The cointegration rank specified in the first null hypothesis in this sequence that cannot be rejected is then chosen as the co-integrating rank. The trace statistics are reported in Table 4 for the first sample period and suggests a co-integrating rank of r=2. This therefore means that there exist two co-integrating relationships amongst real total domestic deposits, real GDP, growth rate of GDP, inflation, financial deepening and real deposit rate.

Table 3 Johansen Test for Co-integration (Trace statistics)

Max rank	Parms	LL	Eigenvalue	Trace statistic	5% critical value
0	30	407.98149	.	147.0332	68.52
1	39	454.65962	0.82251	53.6769	47.21
2	46	470.87223	0.45144	21.2517*	29.68
3	51	477.57822	0.21993	7.8397	15.41
4	54	480.15456	0.09101	2.6870	3.76
5	55	481.4982	0.04854		

Having determined that there are two co-integrating relationships between the variables in our study we now want to estimate the parameters of these relationships by fitting an error-correcting model. An Error Correction Model (ECM) provides a way of combining the long run, co-integrating relationship between the variables in their levels and the short run relationship between the first differences of the variables. By reintroducing the variables in their levels, the error-correcting model avoids the loss of information that arises due to differencing of the variables.

The two equilibrium relationships in the model can be represented as follows:

Lnrgdp = 0.027Findex - 0.0009 Infl – 0.072 realdr (6)

LnRDEP = 0.77 Findex – 0.615 realdr - 0.005Infl (7)

5.3 MODEL ESTIMATION: 1994 TO 2006

The estimation procedure for this period closely follows that of the Pre-liberalisation period

Table 4 Johansen Tests for Co-integration (Trace statistics)

Max rank	Parms	LL	Eigenvalue	Trace statistic	5% critical value
0	55	476.75453	.	122.5297	68.52
1	54	507.13756	0.70828	62.1636	47.21
2	71	524.44775	0.50665	27.5433*	29.68
3	76	533.11424	0.29794	10.2103	15.41
4	79	538.01582	0.19132	0.4071	3.76
5	80	538.21938	0.00824		

The Johansen results indicate that there are two co-integrating relationships among the variables in the model. Details of the parameters of adjustment as well as the parameters of the long-run relationship are presented in Appendix B.

The following is the representation of the two equilibrium relationships in the model:

Lnrgdp = -0.067 realdr – 5.701 Findex - 0.0244 Infl (8)

LnRDEP = 0.8395 Findex + 0.2308 realdr - 0.0349 Inf (9)

5.4 DISCUSSION OF RESULTS

5.4.1 Pre-Liberalisation

The results of the two long-run co-integrating relationships (Equation 5 and 6) show that all the parameters except for the real interest on deposits are correctly signed in accordance with the McKinnon-Shaw hypothesis of financial liberalisation. Further, except for the measure of financial deepening the other coefficients are statistically significant (see appendix A for p-values). In the first co-integrating relationship, financial deepening increases real GDP while inflation and real deposit rate has a negative impact on real GDP. The coefficient on real deposit rate is at odds with the liberalization theory, which posits that a real deposit rate increase real GDP through increased savings and investments. This could be explained by the fact that real

deposit rate in this period was not determined by free market forces but was rather controlled by the government. In the second cointegrating relationship describing the behavior of financial savings, financial deepening has a positive and significant impact on savings while inflation and deposit rate work to reduce the level of financial savings. This result, which goes against the expectation of the liberalization theory, could be attributed to government intervention.

An analysis of the adjustment parameters shows that all the parameters in the first co-integrating relationship except for real inflation and real interest rates carry the right signs. However, only the adjustment parameters on financial deepening and real deposit rate are statistically different from zero at the 5% level of significance. In the second co-integrating relationship, the adjustment parameters for the variables financial deepening, inflation and real interest are statistically significant and are correctly signed. This result has implications on the entire system with suggestions of instability of the system. The expectation is that the sign should be negative for all adjustment parameters and should most likely be less than one. However, post estimation diagnostics carried out and presented below suggest that the cointegrating vectors are stable and further show no evidence of model misspecification except for serial correlation in the residuals.[4]

5.4.2 Post Liberalisation

The results of the first co-integrating relationship in this period show that all the variables, that is, real deposit rate, financial deepening, and the rate of inflation impact negatively on real GDP. Only the coefficient on inflation (which is also statistically significant) bears the correct sign in accordance with the McKinnon-Shaw hypothesis of financial liberalisation.

In the second equation, describing the behavior of financial savings, the results, which are statistically significant, except for financial deepening, are correctly signed. Financial deepening and real deposit rate have a positive impact on real financial savings (real total deposits), while inflation is a disincentive for savings. It is surprising that while we have a positive relationship between financial deepening and financial savings in the long-run, financial deepening appears to impact negatively on real GDP. This result could possibly indicate that there is some allocative inefficiency such that credit is not being channeled to the productive sectors of the

[4] Residual serial correlation is weighted against the power of the estimation. Given the short span of the data, we do not have much margin to correct the serial correlation. Sufficient number of lags has already been added.

economy. To further explore this possibility, there would be need to model investments dynamics separately.

However, as in the pre-liberalisation period, there is need to take these results as indicative as some of the adjustment parameters are positive rather than negative, casting doubt on the stability of the system.

5.5. POST –ESTIMATION SPECIFICATION TESTS

Inference on the parameters in α matrix depends crucially on the stationarity of the cointegrating equations, thus it is important to check the specification of the model. This involves checking the following three aspects, which encompass most of what Lutkepohl (2005) recommends:

i. that the number of cointegrating equations have been correctly specified (stability test);
ii. testing for serial correlation in the residuals ; and
iii. testing that the errors are normally distributed.

5.5.1 Stability Test

The companion matrix of a VECM with K endogenous variable and r cointegrating equations has K-r unit eigenvalues. If the process is stable, the moduli of the remaining r eigenvalues are strictly less than one and the roots of the companion matrix should all lie within the circle. The results of the stability test for the two estimation period as well as the graph of the roots of the companion matrix, which are given in the appendix A and B respectively of this report, indicate that the estimated models are stable.

5.5.2 Serial Correlation in residuals and normality of residuals test

The results for the test for serial correlation in the residuals yield the results displayed in the appendix A and B for the two respective periods. The results clearly indicate that the presence of serial correlation in the residuals in the first two lags for the period before the reforms and in the first lag in the period after the reforms. [5]

The results for the test for normality of the errors indicate that we cannot reject the null hypothesis of normally distributed errors using the Jarque-Bera test for all the variables except

[5] See note footnote 4

for the real deposit rate. The variable real deposit appears to be skewed and kurtotic. We attempted to address the problem of skewness and kurtosis in the residuals by introducing the lag of real deposit rate and real GDP as well as dummy variables, however, the difference in the test results was not significant. There is a possibility of outliers in the series of these variables.

6. CONCLUSION

Zambia embarked on financial deregulation with major reforms taking place between 1992 and 1994. These reforms were part of the overall structural adjustment programme aimed at realigning the economy and addressing the decline in the economic performance of the country. In line with arguments made for financial liberalisation, the financial reforms were aimed at enhancing the allocation efficiency of the financial sector through an increase in savings and investments and ultimately the level of economic growth.

An assessment of the indicators of financial depth shows that there has not been any improvement in the depth of the financial sector in Zambia. The ratio of the liquid assets of the commercial bank to GDP, the ratio of broad money to GDP and the ratio of private credit to GDP are lower after deregulation. Intermediation efficiency in the banking sector as measured by the interest rate spreads shows that the level of efficiency as well as the competition in the Zambian financial sector is still very low. What can be inferred from this analysis is that although the deregulation of the financial sector has enhanced the entry into the sector of new bank and non-bank financial institutions, there is still doubt that it has increased the efficiency and competition of these institutions to levels that would promote the optimal mobilization and allocation of resources.

An econometric examination of the behavioural relationship between financial savings (measured by total deposit), real gross domestic product, financial depth, real deposit rate and inflation suggests that financial savings are influenced by both financial depth and real deposit rates in the post-liberalisation period. The relationship between financial savings and real deposit rate as posited by the McKinnon-Shaw liberalisation hypothesis is not borne out for the pre-liberalisation period. The results for the post-liberalisation period also show a negative relationship between financial deepening and real GDP. This result could possibly indicate that there is some allocative inefficiency such that credit is not being efficiently channeled to the

productive sectors of the economy. This point raises the need to model investments dynamics separately. However, there is need to take the results from this study as suggestive largely due to some deficiencies in the data as indicated in the specification tests..

Given the policy importance of enhancing domestic savings in Zambia, it is vital that a clear understanding of the relationship between financial savings and other macroeconomic variables is obtained. This will contribute to more directed policy formulation for savings enhancement. There is need to test for the significance of variables other than the ones in this study that have cited in others studies as being important in contributing to reduced access to financial services in Zambia.

One policy recommendation from the econometric results is that there is need to enhance the financial depth of the country. There is need for policy measures that would foster an increase in the availability of financial services to the rural population. Further, the range of services offered by the banking sector in the urban areas has to be expanded and improved in terms of cost efficiency.

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Appendix A:

MODEL ESTIMATION: 1978 TO 1992 (PRE – LIBERALISATION)

PREESTIMATION

Table 5: Selection of lag order

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	41.9426				1.7e-07	1.42087	-1.34894	-1.23325
1	336.849	589.81	25	0.0000	5.2e-12	-11.8019	-11.3703	-10.6762
2	462.053	250.41	25	0.0000	1.1e-13	-15.6559	-14.8647	-13.5921
3	542.058	160.01	25	0.000	1.5e-14	-17.7715	-16.6206	-14.769*
4	577.58	71.014*	25	0.000	1.1e.14*	-18.1762*	-16.6657*	-14.2361

Endogenous: LnRDEP, Lnrgdp, Findex, Infl, Realdr

Exogenous: _cons

ESTIMATION RESULTS

Table 6: Summary results of Co-integrating relationship 1

	LnRDEP	Lnrgdp	Findex	Infl	Realdr
β	Dropped	1	-0.027 (0.38)	0. 0009 (4.81)	0.072(2.71)
α	1.432 (3.19)	-0.093 (7.05)	0.48 (3.11)	72.928 (5.27)	-0.46 (1.63)

Figures in parentheses indicate the p-value

Table 7: Summary result of Co-integrating relationship 2

	LnRDEP	Lnrgdp	Findex	Infl	Realdr
β	1	Dropped	-0.77(3.04)	0. 0015 (2.31)	0.615(6.42)
α	-0.335(2.60)	0.028 (7.44)	-0.045 (1.03)	-2.543 (0.64)	-0.388(4.70)

Figures in parentheses indicate the p-value

POSTESTIMATION

Table 8 Results of Test for Serial Correlation in the Residuals

Lag	Chi2	df	Prob>chi2
1	97. 4442	25	0.00000
2	65.7363	25	0.00002
3	27.8909	25	0.31290

H0: no autocorrelation at lag order

Results of stability Test

Figure 3

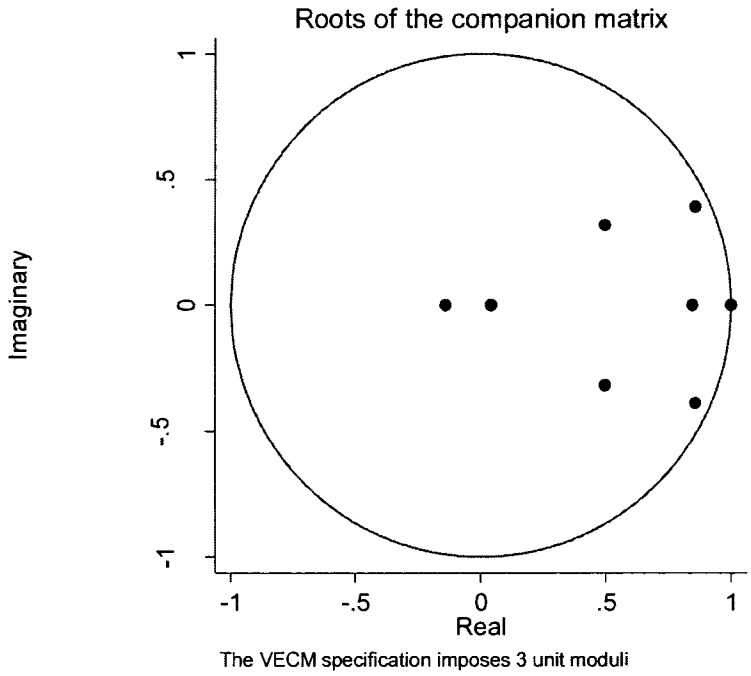


Table 9: Stability Test Result

Eigenvalue	Modulus
1	1
1	1
1	1
.8598257 +3112626i	.944662
.8598257 –3112626i	.944662
.8480101	.84801
.4948401+ .318011i	.588216
.4948404- .318011i	.588216
-.14137	.14137
.0411687	.041168

The VECM specification imposes 3 unit moduli

Appendix B:

MODEL ESTIMATION: 1994 TO 2006 (POST – LIBERALISATION)

PREESTIMATION

Table 10: Selection of lag order

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	107.49				9.6e-09	-4.27043	-4.19677	-4.19677
1	387.764	560.55	25	0.0000	2.3e-13	-14.9068	-14.4649	-13.7373
2	472.644	169.76	25	0.0000	2.0e-14	-17.4018	-16.5916	-15.2578
3	542.391	139.49	25	0.000	3.4e-15*	-19.2663*	-18.0877*	-16.147*
4	571.739	58.696*	25	0.000	3.4e-15	-19.4475	-17.9006	-15.3542

Endogenous: Lnrtdep, Lnrgdp, Infl, Findex, realdr

Exogenous: _cons

ESTIMATION RESULTS

Table 11: Estimates of Co-integrating relationship 1

	LnRDEP	Lnrgdp	Findex	Infl	realdr
β	Dropped	1	5.701 (4.40)	0. 0244 (9.85)	0.0673(0.83)
α	-0.8136 (4.43)	-0.014 (2.35)	-0.2298 (3.43)	5.556 (2.30)	-0.890107 (-2.32)

Figures in parentheses indicate the p-value

Table 12: Estimates of Co-integrating relationship 2

	LnRDEP	Lnrgdp	Findex	Infl	realdr
β	1	Dropped	-0.8395(-0.69)	0. 0349 (15.07)	-0.2308 (-3.03)
α	0.4322 (2.41)	-0.0078 (2.20)	-0.1345 (3.23)	-10.9892 (-6.01)	-0.9142(3.14)

Figures in parentheses indicate the p-value

POST – ESTIMATION

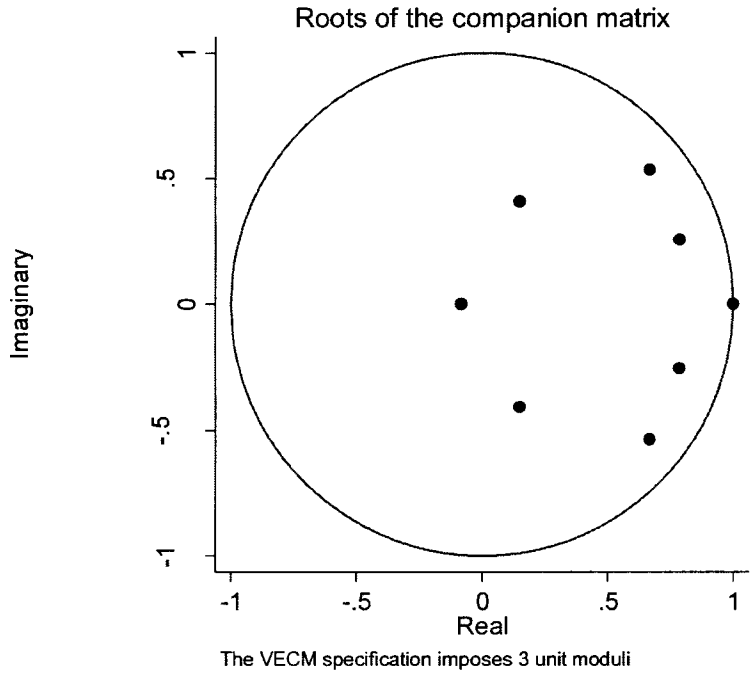
Table 13: Results of Test for Serial Correlation

Lag	Chi2	df	Prob>chi2
1	98. 3065	25	0.00000
2	32.2753	25	0.15020
3	31.5185	25	0.17242

H0: no autocorrelation at lag order

Results of stability Test

Figure 4: Graph



Eigenvalue	Modulus
1	1
1	1
1	1
.6665348 + .5364961i	.855626
.6665348 – .5364961i	.855626
.785554 + .25620321i	.826278
.785554 + .25620321i	.826278
.1462115 - .4083717i	.433757
.1462115 -.4083717i	.433757
-.0841782	.084178