THE CAUSAL RELATIONSHIP BETWEEN THE FLOW OF DOMESTIC CREDIT AND CHANGES IN NET FOREIGN RESERVES IN LESOTHO (1980-2000)

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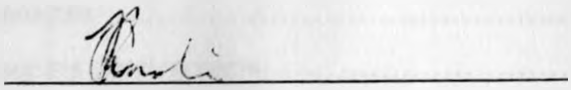
Declaration

This research paper is my original work and has not been presented for a degree in any other University



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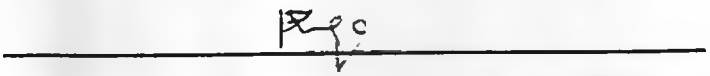

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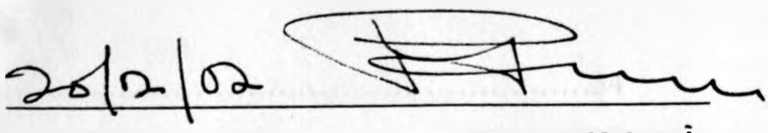

Mr R.M.Kabando

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Abstract

The management of external balance has been the major problem of most of the non-oil less developing countries in the last three decades. The empirical literature on this subject has shown that the major cause of balance of payments disequilibrium in the LDCs was the adverse developments in the international economy which included the deterioration in the terms of trade associated with OPEC oil price hikes and high interest rates, increased protectionism and recession in the developed world. However, the IMF has been of the view that overly expansionary domestic demand policies that created excess demand for imports have been the common cause of payments deficits This has led to its recommendation of the monetary approach to balance of payments in the LDCs.

This study tests the applicability of the monetary approach to balance of payments in Lesotho by concentrating on the casual relationship between the flow of domestic credit and changes in net foreign reserves.

The results show that there was a unidirectional causality between the flow of domestic credit and changes in net foreign reserves in the 1980-2000 period, running from net domestic credit to reserves. The findings are in support of the monetary approach to balance of payments. It therefore follows that given a stable demand for money in Lesotho, the balance of payments disequilibrium can be corrected, at least partly, by appropriate financial programming and monetary targeting.

CHAPTER ONE: INTRODUCTION

1.1 Background

In the last three decades following severe deficits in the balance of payments experienced by the majority of non-oil less developed countries, much thought has been given to the adaptation of monetary theory to monetary management, honing techniques of analysis and building up a substantial body of empirical knowledge in the field. The studies neither reject nor accept the monetary approach to the balance of payments. Despite these, however, the Sub-Saharan African (SSA) countries have increasingly adopted this approach in financial programming especially in the design and implementation of stabilization programmes pursued under the auspices of the International Monetary Fund.

Much of the controversy has been in the prime causes of BOP problems, especially in the developing countries. It is generally agreed in the literature that a major cause of BOP disequilibrium in the LDCs has been the adverse developments in the international economy beyond the control of domestic policy makers. Such developments included deterioration in the terms of trade associated with OPEC oil price hikes and high interest rates, increased protectionism and recessions in western industrial countries (Mwega and Ngola, 1988).

In the Southern African region, Lesotho and Zambia were the countries most affected by these external shocks. The shocks cost each of the two countries an external income equivalent to 0.8% of GDP in the 1980-1990 period (Kusi, 1995). However, the IMF has been of the view that overly expansionary domestic demand policies that created excess

demand for imports, have been the common cause of payments deficits (Bird, 1984). These conflicting views may, of course, simply reflect time periods and countries studied.

Over the period of study, Lesotho has maintained a favorable balance of payments with the exception of 1988, 1989 and 1999. Apart from the few years, the migrant earnings, unrequited transfers and most importantly, the external borrowing have played a major role in the financing of the ever negative trade balance. These have kept the current account favorable for the greater part of the period. The government has also relied on such ad hoc measures as import compression through exchange controls, and non-tariff trade restrictions. However, Lesotho also got into the 1980s with greater structural imbalances and these seem to fit her into Kusi's (1995) description of the category of SSA countries whose structural imbalances were often hidden because external borrowing had temporarily maintained growth. Furthermore, stiff competition in the manufacturing sector emanating from the neighbouring countries (in terms of low costs of public utilities) poses a threat to the country's external balance, especially that the sector has become one of the main foreign exchange earners. It is the purpose of this paper to test the hypothesis that under the fixed exchange rate system, changes in the domestic credit led to changes in the net foreign reserves in Lesotho, as implied by the monetary approach to the balance of payments, using vector autoregressive and vector error correction model.

1.2 Overall Developments

It has been widely argued that due to its characteristics of being an enclave to South Africa and having a very narrow resource base, Lesotho is subject to a number of limitations against development. The economy got into the 1980s with a negative growth of real GDP of -1.9% in 1980. During the early to mid 1980s, the decline in real GDP was attributed to severe drought which hampered agricultural output. This, together with changing attitudes towards farming brought about by increasing migration to South African mines, reduced agriculture share of GDP. Despite policies geared towards the solution of environmental problems and increased output, the share of agriculture in GDP continued to decline to this end (refer to Appendix 1). The closure of the only diamond mine in 1982 following a fall in the international prices also contributed to sluggish growth in the early 1980s. Since then, mining existed at a very small individual scale and contributed very little to GDP. The government is currently working towards the reopening of the mine.

The early 1980s are also characterized by relatively vibrant mining activity in the neighboring South Africa which brought an increase in migrant earnings that contributed significantly to the growth of GDP. However, the decline in the gold prices and mechanization in the South African mines in the mid-1980s to the 1990s led to significant retrenchment of miners. This, together with citizenship awarded to miners who have worked in South Africa for more than five years, led to the decline in miners' remittances. The political developments in the country have also contributed negatively to the economy's performance. This is evident from the political turbulence that resulted from a coup in 1986 which led to military regime for seven years up to 1992. Another

political disturbance was experienced in 1998 following the general elections, which resulted in significant destruction of property in towns. One of the sectors that have come to be the most important in the economy is manufacturing. The contribution of this sector to the general output has grown significantly following the government's export promotion policies. The construction sector has also grown significantly owing to construction related to the Lesotho Highlands Water Project (LHWP).

1.3 Balance of payments developments

Over the years, Lesotho has depended heavily on South Africa in terms of imports and migrant earnings, with more than 80 percent of Lesotho's trade done with South Africa. Since the 1980s, trade deficits have been a common feature in the economy of Lesotho (see Table 1). The migrant earnings, unrequited transfers and external borrowing played a major role in the financing of the trade gap. With the exception of 1985, 1986 and 1988 these have helped maintain a surplus in the current account in the 1980-1994 period. However, from 1995 a sharp decline in the unrequited transfers left part of the trade deficit unfinanced. This led to the current account deficit that extended to the year 2000.

Following the closure of the diamond mine in 1982, exports began to fall. The diamonds, which were exported to Switzerland, constituted about half of the value of exports. The exports recovered again in 1986 following the rapid growth of the manufacturing sector. The trend of good performance in the sector extended to the 1990s. Initiatives such as enhancement of export financing schemes, establishment of investment promotion centre and tax holidays have helped boost investments in such areas as electronics, clothing, footwear etc. The imports on the other hand have continued to grow since 1980. This

consists mainly of consumption goods given the poor performance of agriculture and limited productive activities in the country.

During the period of study, Lesotho has maintained a favorable balance of payments with the exception of 1988, 1989 and 1999. In the process, it has expanded exports, diversified production, increased savings and accumulated substantial foreign exchange reserves. The increases in external public debt have been quite moderate in relative terms (refer to Appendix 1). A tight external borrowing policy and increase in exports have been of great assistance in maintaining the debt service and other debt indicators at reasonably low levels in recent years.

1.4 Evolution of financial institutions[1]

At independence in 1966, there was essentially no financial or monetary control in the economy of Lesotho and as such the government had no control over credit in the country. Commercial banking was introduced by what is now the Standard Chartered bank. It was later followed by the now Barclays PLC in 1957. These institutions essentially performed the function of collecting deposits in Lesotho and channeling them to South Africa. The reason given for this practice was that there were no loanable investment opportunities in the country. In response to this, the Lesotho authorities had to intervene by specifying the amount of assets the banks had to hold in Lesotho in 1973 but which took a significant effect in the 1980s.

[1] A thorough presentation of the evolution of deposit taking and lending institutions in Lesotho is contained in Maruping (1989)

By 1966, Lesotho had started its own Post Office Savings Bank (POSB) through the post office network which initially functioned as branches of the South African Post Office Savings Bank. Along with the POSB has been the evolution of cooperative systems providing loans for purposes ranging from medical fees, school fees, agriculture, to building a family house. However, all these cooperative systems with the exception of Cooperative Credit Union, were overburdened and eventually collapsed. In 1972, the POSB with good growth prospects, was absorbed by the newly created government owned Lesotho Bank. This bank also faced financial problems in 1990s which led to its privatization. The Lesotho Bank is presently under the control of the Standard Bank group of South Africa which owns the greater stake of the bank.

In response to the absence of a development bank or any major financial institution to finance large productive projects, Lesotho National Development Cooperation (LNDC) was instituted in 1967. Its mandate has been to initiate, promote and facilitate development of manufacturing and processing industries, mining and commerce etc. In 1975 Basotho Enterprises Development Corporation (BEDCO) which later became a separate parastatal institution, was formed as a subsidiary of LNDC. It has been providing aspiring Basotho (people of Lesotho) entrepreneurs with loans, shelter, training and extension services. While LNDC and BEDCO were addressing the finance needs on the industry side, there was no major institution to provide finance to agriculture. Upon this, the Lesotho Agricultural Development Bank (LADB) was instituted and started operation in 1980. However, due to high risk involved in agricultural credit as a result of unpredictable climatic conditions, the LADB could not withstand the pressure and had to close in the 1990s.

Before independence the then British High Commission territories of Basutoland (Lesotho), Bechuanaland (Botswana) and Swaziland were using the British currency and later the South African "Rand" as legal tender. Following independence however, Botswana, Lesotho and Swaziland (BLS) sought more formal arrangements with South Africa. BLS entered into the Rand Monetary Area (RMA) in 1974 in terms of which the SA Rand was to remain a legal tender in the BLS. Subsequently, the BLS issued their own respective currencies.

The Lesotho Monetary Authority Act was passed in 1978 and the "loti", which has remained pegged at par to the SA Rand, was issued at the same time as the Monetary Authority became operational in 1980. The Lesotho Monetary Authority was elevated to the Central Bank of Lesotho (CBL) in 1982. The responsibilities of the CBL have been to supervise and monitor the entire financial system, issuing of currency, management of reserves, administration of exchange controls as well as monetary policy. It later assumed the role of being the sole banker of government. The RMA was replaced by the Common Monetary Area (CMA) Agreement in 1986 and this gave Lesotho a comparatively higher degree of autonomy.

During the period of study, the composition of Lesotho's financial institutions has evolved to include the Central Bank of Lesotho, the five commercial banks (Barclays, Stanbic, Lesotho Bank, Standard Chartered and Nedbank), an institution that plays the role of the building society (Lesotho Building Finance Corporation), Lesotho Co-operative Credit Union League together with its member Co-operative Credit Unions. In addition there is currently some insurance companies, insurance brokers and asset

managers. Of late, the importance of the rapidly growing informal financial sector in the economy cannot be ignored.

1.5 Monetary Trends[2]

Following the introduction of the Central Monetary Authority in 1979, the annual average growth of money supply for the 1980-1983 period was a high rate of 22.8 percent. The net domestic credit as a ratio of GDP continued to increase rapidly from 27 percent in 1984 to 44 percent in 1988 (Lesotho Government, 1996). Table 2 gives the rough picture of these trends in terms of annual changes. Some economists would argue that the phenomenon is acceptable for a developing country where the process of monetization could still be taking place. Others would worry especially in economies like Lesotho where a high expansion of domestic credit is likely to lead to external imbalances through imports and capital outflows. This is one of the reasons underlying the IMF intervention through Structural Adjustment Facility. However, in the 1990s, the growth of money supply was moderate as compared to the 1980s.

In the 1980s, the government share of domestic credit rose rapidly following the high fiscal deficits, thus crowding out the private sector investments. However, following the adoption of IMF Structural Adjustment Policies in 1988, the domestic credit to the public sector began to decline. The major reforms were made especially in agriculture, taxation, public expenditure and the civil service. These resulted in a fiscal surplus for the first time in 1991 since 1975. The domestic credit to the private sector was also growing in the 1980s though at a very low rate. Trade and catering traditionally absorbed the bulk of

[2] see Table 2

domestic credit during this period. This dominance was later criticized because of low value added, as well as low forward and backward linkages generated by this sector. Transition into the 1990s saw an increased credit expansion in the private sector, especially in the manufacturing and construction sector. This coupled with tax holidays and the establishment of the investment promotion centre saw the manufacturing sector expanding smoothly well into the new millennium.

1.6 Statement of the problem

Over the years, the IMF has endeavored to develop various models that would indicate, if only in an approximate way, the likely relationship between credit creation and balance of payments, especially in developing countries. The main concern in this effort at model building has been simplicity. It is from this effort that what is now known as the monetary approach to balance of payments (MABP) came into being.[3] Briefly stated, the model postulates that the overall balance of payments, as measured by international reserves, reflects disequilibrium in the money market, between demand for and supply of money.

The MABP has been, and continues to be, used in financial programming in developing countries. Several reasons had been cited in favor of this model among other alternative models. First, many developing countries lacked the detailed national accounts needed for the application of Keynesian analysis, while financial data were fairly easily available. At the same time, only aggregative payments data could be obtained and this ruled out an approach based on elasticities. Second, analysis based on monetary

[3] For the origins and development of the monetary approach of balance of payments. see Frenkel and Johnson (1976); IMF (1977); Kreinin and Officer (1978); Rivera-Batiz and Rivera-Batiz (1985)

aggregates was not excessively complex and could be understood easily. Third, the scope for developing countries to adopt sterilization policies was limited. (Bird, 1984, p.96)

Despite the extensive research that has been done on the applicability of the monetary models in the context of developing countries, as yet no clear consensus has emerged. Following a comprehensive review of major studies up to 1977, Kreinin and Officer (1978) conclude that the evidence is inconclusive. The recent studies in SSA have also given mixed results. In the light of these, and given that Lesotho has implemented IMF supported schemes since 1988, there appears a need to evaluate the applicability of this approach in the Lesotho context. While there are various ways of testing the monetary approach to balance of payments, the present study will specifically concentrate on the causal directions between the flow of domestic credit and changes in foreign reserves.

1.7 Objectives of the Study

The paper aims at determining the relevance of monetary approach to balance of payments in Lesotho. Thus the specific objectives of the study are:

1- To empirically test for causality between the flow of domestic credit and changes in foreign reserves in Lesotho using vector autoregressive and vector error correction models.

2- Based on the findings in (1) above, draw and discuss the policy implications.

1.8 Significance of the Study

The results should be of great interest to both policy-makers and students of open economy macroeconomics. Furthermore, though the balance of payments adjustment may be inevitable given the generally limited capacity of non-oil developing countries to finance them, establishing their causes may help in the design of the least cost adjustment policies (Mwega and Ngola, 1988). Also, the findings of this study will contribute to the existing literature so that there is growing literature, and in addition stimulate similar studies on Lesotho.

Table 1 : Balance of Payments:
A Summary for Selected Years
Millions of US Dollars: Minus Sign Indicates Debit

	1980	1982	1984
Current Account, n.i.e.	**56.33**	**22.08**	**6.45**
Goods: Exports f.o.b.	58.16	37.35	28.33
Goods: Imports f.o.b.	-424.48	-446.94	-433.23
Trade Balance	-366.32	-409.58	-404.9
Services: Credit	32.23	26.22	24.35
Services: Debit	-50.33	-46.68	-45.1
Balance on Goods & Services	-384.42	-430.05	-425.64
Income: Credit	273.1	361.4	343.5
Income: Debit	-7.58	-15.11	-11.07
Balance on Gds, Serv. & Inc.	-118.9	-83.76	-93.22
Current Transfers, n.i.e.: Credit	222.09	163.1	147.5
Current Transfers: Debit	-46.86	-57.26	-47.84
Capital Account, n.i.e.	**0**	**0**	**0**
Capital Account, n.i.e.: Credit	0	0	0
Capital Account: Debit			
Financial Account, n.i.e.	**-3.73**	**7.23**	**-28.37**
Dir. Invest. in Rep. Econ., n.i.e.	4.49	3.04	2.31
Other Investment Assets	-41.95	-31.18	-17.87
Other Investment Liab., n.i.e.	33.73	35.37	-12.81
Net Errors and Omissions	**-11.16**	**-21.27**	**30.49**
Overall Balance	**41.44**	**8.05**	**8.58**

Source: IMF, International Financial Statistics

1986	1988	1990	1992	1994	1996	1998	2000
-2.8	**-24.61**	**65.02**	**37.61**	**108.14**	**-302.52**	**-280.23**	**-151.44**
25.39	63.69	59.46	109.25	143.48	186.86	193.43	211.1
-341.55	-559.37	-672.64	-932.61	-810.22	-998.63	-865.98	-727.6
-316.16	-495.68	-613.18	-823.37	-666.75	-811.77	-672.55	-516.5
20.22	32.07	40.61	41.28	37.77	42.61	53.57	42.68
-46.2	-69.12	-81.45	-82.78	-64.21	-55.93	-52.18	-42.54
-342.15	-532.73	-654.02	-864.86	-693.18	-825.09	-671.15	-516.36
268.64	384.9	454.97	496.28	369.56	452.97	357.68	288.77
-10.3	-14.92	-21.83	-32.56	-39.4	-119.5	-123.65	-62.65
-83.81	-162.76	-220.87	-401.15	-363.02	-491.62	-437.12	-290.24
116.85	196.98	362.27	542.08	472.11	190.16	158.05	139.82
-35.84	-58.83	-76.38	-103.32	-0.94	-1.07	-1.16	-1.02
0	**0**	**0**	**0**	**0**	**45.48**	**22.87**	**21.99**
0	0	0	0	0	45.48	22.87	21.99
16.82	**-8.02**	**-44.97**	**-66.98**	**32.98**	**350.64**	**316.15**	**85.18**
2.06	21.03	17.08	2.67	18.74	287.5	264.8	117.78
-1.56	-79.99	-109.67	-106.44	-13.37	-6.97	-1.67	-19.11
16.32	51	47.61	36.79	27.61	70.11	53.03	-13.49
-1.38	**26.51**	**-2.83**	**79.23**	**-20.26**	**23.26**	**56.81**	**62.06**
12.63	**-6.12**	**17.21**	**49.86**	**120.86**	**116.85**	**115.6**	**17.8**

Table 2: Trends in money supply, net foreign assets, net claims on government and claims to private sector (annual changes)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Foreign Assets (Net)	n.a.	22.98	60.34	-8.57	6.93	166.74	235.54	385.15	513.61	834.56	149.22
Domestic Credit	n.a.	25.6	6.4	53.74	128.41	-46.38	-183.33	-126.04	-222.76	-187.29	248.87
Claims on Public Sector (Net)	28.13	15.78	-10.2	52.22	95.61	-83.07	-228.07	-323.06	-224.34	-38.73	223.37
Claims on Private Sector	-2.4	9.82	16.59	1.53	32.8	36.69	44.73	197.02	1.58	-148.57	25.51
Money	n.a.	18.55	18.61	21.5	63.07	19.04	38.37	53.41	103.92	196.14	78.64
Quasi-Money	n.a.	22.66	14.68	19.89	39.86	27.78	26.17	48.43	91.35	41.7	-55.58
Other Items (Net)	n.a.	7.38	33.45	3.78	32.42	73.55	-12.34	157.28	95.57	409.42	375.02

Source: IMF, International Financial Statistics

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Literature

The theoretical basis of this study is on the consolidated balance sheet approach which focuses on the assets of the monetary system. The point of departure for this approach is the money supply identity which is expressed as follows:

$$MS = NFR + NDCp + NDCg$$

Where: MS is broad money supply, NFR is net foreign reserves, NDCp is net domestic credit to the private sector, NDCg is net domestic credit to the public sector. This can be transformed as follows;

$$NFR = MS - (NDCp + NDCg)$$

At equilibrium in the money market, the demand for money (MD) is equal to the supply of money (MS), but for ease of exposition, MS instead of MD will continue to be used. In terms of changes, the consolidated balance sheet of the banking institutions can be stated as:

$$\Delta NFR = \Delta MS - (\Delta NDCp + \Delta NDCg)$$

According to this approach, changes in net foreign reserves (ΔNFR) can be expressed as the difference between the change in money supply (ΔMS) and the sum of the changes in

domestic credit to the public sector (ΔNDCg) and to the private sector (ΔNDCp). It is this identity which forms the basis of the monetary theory to the balance of payments. According to this theory, if the demand for money is stable and an economy maintains a fixed exchange rate, domestic credit creation is fully offset by the movement in net foreign reserves of the monetary system, with the overall balance of payments reflecting disequilibrium in the money market.

The rationale is that, the flow of domestic credit will tend to increase money supply. This will induce an increase in the demand for goods and services, and most importantly, imports and net capital outflows. This will result in some of the original addition to money supply being drained away by the increase in imports and net capital outflows. In the long run, given a stable demand for money function, the increase in domestic credit will be fully offset by the change in net foreign reserves through increases in imports and net capital outflows.

Although the theory's emphasis is on the long run equilibrium, it is however the short run implications that are more important for policy formulation and in tracing the time path of the BOP adjustment process than the long run results achieved when the economy is in equilibrium. Furthermore, such equilibrium is rarely attained due to relative instability in many LDCs economies (Leff and Sato, 1980). In the short run, changes in availability and terms of credit may influence the demand for money so that the offset relationship is not significant. The flow of domestic credit may also endogenously reflect changes in the net foreign reserves so that the monetary theory becomes misspecified. (Mwega and Ngola, 1988)

The main assumptions underlying the monetary approach to balance of payments are as outlined below:

1- There exists a demand for money function which is stable

2- Arbitrage is operating in the goods market, which tends to equalize price levels at a given fixed exchange rate

3- There is perfect capital mobility, which imply that interest rate parity holds.

2.2 Empirical Literature

Tullio (1979) using a two-area (United States and Europe[4]) model of the world, derived the following equation for the U.S. balance of payments along the lines of the monetary approach to balance of payments:

$$dNIR'_{US} = \dot{a}_E - \dot{a}'_{US} + dDA'_E - dDA'_{US} + \eta fy(\frac{\dot{y}_{US}}{\beta} - \dot{y}_E) + \eta fy(\frac{\dot{r}_{US}}{\beta} - r_E)$$
$$-\alpha(\dot{IEE} - \dot{Y}_E)' + (\frac{1}{X}) + (\dot{P}_{US} - \dot{P}_E)$$

Where: $dNIR_{US}$= U.S. balance of payments expressed in dollars, NIR=net international reserves, a= money multiplier, DA= domestic assets of the central bank backing the money supply, IEE= intra-European exports, η= a demand elasticity, y=aggregate real output, r= nominal interest rate, P_E= price of one unit of output expressed in pounds, P_{US}= price of one unit of output expressed in dollars. d=first difference; a dot above a variable indicates a rate of change. The subscripts E and US on the variable signify Europe and U.S. part respectively.

[4] Europe represented the rest of the world

Using the data for the 1951-73 period, the empirical results supported the MABP. The U.S. balance of payments was significantly explained by not only the changes in domestic assets of the U.S. central bank, but also by the changes in domestic assets of the central banks of the rest of the world. While the U.S. monetary authorities had tried to sterilize gold losses that resulted from conversions of dollars for gold by Europe, the potential bias that could be introduced by this was ignored since annual changes in the U.S. gold stocks were, on average, only a relatively small fraction of the average absolute value of the annual balance of payments.

Sheehey (1980) using Brazil and Chile as case studies, estimated the following model incorporating the MABP equation (first equation) and the central bank reaction function (second equation):

$$B1 = \alpha_0 + \alpha_1 \hat{Y} + \alpha_2 \hat{B2}_{-2} + \alpha_3 E + \alpha_4 t$$

$$B2 = \gamma_0 + \gamma_1 \hat{Y} + \gamma_2 \hat{B1} + \gamma_3 GDC + \gamma_4 t$$

Where: B1= international reserves, B2= domestic credit, GDC= cumulative government budget deficit, E= exchange rate, Y= Gross Domestic Product, t= time trend.

The central banks of both countries appeared to have financed a large part of the government budget deficit and sterilizing only about one-third of their payments imbalances. The results however, did not support the MABP- the offset coefficients were significantly less than minus one and the sterilization coefficients significantly negative. It was concluded therefore that the balance of payments flows considerably reduced the monetary authorities' control over the money supply, even when they were able to finance payments deficits.

Johannes (1981) carried out a formal test of exogeneity with respect to reserve flows, of domestic price level, interest rate, level of real income and domestic credit, an assumption implicit in the MABP empirical studies, and the theoretical specification of the MABP model in general. The study used the monthly data for the period 1963-1971 for five countries- Australia, France, Germany, Norway and Sweden. The results rejected the null hypothesis that the price level, real income, interest rate and domestic credit were jointly exogenous with respect to reserve flows in the short to medium run for each country in the sample. The study came out with two conclusions; first that the empirical results of the MABP that had implicitly or explicitly assumed exogeneity even in the short run are subject to serious problems of simultaneity as had been suspected by Magee (1976). Secondly, that the theoretical specification of the MABP itself, which is meant to characterize the long run, is incorrect.

Kamas (1986) estimated the offset coefficient in the context of three different balance of payments specifications: the monetarist, the portfolio balance and a general equation incorporating current as well as capital account (Keynesian). The equations were estimated by both ordinary least squares and two stage least squares using the quarterly data for Mexico (1971.III – 1981.IV) and Venezuela (1970.IV – 1982.IV). The empirical results of the three equations supported the hypothesis of a high offset to monetary policy through reserve flows in Venezuela, but not for Mexico. While in all cases, the estimated coefficients for Venezuela were significantly different from the minus one predicted by the MABP, they were large (ranging from -0.65 to -0.82 in the two stage least squares estimates). The estimated offsets for Mexico on the other hand, were between 0.04 and 0.09. Some evidence of sterilization was also found for Venezuela, but not for Mexico.

The Granger causality tests were also conducted for domestic credit and reserves. For both countries, the causality was bidirectional, indicating the existence of both an offset and sterilization.

A series of studies have been carried out in Kenya. Among other monetary studies, King(1979), using the annual data for the 1967-1973 period, concentrated on the relative merits of Keynesian IS-LM model and monetarist (Polak) model in explaining the macroeconomic behavior of Kenya and concluded firmly in favour of the latter. The modified version of the Polak model presented was as follows:

$$Y = A + X - M$$

$$MO + SA = -900 + 1.7Y$$

$$M = 100 + 0.4A$$

$$\Delta(MO + SA) = \Delta FR - V + \Delta(DA - SA)$$

$$\Delta FR = X - M + F + V$$

Where: Y. is monetary GDP at current market prices. X is exports. M is imports. A is the resources available for domestic investment and consumption. MO is the Kenya's money stock. SA is crude seasonal adjustment factor. FR is foreign assets. DA is domestic credit. F is capital account balance. V is sum of SDR allocations and revaluations of foreign assets by the Central Bank of Kenya.

Though the period of analysis was characterized by currency devaluation and foreign exchange controls, the results strongly suggested that the flow of domestic credit was a significant cause of changes in net foreign reserves in Kenya.

Killick (1984) criticized this and other monetarist studies which implied that the BOP changes in Kenya were mainly caused by monetary factors within the control of domestic policy makers. The main arguments put forward rested upon:

1- The failure to take into account the "real" forces that underly the flow of domestic credit in the economy, these being, among others, the export performance and the structure of incentives underlying it.

2- The models used and the stability of the results. It was shown that changes in reserves was an unreliable reflector of changes on current account since capital movements, in some years, tended to dampen and in others magnify the impact of current account on monetary account.

3- The policy applicability of the derived results. Their domestic credit was complex and included items ("uncleared effects", "revaluation account", "other" assets and liabilities, etc) which could not be easily manipulated for purposes of short-run economic management and which in fact change quite substantially from one year to the next.

The main conclusion reached here is that it was non-monetary factors which were the main cause of changes in net foreign reserves in Kenya with the flow of domestic credit responding passively to these changes.

Mwega and Ngola (1988) later reconciled the differences by using the Granger-Sims methodology of detecting causality in temporal systems. The following equations were fitted to the quarterly data for the 1970 II – 1985 IV period.

$$\Delta FR(t) = a_0 + \sum_{j=1}^{8} a_{1j}\,\Delta FR(t-j) + \sum_{j=1}^{8} a_{2j}\,\Delta DC(t-j) + a_3\,\Delta TOT + a_4\,TIME + \sum_{j=1}^{3} a_{5j}\,SD_j + U(t)$$

$$\Delta DC(t) = b_0 + \sum_{j=1}^{8} b_{1j}\,\Delta DC(t-j) + \sum_{j=1}^{8} b_{2j}\,\Delta FR(t-j) + b_3\,TIME + \sum_{j=1}^{3} b_{4j}\,SD_j + V(t)$$

Where; DC is total domestic credit or one of its components. TOT is terms of trade. TIME is time trend variable. SD is the seasonal dummies. U(t) and V(t) are uncorrelated "white noise" residuals.

The results showed that the flow of domestic credit to the private sector had a negative impact on net foreign reserves. However, changes in net foreign reserves had a positive impact on the flow of domestic credit. The flow of domestic credit to the public sector and net foreign reserves on the other hand, impacted negatively on one another. Both components of domestic credit reinforced one another to impose a negative impact on the net foreign reserves without feedback effects, thus supporting the monetarist studies of Kenya's balance of payments. However, the results were not stable so that they could not be generalized to other periods.

Ndung'u (1997) in another study used the vector error correction methodology for the 1970-1993 period. The results showed that the flow of domestic credit and changes in net foreign reserves Granger-caused each other.

Nyakawa (1997) investigated the overall balance of payments effects of the exchange rate, real income, prices level, domestic credit and money multiplier within the reserve flow equation of the MABP in Kenya using the quarterly data for the 1970-1995 period. The results were found to be in support of the MABP with the offset coefficient of negative one. The study also established a positive relationship between reserves on the one hand and price level, income, money multiplier on the other hand, as well as the negative relationship between reserves and interest rate. The sterilization hypothesis was rejected, with the exception of the 1980s when the Central Bank of Kenya carried out marginal sterilization. The causality tests between reserves and credit on the other hand showed that causality was unidirectional running from domestic credit to reserves in line with the MABP.

Jimoh(1990) employing the "exchange-market-pressure equation" and the correlation coefficient test, examined the relevance of the monetary approach to balance of payments in Nigeria for the period 1960-1985. Since Nigeria was controlling its external disequilibrium by a combination of reserves and exchange rate changes during the period of study, the exchange-market-pressure equation was deemed appropriate. The model used is:

$$(\frac{dR}{B} + \frac{d(1/e)}{1/e}) = D_1(\frac{dD}{B}) + D_2(\frac{dB^*}{B^*}) + D_3(\frac{dy^*}{y^*}) + D_4 P^*_0$$

Where: R= foreign reserves, B= monetary base, e= effective exchange rate, D= domestic credit, y*= foreign real income, B*= foreign monetary base, P^*_o= dollar price of crude oil. D_i are the estimated coefficients.

The offset coefficient (D_1) was significantly different from zero and not significantly different from one. This result was further confirmed by the correlation coefficient test. The Granger-causality test was also implemented. The results revealed a unidirectional causality between domestic credit (and money supply) and foreign reserves, running from domestic credit and money supply to foreign reserves, in line with the MABP.

Cavendish (1989) using data for the 1979-1987 period explicitly tested the Polak model using Lesotho as the case study. The results showed that though simple, the Polak model simulated BOP changes in Lesotho quite well. This, in line with monetary theory, suggested that it is the flow of domestic credit that has been a significant cause of changes in net foreign reserves in Lesotho.

Silumbu (1995) tested the relevance of the monetary approach to the balance of payments in Malawi. Within the reserve flow equation variant of the MABP, the domestic credit had the expected negative impact on reserves followed by a positive coefficient thus suggesting the effectiveness of selective credit policy.

The Granger causality test between domestic credit and reserves on the other hand revealed mixed results. The results based on annual data supported the MABP: the direction of causality was from credit to reserves, for both total domestic credit and Reserve Bank of Malawi credit to government. This was attributed to the high proportion of public sector credit in total credit. The quarterly data, however, revealed that total credit and government credit are each in interdependent causation with reserves. The

private sector credit on the other hand indicated that the direction of causality was from reserves to credit, for both annual and quarterly data.

Dhliwayo (1996) tested the reserve flow equation variant of the MABP for Zimbabwe using the Johansen and Juselius multivariate cointegration and error correction modeling. The following cointegrating vector was estimated:

$$r_t = \alpha_1 y_t + \alpha_2 p_t + \alpha_3 i_t + \alpha_4 d_t$$

Where; r_t is the net foreign reserves. y_t is the level of real domestic income. p_t is price level. i_t is rate of interest. d_t is domestic credit.

The results suggested that money played a significant role in determining balance of payments in Zimbabwe. The change in domestic credit caused an equal and opposite change in international reserves, supporting the monetary approach to BOP.

2.3 Literature Overview

The monetarist studies (e.g. King, 1979; Dhliwayo, 1996; Cavendish, 1989) rely on historical data to argue that the dominant causality is from the flow of domestic credit to the changes in net foreign reserves. As they are, they suggest that there are no significant feedback effects so that domestic credit can be controlled by the monetary authorities independently of these effects. This has been the main drawback of the monetarist studies.

As Killick (1984) argues, they fail to take into account the real factors underlying the flow of domestic credit in the economy. If the flow of domestic credit in Lesotho is the reflection of the real factors, one of the main factors is likely to be the availability of foreign reserves given that a large proportion of domestic credit is used to finance imports[5]. The overall balance of payments also increases the monetary base so that causality is likely to be from changes in net foreign reserves to flow of domestic credit. This will also be the case if the monetary authorities sterilize the financial effects caused by changes in net foreign reserves and if the availability of foreign reserves significantly influences their propensity to relax or stiffen credit controls (Mwega and Ngola, 1988). If on the other hand, the supply of money affects the output, prices and interest rates, there will be significant feedback effects which will imply that the econometric results of monetary studies suffer from simultaneous equation bias (Magee, 1976). These imply that any of the causal directions could exist.

[5] See Cavendish, 1989, p.4

The Cavendish (1989) model, and the Polak models in general, among other significant drawbacks, also suffer from a lot of aggregation. Of even major concern is the aggregation of credit to private sector and credit to public sector, especially from the policy point of view. For instance, if it is credit to the private sector that is overshooting, then the monetary authorities can consider interest rate or credit controls etc. However if it is the public sector credit that is skyrocketing, then the government revenue and expenditure would need careful examination. Therefore, there may be quite different implications for imports and income, in credit directed to the public sector, in terms of the coefficients generated in this model.

The empirical studies based on the Granger causality procedure yield mixed results. These also imply that any of the causal orderings between the flow of domestic credit and changes in foreign reserves could be dominant, depending on the macroeconomic structure of the economy under study, differences in methodological approaches and time periods notwithstanding.

CHAPTER THREE: METHODOLOGY

3.1 Model Specification

The concept of causality arose from an examination of the underlying assumptions of an econometric model estimated from time series data which were non-experimental in nature (Pearce, 1995). The current use of causality in time series analysis is attributable to Granger, hence the term Granger causality. According to Granger (1969) definition of causality, a variable X causes Y relative to a given information set if past Xs are significant in explaining Y when past Ys are included as explanatory variables of present Y in a regression model. However, it has been noticed in the econometrics literature that the traditional Granger (1969) and Sims (1972) methodology (as is usually referred to) for detecting causality in temporal systems will end up with spurious regression results. Furthermore, the F-test is not valid unless the variables in levels are cointegrated.

The recent developments in econometrics have come up with alternatives for testing causality, such as the error-correction model (by Engle and Granger, 1987) and vector error-correction model (by Johansen and Juselius, 1990). The general VAR model applicable to the present study can be expressed as follows:

$$X_t = \Omega + A_1 X_{t-1} + A_2 X_{t-2} + \ldots + A_p X_{t-p} + \theta D + \varphi Z_t + \varepsilon_t \quad \ldots\ldots 1$$

Where: X is a vector of dependent variables, that is, total net domestic credit (NDC) or one of its components i.e. net domestic credit to private sector (NDCp) or net domestic credit to public sector (NDCg), and net foreign reserves (NFR). Z is the vector of

exogenous variables i.e. real national income (Y), price level (P) and interest rate (R)[6] respectively. **A**'s, φ and θ are matrices of coefficients, with 'Ω' a two-dimensional vector of coefficients. ε is a vector of innovations that may contemporaneously be correlated with each other but are uncorrelated with their own lagged values as well as all of right-hand side variables. D is a vector of seasonal dummies orthogonal to the constant term[7]. Thus the specific model to be analyzed can be disintegrated as follows:

$$NDC_t = \alpha_{10}^{0} + \sum_{i=1}^{p} \alpha_{11}^{i} NDC_{t-i} + \sum_{i=1}^{p} \alpha_{12}^{i} NFR_{t-i} + \alpha_{13} D2 + \alpha_{14} D3 + \alpha_{15} D4 + \alpha_{16} P + \alpha_{17} R + \alpha_{18} Y + \varepsilon_{1t}$$

$$NFR_t = \alpha_{20}^{0} + \sum_{i=1}^{p} \alpha_{21}^{i} NDC_{t-i} + \sum_{i=1}^{p} \alpha_{22}^{i} NFR_{t-i} + \alpha_{23} D2 + \alpha_{24} D3 + \alpha_{25} D4 + \alpha_{26} P + \alpha_{27} R + \alpha_{28} Y + \varepsilon_{2t}$$

.....2

However, since the main focus of this study was in the short run relationship, the above model was transformed to include the error correction vector, and variables expressed in their first differences. Under the assumption that the temporal effects take at least one quarter and at most eight quarters to manifest themselves the following vector error correction model (VECM) was estimated:

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[6] Though the main assumption in this analysis is that the demand for money is stable, wrong assumptions can hamper our results significantly. To counteract this, the variables Y, P and R are included to take care of the possibility of the unstable demand for money function.

[7] These, as opposed to 0-1 seasonal dummies, will only affect the mean of the series without contributing to the trend as suggested by Johansen (1991).

$$\Delta NDC_t = \alpha_{10}^{0} + \sum_{i=1}^{8} \alpha_{11}^{i} \Delta NDC_{t-i} + \sum_{i=1}^{8} \alpha_{12}^{i} \Delta NFR_{t-i} + \alpha_{13} D2 + \alpha_{14} D3 + \alpha_{15} D4 - \alpha_{16} \Delta P + \alpha_{17} \Delta R + \alpha_{18} \Delta Y + \lambda \varepsilon_{1t-1} + \mu_{1t}$$

$$\Delta NFR_t = \alpha_{20}^{0} + \sum_{i=1}^{8} \alpha_{21}^{i} \Delta NDC_{t-i} + \sum_{i=1}^{8} \alpha_{22}^{i} \Delta NFR_{t-i} + \alpha_{23} D2 + \alpha_{24} D3 + \alpha_{25} D4 - \alpha_{26} \Delta P + \alpha_{27} \Delta R + \alpha_{28} \Delta Y + \lambda \varepsilon_{2t-1} + \mu_{2t}$$

.....3

Where: λ is the speed of adjustment coefficients; ε is the residuals of the restricted cointegrating vector (error-correction term); the other variables are as described above.

Before the vector error-correction model was estimated, pretests were conducted to determine the number of unit roots and cointegrating ranks. Upon this, the augmented Dickey-Fuller (ADF), Hylleberg-Engle-Granger-Yoo(1990),(EGHY) and Dickey-Hazna-Fuller(1984), (DHF) tests were used to determine the order of integration of each of the variables in the model. However, in interpreting these test results, cognizance should be taken that they have poor power against alternatives close to the null hypothesis, especially the EGHY tests. This implies that one may find evidence of too many roots in practice in using especially the EGHY test (Lof and Lyhagen, 2001). In applying these tests, the modifications and procedures of Osborn et al. (1992) were adopted. In this instance, the non-deterministic series X_t is said to be integrated of order (d,D), denoted $X_t \sim I(d,D)$, if the series has a stationary invertible ARMA representation after one-period differencing 'd' times and seasonally differencing 'D' times.

Considering that seasonality may have both deterministic and stochastic components, they assume that the series Y_t can be expressed as follows:

$$Y_t = X_t + k_q \quad \text{.....4}$$

Where: X_t is purely stochastic and k_q is the deterministic seasonal component for season q. The deterministic seasonality was first removed by regressing the levels series on four quarterly dummy variables; the residuals from this regression were then treated in the stationarity tests as if they were the true X_t. The tests are as follows:

1- Augmented Dickey-Fuller (ADF(p)):

The test is based on the t-statistic for β in the following regression.

$$\Delta X_t = \beta X_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta X_{t-i} + \mu_t \quad \text{.....5}$$

H_0: $X_t \sim I(1,0)$ which corresponds to $\beta=0$

H_1: $X_t \sim I(0,0)$ which corresponds to $\beta\neq0$

The applicable critical values in this test are provided in Fuller (1976, Table 8.5.2) for the regression including an intercept. If the computed t-statistic (referred to as the tau statistic in this test) exceeds the absolute critical tau values, then the null hypothesis is not rejected, implying that the series is stationary.

2- Dickey-Hazna-Fuller (DHF(p)):

The test is based on the t-statistic for β in the following regression.

$$\Delta_4 X_t = \beta Z_{t-4} + \sum_{i=1}^{p} \alpha_i X_{t-i} + \mu_t \quad \ldots\ldots 6$$

H_0: $X_t \sim I(0,1)$ which corresponds to $\beta=0$

H_1: $X_t \sim I(0,0)$ which corresponds to $\beta\neq0$

Where $Z_t = \lambda_i(L)X_t = (1-\lambda_1 L - \ldots - \lambda_p L^p) X_t$ and L is the lag operator. The λ_i are the coefficient estimates obtained in the regression of $\Delta_4 X_t$ on $\Delta_4 X_{t-1}$,..., $\Delta_4 X_{t-p}$ (NB: $\Delta_4 X_t = X_{t-1} - X_{t-4}$). The applicable critical values in this test are provided in Table 7 of Dickey, Hazna and Fuller (1984).

3- Engle-Granger-Hylleberg-Yoo(EGHY(p)):

The test is based on the t-statistics for π_1, π_2 and π_3 in the following regression.

$$\Delta_4 X_t = \pi_1 Z_{1,t-1} + \pi_2 Z_{2,t-1} + \pi_3 Z_{3,t-2} + \sum_{i=1}^{p} \alpha_i \Delta_4 X_{t-i} + \mu_t \quad \ldots\ldots 7$$

Where: $Z_{1t} = \lambda(L)(1 + L + L^2 + L^3)X_t$

$Z_{2t} = -\lambda(L)(1 - L + L^2 - L^3)X_t$

$Z_{3t} = -\lambda(L)(1 - L^2)X_t$

$\lambda(L)$ is obtained as for the DHF(p) statistic above. In this test, the overall hypothesis is:

H_0: $X_t \sim I(0,1)$

The alternative hypotheses are:

H_1: $X_t \sim I(1,0)$ which corresponds to $\pi_1 = 0$ with π_2 or π_3 non-zero

H_1: $X_t \sim I(0,0)$ which corresponds to $\pi_1 \neq 0$ and π_2 or π_3 is also non-zero.

The applicable critical values in this test are provided in Engle et al.(1987)

The cointegration test on the other hand, involves the determination of the cointegrating vectors (r), which is analogous to determining the rank of the matrix λ in the above VECM. This can be decomposed into $\lambda = \alpha\beta^1$, where the columns of α are known as loading factors since they load the cointegrating vectors into various equations of the system and the rows of β^1 are the cointegrating vectors. The Johansen-Juselius procedure employs two test statistics, the trace statistic and the max statistic (Johnston and Dinardo,1997). The null hypothesis of the trace statistic is that the cointegrating rank is at most r(<k), k=0,1,2,3,4. Here the null hypothesis of r<0 is tested against the general hypothesis of r<1, r<2 and so on. The null hypothesis of the max statistic is that cointegrating rank is zero i.e. r=0, against the alternative hypothesis that r=1, r=2 and so on.

The causality test in the VECM model then entails imposing restrictions on the coefficients of the lags of variable of interest. Therefore when testing whether NFR does not Granger-cause DC, the null hypothesis becomes:

$$H_0 : \sum_{i=1}^{k} \alpha_{12}^{i} = 0$$

Where: $\alpha_{12}{}^{i}$ are the coefficients of ΔNFR_{t-i} (i=1.2.....8) in the first row of VECM

The Wald statistic for the NFR lagged independent variables is chi-square distributed. The rejection of the null hypothesis implies that net foreign reserves Granger cause the domestic credit. The same kind of analysis was conducted on the second equation of the system which entails testing the hypothesis that DC does not Granger-cause NFR.

3.2 Data

The study used the quarterly time series data for the period covering 1980 to 2000 obtained from the IMF International Financial Statistics. International reserves are the Central Bank of Lesotho's (CBL) foreign reserves. Domestic credit to the public sector consists of credit to the central government and to the public enterprises. Domestic credit to the private sector consists of credit to the private enterprises including financial institutions. The interest rate is the commercial bank savings deposit rate. The domestic price is the Maseru consumer price index (CPI). Since neither national income nor its proxy could not be obtained in quarterly series, the SAS program was used to convert the annual series to quarterly series. The quarterly inflation rate was then calculated from the consumer price index, and this was used to convert nominal national income to real income.

CHAPTER FOUR: EMPIRICAL RESULTS

4.1 Unit Roots Tests

The results in this paper have been carried out using E-Views programme. In implementing the integration tests, it was recognized that the selection of the lag length was critical to the results to be obtained, as too short a lag length could lead to invalid statistics due to autocorrelation remaining in the residuals, while too long a lag length could imply a reduction in the power of the test. The regression equation of $\Delta_4 X_t$ (i.e. $\Delta_4 X_t = X_{t-1} - X_{t-4}$) on its past values was first estimated.

The order of this autoregressive regression was selected in such a manner that the residuals were not autocorrelated. The lag length (p) was initially set to one and the procedure was then to calculate a Lagrange Multiplier test for residual autocorrelation up to order 4. Significant autocorrelation at the 5 per cent level led to an increase of the lag length. The coefficients of this equation were then used to transform the X_t variables to be used in the DHF and EGHY tests. The same procedure was followed in the selection of the lag length in the integration tests equations. In this case the lag length was initially set to one and then the Lagrange Multiplier test calculated up to order 4. Significant autocorrelation at the 5 per cent level led to the lag length being increased.

Table 3: Testing Orders of Integration

	NDC	NDCg	NDCp	NFR	P	R	Y
ADF(p)	-2.38(5)	-0.08(6)	0.15(6)	-0.09(5)	0.42(3)	-3.22(6)	-1.13(2)
DHF(p)	-2.52(2)	-2.32(3)	-0.44(7)	-2.03(7)	1.77(3)	0.49(5)	0.71(2)
EGHY							
π_1(p)	-3.49(7)	-0.08(4)	-0.22(6)	-2.22(6)	-0.27(4)	-3.22(4)	0.05(3)
π_2	1.95	5.10	6.03	4.95	4.98	5.14	4.30
π_3	-2.64	-0.70	3.41	3.65	9.46	4.65	2.73

Table 4: Testing Orders of Integration on Changes of Variables

	ΔNDC	ΔNDCg	ΔNDCp	ΔNFR	ΔP	ΔR	ΔY
ADF(p)	-3.35(2)	-3.58(3)	-3.98(3)	-3.11(4)	-3.31(2)	-3.51(6)	-5.78(4)
EGHY							
π_1(p)	-3.09(4)	-3.68(3)	-4.46(2)	-3.96(2)	-4.40(1)	-4.17(1)	-5.78(2)
π_2	3.23	5.18	7.40	2.92	5.87	7.62	6.39
π_3	-1.43	-0.93	4.66	1.94	1.50	5.83	6.72

Table 5: Critical Values for Unit Roots Tests

	5% c.v.
ADF(p)	-2.89
DHF(p)	-4.11
EGHY(p):	
π_1	-2.96
π_2	-2.95
π_3	-3.51

The tests (refer to Table 3 above) yielded mixed results with regard to seasonal integration. The DHF test showed that all the variables have seasonal unit roots, which implies a need for seasonal differencing. The EGHY test on the other hand reflected the opposite, thus rejecting the need for seasonal differencing. At this point its worth mentioning the possibility that the acceptance of the I(0,1) null hypothesis for the DHF test may in fact be due to a I(1,0) process because a unit root at lag four also implies a non-seasonal unit root (Osborn et al. 1992:453). In this instance, the EGHY results were taken since by looking at three distinguishable roots implied by Δ_4 (NB:$\Delta_4 X_t = X_{t-1} - X_{t-4}$) which in fact separates the non-stationary seasonal and non-seasonal polynomials, rules out this possibility.

With respect to unit roots at zero frequency however, the ADF and EGHY tests yielded the same results. They accepted the hypothesis that net domestic credit (NDC), domestic credit to public sector (NDCg), domestic credit to private sector (NDCp), net foreign reserves (NFR), price level (P) and real income (Y) were all I(1.0). and that interest rate

(R) was I(0,0). These were further confirmed by integration tests on the unit differences of variables (refer to Table 4 above). Though the I(0,0) hypothesis with respect to ΔNFR was marginally rejected by π_2 , it was however concluded that ΔNFR is I(0,0) ; this was confirmed by the acceptance of first-order unit root by the ADF t-ratio[8]. The results therefore implied that there was a possibility that the VAR model in levels could be cointegrated.

4.2 Cointegration Tests

The Johansen and Juselius cointegration test was applied on the VAR equations of eight lags under the assumption of a constant (no trend) on both the VAR and the cointegrating equation. However in interpreting the results (see Table 6), it should be recognized that the Eviews program assumes no exogenous variables when computing the critical values. The program reports the likelihood ratio which is computed from the eigenvalues and trace statistics. The results as summarized in Table 6 below, show that there is one cointegrating equation in all the VAR systems except for the VAR equation of NDC and NFR (refer to Appendix 3)

Table 6: Johansen and Juselius Cointegration Test Results

Endogenous Variables in VAR	Likelihood Ratio	5% critical value	1% critical value	Hypothesized No. of CEs
NDC, NFR	0.025	3.76	6.65	At most 1
NDCg, NFR	1.896	3.76	6.65	At most 1
NDCp, NFR	2.246	3.76	6.65	At most 1

[8] The DHF test was not carried out since the need for seasonal differencing was rejected in the integration tests of variables in levels. Furthermore, the EGHY test is capable of detecting any prior or further need for seasonal integration.

In addition to the above, the Engle and Granger (1987) methodology for cointegration test was also applied. In this case the Augmented Dickey-Fuller test was applied on the residuals of the cointegrating equations. The results (refer to Table 7 below) show that all the residuals are stationary, implying that the variables in levels VAR systems are cointegrated. It was therefore concluded that all the VAR systems had one cointegrating equation and this led to the next step of estimating the vector error correction model (equation 3).

Table 7: Testing Orders of Integration of Cointegration Errors

	endc	endcg	endcp	enfrndc	enfrndcg	enfrndcp
ADF(p)	-3.08(4)	-3.45(5)	-3.50(5)	-4.50(5)	-3.19(5)	-5.97(2)

Note: endc is residuals from regression ndc=f(nfr,...), endcg is residuals from regression ndcg=f(nfr,...), endcp is residuals from regression ndcp=f(nfr,...), enfrndc is residuals from regression nfr=f(ndc,...), enfrndcg is residuals from regression nfr=f(ndcg,...), enfrndcp is residuals from regression nfr=f(ndcp,...).

4.3 Empirical Results

Following unit root and cointegration tests, the vector error correction model (equation 3) was estimated by ordinary least squares. The equation was used in testing for the causal relationship between domestic credit (and its components) and net foreign reserves. The summary of the results are presented in Table 8 below, and the full regression results are in the appendices.

Table 8: Results of Granger Non-Causality

Direction of Causality	Sum of Coefficients	p-value	Speed of Adjustment
ΔNDC → ΔNFR	-0.845529	0.055*	-1.241
ΔNFR → ΔNDC	0.000851	0.998	-1.351
ΔNDCg → ΔNFR	0.373903	0.300	-1.092
ΔNFR → ΔNDCg	0.172056	0.694	-1.306
ΔNDCp → ΔNFR	-0.815612	0.091*	-1.370
ΔNFR → ΔNDCp	-0.023959	0.769	-1.238

Note: Sum of the coefficients is the sum of the Granger-causality coefficients in the estimation equations. The p-value is the probability that the sum of the estimated Granger-causality coefficients is equal to zero.(*) means significant at 10% level.

The results indicate the following:

1- The flow of domestic credit to the private sector had a significant negative impact on the net foreign reserves of the banking system in the 1980 - 2000 period. Changes in net foreign reserves also had a negative impact on domestic credit to the private sector, but this impact was not significant. This means that there was no feedback effect, thus supporting the monetary approach to BOP.

2- The flow of domestic credit to the public sector and changes in net foreign reserves impacted positively on each other, but the impacts were not significant. This was the case perhaps because government borrowing was used mainly to finance the purchase of non-tradable goods, most of which are available within the country and therefore need not be imported.

3- Though the flow of domestic credit to the public as well as the private sector individually impacted on net foreign reserves in different directions, they jointly imposed a significant negative impact on the net foreign reserves of the banking system. The impact of changes in net foreign reserves on net domestic credit on the other hand was highly insignificant. This implies that there were no feedback effects in line with the predictions of the monetary approach to balance of payments.

4- The speed of adjustment coefficients in the vector error correction model also depict that adjustment to long run equilibrium values was very fast, taking less than three months.

While most empirical studies on MABP have used the reserve flow equation in levels of variables to analyse the long run relationship between domestic credit and net foreign reserves, it has been acknowledged in the empirical literature on MABP that the offset coefficient is biased towards minus one and as such the results cannot be trusted especially if the variables are not stationary. Therefore in this paper the correlation matrix of the variables in levels was used instead.

Table 9: The Correlation Table of Variables

	NFR	NDC	NDCG	NDCP
NFR	1.000000	-0.739479	-0.906208	0.934647
NDC		1.000000	0.928302	-0.672267
NDCG			1.000000	-0.899333
NDCP				1.000000

The correlation coefficients above depict that there is a high negative correlation between net foreign reserves (NFR) and net domestic credit (NDC), as well as domestic credit to the public sector (NDCg). Surprisingly it shows a very high positive correlation between net foreign reserves and domestic credit to the private sector (NDCp). However, this may be the result of the trend inherent in both variables as can be observed on the graphs in Appendix 2. The correlation matrix for variables in first differences below (Table 10) shows a better picture. It shows that there is a negative correlation between net foreign reserves and net domestic credit (or its components).

Table 10: The Correlation Table of Variables in First Differences

	DNFR	DNDC	DNDCG	DNDCP
DNFR	1.000000	-0.492651	-0.485735	-0.044983
DNDC		1.000000	0.946501	0.210877
DNDCG			1.000000	-0.115849
DNDCP				1.000000

CHAPTER FIVE: CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

This study has attempted to examine the relevance of the monetary approach to the balance of payments in Lesotho using the quarterly data for the period 1980-2000. Of particular interest was the causal relationship between domestic credit and net foreign reserves. The causality test was conducted through the medium of cointegration and error correction modeling.

The first step was to check for the existence of unit roots in the series to be used in the models. The unit root tests (ADF, DHF and EGHY) were able to reject the null hypothesis of seasonal unit roots in all the variables: foreign reserves, real national income, price level, interest rate and domestic credit (and its components). However, they were unable to reject the null hypothesis of a single unit root at annual frequency in the variables: foreign reserves, real national income, price level, interest rate and domestic credit (and its components). The cointegration analysis indicated that net domestic credit (or one of its components), net foreign reserves, price level, interest rate, and real income are cointegrated. The VECM was then estimated by ordinary least squares using EViews program and causality tests conducted accordingly.

The results indicate that there was a unidirectional causality between the flow of domestic credit to the private sector and changes in net foreign reserves of the banking system in the 1980 – 2000 period, running from net domestic credit to reserves. The flow of domestic credit to the public sector and changes in net foreign reserves impacted

positively on each other, but the impacts were not significant. The flow of domestic credit to the public as well as the private sector jointly imposed a significant negative impact on the net foreign reserves of the banking system without any feedback effects in line with the predictions of the monetary approach to balance of payments. The correlation analysis on the other hand depicted a very high correlation between net foreign reserves and net domestic credit (and its components).

In aggregate, the empirical results suggest that the monetary approach to balance of payments is indeed applicable to Lesotho. They imply that money has played a significant role in the determination of deficits and surpluses in the balance of payments in the 1980 – 2000 period.

5.2 Policy Implications

The findings of this study show that the overall balance of payments in Lesotho has been influenced heavily by imbalances in the demand for versus the supply of money. Therefore in this regard, given the stable demand for money function, the balance of payments disequilibrium can be corrected by appropriate financial programming and monetary targeting. The conventional policy measures such as import compression and export subsidization can only succeed when domestic credit creation is consistent with the difference between the project demand for money and the targeted international reserve level.

5.3 Areas for Further Research

The following suggestions for further research are worth noting. First, there is a need to carry out a non-monetarist study of balance of payments. This will provide a basis for comparison with the monetarist studies. Secondly there is a need to estimate the demand for money function and test for its stability. Thirdly, there is a need to examine the main determinants of foreign reserves, as well as the domestic credit to the private sector.

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Appendix 1: Selected Macroeconomic Indicators

	Fiscal Deficit*	Agric share**	Manuf share**	Debt /exp**	Debt /gdp**	GDP*
1980	n.a.	22.435	7.6781	19.78	16.66	244.3
1981	n.a.	24.347	8.2815	22.128	19.439	287
1982	n.a.	19.533	9.0725	28.731	30.38	328.4
1983	n.a.	20.488	10.066	28.345	30.787	372.9
1984	n.a.	21.133	10.79	34.833	37.762	390.6
1985	n.a.	19.665	10.57	61.993	60.462	455.5
1986	-160.54	19.22	11.483	62.881	61.141	551.1
1987	-181.24	19.416	12.439	58.932	59.699	631.2
1988	-103.37	21.006	12.05	59.731	57.709	881.9
1989	-16.8	19.175	12.122	68.458	62.515	1144
1990	-9.85	19.568	11.465	71.274	64.282	1391.1
1991	81.5	14.257	11.791	76.537	66.349	1609.7
1992	147.21	14.91	12.952	76.468	60.205	1905.3
1993	149.3	15.765	14.143	84.278	66.309	2357.7
1994	108.6	15.721	14.117	98.812	74.182	2672.6
1995	137.4	15.499	13.87	103.78	72.569	2971.5
1996	88.8	16.309	14.431	97.016	71.03	3383.7
1997	-188.8	14.54	14.491	95.487	64.448	4053.6
1998	-360.6	15.998	15.762	103.94	77.755	4719.6
1999	n.a.	15.69	14.794	118.86	75.313	4920.7
2000	n.a.	15.386	14.574	130.04	80.205	5564.9

Source: (*) from IMF International Financial Statistics
(**) from 2002 World Bank Africa Database

Note: Fiscal Deficit = government fiscal deficit, Agric share = Agriculture share of GDP (%), Manuf share = Manufacturing share of GDP (%), Debt/Exp = Total External Debt to Export Ratio (%), Debt/GDP = Total External Debt to GDP Ratio (%), GDP = Gross Domestic Product.

Appendix 2: The Data used in Regression Analysis

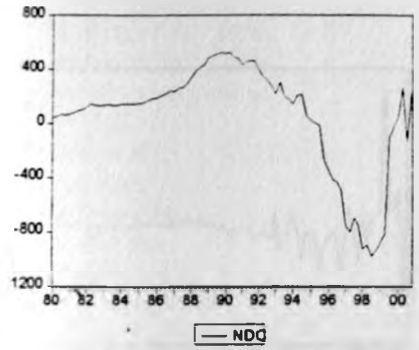
	NFR	NDCg	NDCp	NDC	R	P	π%	rY	nY
1980Q1	64.94	13.86	27.84	41.69	7.5	14.82	3.6364	143.3946	521.44
1980Q2	60.76	22.62	28.93	51.55	7.5	15.21	2.631579	184.2202	484.79
1980Q3	55.93	35.96	27.72	63.68	7.5	15.63	2.761341	171.9816	474.9
1980Q4	64.09	36.68	21.45	58.13	7.5	16.16	3.390915	143.6485	487.1
1981Q1	65.9	39.98	28.41	68.39	7.5	16.78	3.836634	134.4955	516.01
1981Q2	54.78	46.09	29.36	75.46	10	17.02	1.430274	389.0793	556.49
1981Q3	47.81	58.46	34.94	93.4	10.5	17.59	3.349001	180.4389	604.29
1981Q4	49.96	66.39	37.15	103.54	10.5	18.11	2.956225	221.316	654.26
1982Q1	37.37	78.15	43.29	121.43	12	18.59	2.650469	264.3155	700.56
1982Q2	42.45	95.22	46.96	142.18	12	19.11	2.797203	264.0459	738.59
1982Q3	52.74	91.25	45.11	136.36	12	19.78	3.506018	218.0251	764.4
1982Q4	72.94	82.17	46.97	129.14	11	20.45	3.38726	229.8554	778.58
1983Q1	81.78	91.29	42.46	133.75	6	22.16	8.361858	94.18959	787.6
1983Q2	87.33	88.47	49.5	137.97	8	22.74	2.617329	305.1432	798.66
1983Q3	107.44	83.47	51.87	135.35	10.5	23.21	2.066843	396.0824	818.64
1983Q4	110.01	84.91	51.75	136.67	13	23.45	1.034037	821.2182	849.17
1984Q1	120.59	84.65	58.21	142.86	9.4778	24.36	3.880597	228.3386	886.09
1984Q2	135.32	81.48	62.09	143.58	9.8368	25.12	3.119869	296.5029	925.05
1984Q3	149.67	74.95	66.77	141.73	10.0883	25.88	3.025478	318.0853	962.36
1984Q4	170.35	74.72	68.34	143.07	10.1919	26.26	1.468315	678.3897	996.09
1985Q1	192.2	72.45	74.06	146.51	10.2284	27.36	4.18888	244.9413	1026.03
1985Q2	193.85	74.02	78.58	152.6	15.83	28.03	2.44883	429.9726	1052.93
1985Q3	209.64	82.63	87.71	170.34	13.83	29.65	5.779522	186.5085	1077.93
1985Q4	208.62	97.86	89.33	187.19	12	30.12	1.58516	696.2829	1103.72
1986Q1	214.58	94.53	96.03	190.57	12	32.75	8.73174	129.973	1134.89
1986Q2	204.47	111.64	99.8	211.44	12	33.46	2.167939	542.7459	1176.64
1986Q3	203.51	127.31	92.44	219.74	8.83	34.41	2.839211	434.8497	1234.63
1986Q4	200.05	150.08	90.85	240.93	7.33	35.27	2.499273	524.1883	1310.09
1987Q1	185.31	143.97	95.25	239.22	7	36.03	2.154806	649.2743	1399.06
1987Q2	216.22	152.79	111.1	263.89	7	37.8	4.912573	305.0927	1498.79
1987Q3	224.07	162.2	109.85	272.05	7	38.75	2.513228	639.7829	1607.92
1987Q4	184.12	186.16	113.49	299.65	7	39.28	1.367742	1258.527	1721.34
1988Q1	175.25	208.86	133.03	341.89	7.5	40.23	2.418534	757.2936	1831.54
1988Q2	188.84	238.6	148.05	386.65	9.17	41.13	2.237136	863.6889	1932.19
1988Q3	185.27	262.66	154.98	417.64	10.17	43.14	4.886944	413.0741	2018.67
1988Q4	191.05	281.77	146.3	428.06	11.5	44.76	3.755216	557.225	2092.5
1989Q1	152.15	328	157.39	485.39	11.77	46.23	3.284182	658.243	2161.79
1989Q2	144.71	336.3	162.26	498.56	13	47.66	3.09323	723.1213	2236.78
1989Q3	193.68	342.91	170.88	513.79	13.5	49.33	3.503987	664.3119	2327.74
1989Q4	170.16	354.5	172.23	526.73	13	50.95	3.284006	740.894	2433.1
1990Q1	196.05	336.26	180.9	517.15	13	52.91	3.846909	660.0339	2539.09
1990Q2	220.38	337.48	188.32	525.8	13	53.43	0.982801	2679.525	2633.44
1990Q3	278.97	287.56	203.81	491.36	13	54.67	2.320794	1165.993	2706.03
1990Q4	336.9	271.43	208.92	480.35	13	55.77	2.012072	1371.581	2759.72
1991Q1	402.99	219.69	217.03	436.72	13	61.25	9.826071	286.2945	2813.15
1991Q2	377.93	219.27	240.63	459.9	13	62.87	2.644898	1091.622	2887.23
1991Q3	443.93	198.12	263.72	461.84	13	64.73	2.958486	1014.864	3002.46
1991Q4	432.43	189.77	274.41	464.17	13	66.25	2.348216	1345.264	3158.97
1992Q1	461.67	107.94	295.39	403.33	13.87	69.83	5.403774	617.1595	3334.99

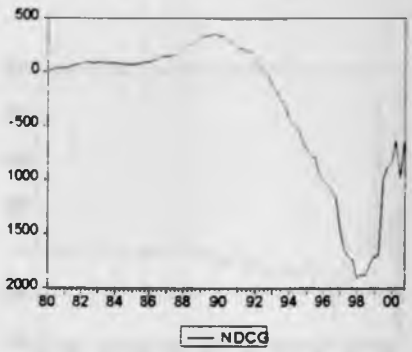
1992Q2	582.67	41.4	303.01	344.41	11	73.26	4.911929	714.2774	3508.48
1992Q3	592.65	14.15	310.72	324.87	8.67	76.36	4.231504	865.1013	3660.68
1992Q4	667.97	-38.3	319.14	280.84	8.97	79.55	4.17758	905.7301	3783.76
1993Q1	714.98	-124.12	344.25	220.14	8.8	82.94	4.261471	910.9367	3881.93
1993Q2	820.26	-186.75	488.97	302.22	7.93	83.79	1.024837	3867.239	3963.29
1993Q3	887.31	-262.32	460.85	198.54	7.9	84.84	1.253133	3220.92	4036.24
1993Q4	938.41	-334.28	512.61	178.33	7.62	86.7	2.192362	1873.249	4106.84
1994Q1	1074.46	-440.15	585.36	145.2	7.6	88.47	2.041522	2047.511	4180.04
1994Q2	1126.05	-496.87	700.94	204.07	7.8	90.42	2.204137	1933.687	4262.11
1994Q3	1151.86	-532.4	748.34	215.94	7.8	91.94	1.681044	2593.656	4360.05
1994Q4	1323.56	-657.34	709.63	52.29	10.5	95.23	3.578421	1250.311	4474.14
1995Q1	1450.39	-725.31	746.99	21.68	12.57	96.04	0.850572	5405.372	4597.36
1995Q2	1489.43	-771.56	775.83	4.27	13.6	98.67	2.738442	1725.766	4725.91
1995Q3	1534.43	-796.63	778.14	-18.5	13.6	101.95	3.324212	1460.981	4856.61
1995Q4	1717.24	-944.36	674.37	-270	13.6	103.34	1.363413	3662.565	4993.59
1996Q1	1873.34	-1001.39	651.94	-349.45	13.6	105.34	1.935359	2660.514	5149.05
1996Q2	1987.42	-1054.2	633.69	-420.51	13.73	108.48	2.980824	1790.485	5337.12
1996Q3	2053.72	-1104.71	669.55	-435.16	11.7	110.63	1.981932	2811.312	5571.83
1996Q4	2230.85	-1168.7	675.95	-492.76	11.9	112.87	2.024767	2882.973	5837.35
1997Q1	2393.07	-1464.49	710.93	-753.55	11.65	114.73	1.647914	3692.257	6084.52
1997Q2	2456.5	-1658.05	857.62	-800.43	12.47	110.9031	-3.33559	-1879.2	5268.23
1997Q3	2716.97	-1705.27	1004.61	-700.65	12.4	112.5104	1.449275	4380.334	6348.31
1997Q4	2812.12	-1740.62	989.81	-750.82	10.73	114.1177	1.428571	4430.482	6329.26
1998Q1	3169.85	-1914.04	984.87	-929.17	10.5	115.725	1.408451	4452.126	6270.6
1998Q2	3414.26	-1880.13	982.23	-897.9	10	123.1	6.372911	978.4179	6235.37
1998Q3	3616.12	-1885.21	904.69	-980.53	11	125.17	1.68156	3736.21	6282.66
1998Q4	3646.68	-1779.35	841.24	-938.11	11.43	129.07	3.115763	2064.166	6431.45
1999Q1	3754.09	-1715.31	834.16	-881.15	9.72	132.05	2.308825	2881.254	6652.31
1999Q2	3472.62	-1706.34	891.62	-814.72	6.85	134.12	1.567588	4411.293	6915.09
1999Q3	3454.83	-992.8	886.82	-105.99	6.85	136.76	1.968387	3654.851	7194.16
1999Q4	3435.95	-877.66	857.49	-20.17	6.4	137.79	0.753144	9902.075	7457.69
2000Q1	3583.07	-828.31	882.15	53.83	5.5	140.31	1.82887	4195.099	7672.29
2000Q2	3438.1	-637.68	899.65	261.98	5	142.61	1.639227	4763.47	7808.41
2000Q3	3688	-992.8	863.14	-129.66	4.67	144.33	1.206087	6497.967	7837.11
2000Q4	3585.17	-654.3	883	228.7	4.5	146.62	1.586642	4869.493	7726.14

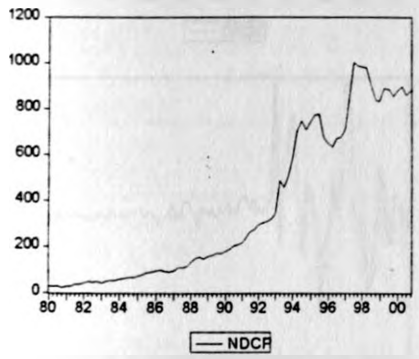
Source: 1- IMF International Financial Statistics
2- The national income (nY) was interpolated using the SAS program

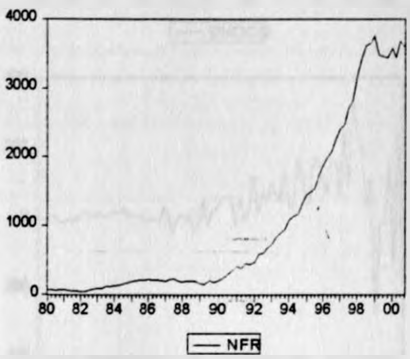
Note: NDC= net domestic credit, NDCg= domestic credit to the public sector, NDCp= domestic credit to the private sector, NFR= net foreign reserves, R= interest rate, P= price level, π = inflation (calculated from the consumer price level), rY= real national income, nY= nominal national income

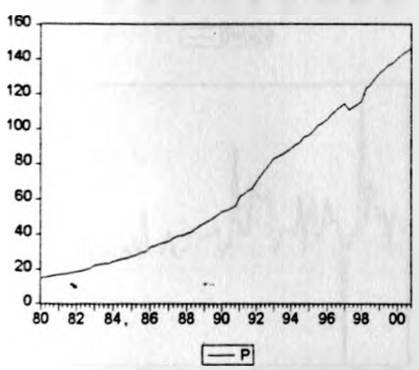
Appendix 3: Graphs of Variables in levels

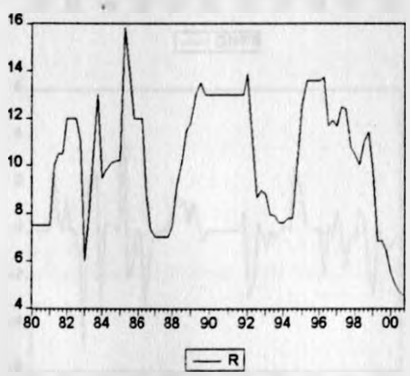


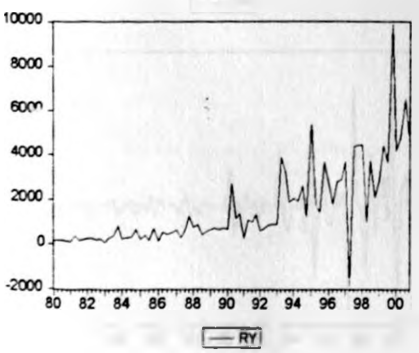




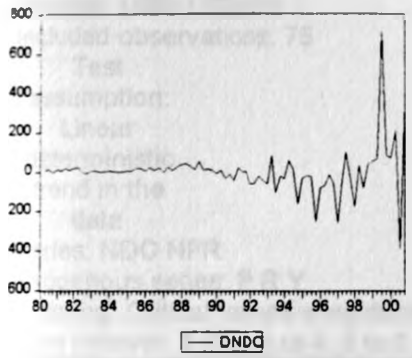


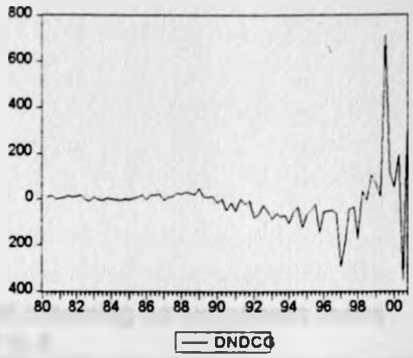


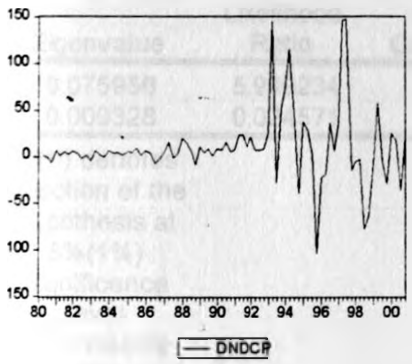


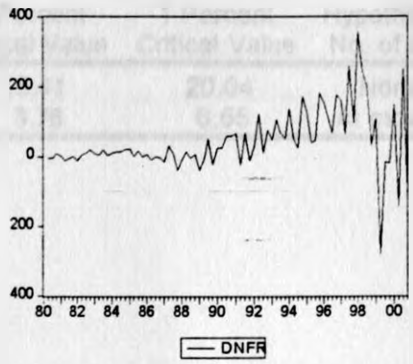


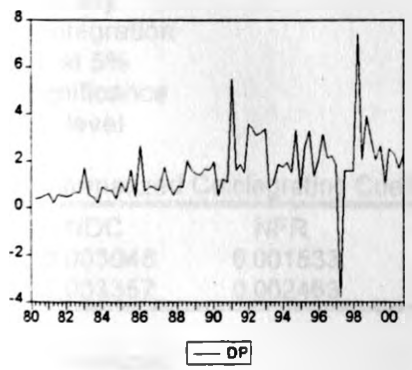
Appendix 4: Graphs of Variables in First Differences

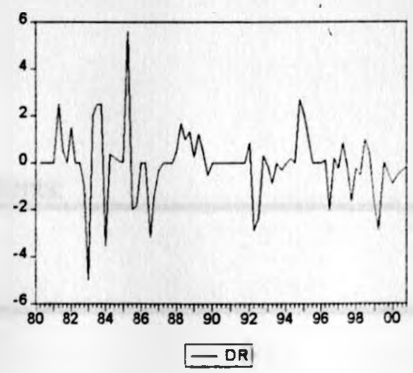


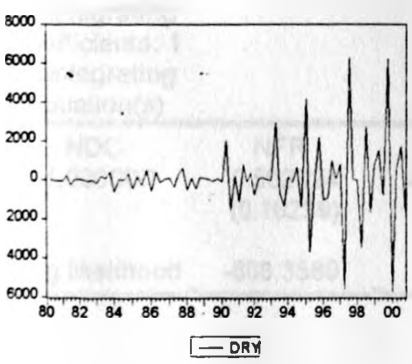












Appendix 5: The Johansen-Juselius Cointegration Results

Date: 07/28/02 Time: 16:51
Sample: 1980:1 2000:4
Included observations: 75
Test assumption: Linear deterministic trend in the data
Series: NDC NFR
Exogenous series: P R Y
Warning: Critical values were derived assuming no exogenous series
Lags interval: 1 to 2, 3 to 4, 5 to 6, 7 to 8

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.075956	5.949234	15.41	20.04	None
0.000328	0.024571	3.76	6.65	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. rejects any cointegration at 5% significance level

Unnormalized Cointegrating Coefficients:

NDC	NFR
0.003048	0.001533
0.003357	0.002463

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

NDC	NFR	C
1.000000	0.502824	-601.8660
	(0.10239)	
Log likelihood	-808.3589	

Date: 07/27/02 Time: 15:28
Sample: 1980:1 2000:4
Included observations: 75
Test assumption: Linear deterministic trend in the data
Series: NDCG NFR
Exogenous series: P R Y
Warning: Critical values were derived assuming no exogenous series
Lags interval: 1 to 2, 3 to 4, 5 to 6, 7 to 8

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.333691	32.34643	15.41	20.04	None **
0.024968	1.896356	3.76	6.65	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

NDCG	NFR
-0.000391	-0.001199
0.002675	0.002400

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

NDCG	NFR	C
1.000000	3.069715	-2994.412
	(2.42746)	
Log likelihood	-787.9700	

Date: 07/27/02 Time: 15:29
Sample: 1980:1 2000:4
Included observations: 75
Test assumption: Linear deterministic trend in the data
Series: NDCP NFR
Exogenous series: P R Y
Warning: Critical values were derived assuming no exogenous series
Lags interval: 1 to 2, 3 to 4, 5 to 6, 7 to 8

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.457383	48.09730	15.41	20.04	None **
0.029502	2.245967	3.76	6.65	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

NDCP	NFR
-0.002508	0.000649
0.002525	-4.02E-05

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

NDCP	NFR	C
1.000000	-0.258631	-113.4934
	(0.03074)	
Log likelihood	-717.0452	

Appendix 6: Empirical Results

Dependent Variable: DNDC
Method: Least Squares
Date: 07/28/02 Time: 10:06
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-22.98867	15.67814	-1.466288	0.1484
DNDC(-1)	0.954654	0.374930	2.546216	0.0138
DNDC(-2)	0.365062	0.197868	1.844973	0.0705
DNDC(-3)	0.471114	0.134739	3.496486	0.0010
DNDC(-4)	-0.452995	0.174811	-2.591338	0.0123
DNDC(-5)	0.752935	0.135131	5.571882	0.0000
DNDC(-6)	-1.430632	0.348227	-4.108326	0.0001
DNDC(-7)	0.126132	0.318078	0.396542	0.6933
DNDC(-8)	0.653753	0.334199	1.956179	0.0556
DNFR(-1)	-0.339030	0.192668	-1.759657	0.0841
DNFR(-2)	-0.060487	0.267416	-0.226191	0.8219
DNFR(-3)	0.758974	0.315222	2.407746	0.0195
DNFR(-4)	0.323718	0.215621	1.501329	0.1391
DNFR(-5)	0.426945	0.246361	1.733009	0.0888
DNFR(-6)	-0.478928	0.321003	-1.491973	0.1415
DNFR(-7)	-0.931440	0.310352	-3.001235	0.0041
DNFR(-8)	0.301099	0.251588	1.196792	0.2366
DP	13.50818	8.121221	1.663319	0.1020
DR	-6.396043	5.965049	-1.072253	0.2884
DY	0.007757	0.007596	1.021095	0.3118
ENDC(-1)	-1.351365	0.380036	-3.555888	0.0008

R-squared	0.752421	Mean dependent var	1.430267
Adjusted R-squared	0.660725	S.D. dependent var	123.6076
S.E. of regression	71.99810	Akaike info criterion	11.62265
Sum squared resid	279921.3	Schwarz criterion	12.27155
Log likelihood	-414.8495	F-statistic	8.205607
Durbin-Watson stat	2.020666	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Null Hypothesis:	C(10)+C(11)+ C(12)+C(13)+ C(14)+ C(15)+ C(16)+ C(17)=0		
F-statistic	3.68E-06	Probability	0.998477
Chi-square	3.68E-06	Probability	0.998470

Dependent Variable: DNFR
Method: Least Squares
Date: 07/28/02 Time: 10:10
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.36831	12.33884	-1.002389	0.3206
DNDC(-1)	-0.255533	0.097786	-2.613196	0.0116
DNDC(-2)	0.251443	0.117136	2.146587	0.0363
DNDC(-3)	-0.197494	0.096347	-2.049827	0.0453
DNDC(-4)	-0.104894	0.093724	-1.119180	0.2680
DNDC(-5)	-0.259578	0.097306	-2.667651	0.0101
DNDC(-6)	0.149729	0.206506	0.725058	0.4715
DNDC(-7)	-0.648269	0.197877	-3.276115	0.0018
DNDC(-8)	0.219067	0.211570	1.035439	0.3051
DNFR(-1)	0.875049	0.180194	4.856160	0.0000
DNFR(-2)	0.084825	0.132560	0.639899	0.5249
DNFR(-3)	-0.532773	0.175145	-3.041901	0.0036
DNFR(-4)	0.187081	0.156136	1.198191	0.2361
DNFR(-5)	-0.666281	0.169111	-3.939901	0.0002
DNFR(-6)	0.454933	0.195522	2.326758	0.0238
DNFR(-7)	-0.408652	0.196487	-2.079792	0.0423
DNFR(-8)	0.387401	0.170162	2.276662	0.0268
DP	20.03481	6.193879	3.234614	0.0021
DR	8.774332	4.304433	2.038441	0.0464
DY	0.024177	0.005796	4.171210	0.0001
ENFRNDC(-1)	-1.240973	0.219685	-5.648867	0.0000

R-squared	0.764952	Mean dependent var	47.30400
Adjusted R-squared	0.677897	S.D. dependent var	91.77029
S.E. of regression	52.08339	Akaike info criterion	10.97507
Sum squared resid	146484.7	Schwarz criterion	11.62396
Log likelihood	-390.5649	F-statistic	8.787020
Durbin-Watson stat	1.945476	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Null Hypothesis:	C(2)+C(3)+C(4)+C(5)+C(6)+C(7)+C(8)+C(9) =0		
F-statistic	3.832332	Probability	0.055449
Chi-square	3.832332	Probability	0.050273

Dependent Variable: DNDCG
Method: Least Squares
Date: 07/28/02 Time: 10:14
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26.74492	14.95722	-1.788095	0.0794
DNDCG(-1)	1.077535	0.274020	3.932321	0.0002
DNDCG(-2)	0.143660	0.142207	1.010221	0.3169
DNDCG(-3)	0.250398	0.117884	2.124106	0.0383
DNDCG(-4)	-0.726348	0.156898	-4.629437	0.0000
DNDCG(-5)	0.933580	0.163996	5.692691	0.0000
DNDCG(-6)	-1.698701	0.332063	-5.115602	0.0000
DNDCG(-7)	1.458180	0.417620	3.491643	0.0010
DNDCG(-8)	0.000736	0.346817	0.002124	0.9983
DNFR(-1)	-0.417357	0.149890	-2.784417	0.0074
DNFR(-2)	0.126589	0.221079	0.572597	0.5693
DNFR(-3)	0.655550	0.211506	3.099438	0.0031
DNFR(-4)	-0.358257	0.240956	-1.486815	0.1429
DNFR(-5)	0.608707	0.182118	3.342372	0.0015
DNFR(-6)	-0.167143	0.212078	-0.788117	0.4341
DNFR(-7)	-0.453109	0.238238	-1.901916	0.0625
DNFR(-8)	0.177076	0.200101	0.884934	0.3801
DP	16.20442	6.994154	2.316853	0.0243
DR	-0.833662	5.658471	-0.147330	0.8834
DY	0.010121	0.007786	1.299937	0.1991
ENDCG(-1)	-1.306133	0.302323	-4.320325	0.0001

R-squared	0.775062	Mean dependent var	-9.766000
Adjusted R-squared	0.691752	S.D. dependent var	121.5611
S.E. of regression	67.49079	Akaike info criterion	11.49336
Sum squared resid	245970.4	Schwarz criterion	12.14225
Log likelihood	-410.0008	F-statistic	9.303332
Durbin-Watson stat	2.025669	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Null Hypothesis: C(10)+ C(11)+ C(12)+ C(13)+ C(14)+ C(15)+ C(16)+ C(17)=0

F-statistic	0.156033	Probability	0.694392
Chi-square	0.156033	Probability	0.692836

Dependent Variable: DNFR
Method: Least Squares
Date: 07/28/02 Time: 10:15
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.585878	9.825470	-0.466734	0.6426
DNDCG(-1)	-0.261044	0.080262	-3.252397	0.0020
DNDCG(-2)	0.052199	0.094196	0.554157	0.5818
DNDCG(-3)	-0.368845	0.073844	-4.994903	0.0000
DNDCG(-4)	-0.021167	0.083218	-0.254349	0.8002
DNDCG(-5)	-0.179370	0.091004	-1.971000	0.0539
DNDCG(-6)	0.758657	0.193920	3.912227	0.0003
DNDCG(-7)	-0.618213	0.207417	-2.980538	0.0043
DNDCG(-8)	1.011686	0.215496	4.694687	0.0000
DNFR(-1)	0.590415	0.118410	4.986193	0.0000
DNFR(-2)	0.225441	0.116637	1.932845	0.0585
DNFR(-3)	-0.406609	0.129511	-3.139558	0.0027
DNFR(-4)	0.375480	0.140713	2.668405	0.0100
DNFR(-5)	-0.493405	0.116182	-4.246845	0.0001
DNFR(-6)	0.506005	0.134321	4.362720	0.0001
DNFR(-7)	-0.189754	0.151293	-1.254216	0.2152
DNFR(-8)	0.723692	0.131791	5.491202	0.0000
DP	1.389873	4.609325	0.301535	0.7642
DR	3.878802	3.686782	1.052083	0.2974
DY	0.012464	0.004988	2.498694	0.0155
ENFRNDCG(-1)	-1.092012	0.173416	-6.297065	0.0000

R-squared	0.829563	Mean dependent var	47.30400
Adjusted R-squared	0.766438	S.D. dependent var	91.77029
S.E. of regression	44.35095	Akaike info criterion	10.65364
Sum squared resid	106218.3	Schwarz criterion	11.30254
Log likelihood	-378.5115	F-statistic	13.14164
Durbin-Watson stat	2.066275	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Null Hypothesis: C(2)+C(3)+C(4)+C(5)+C(6)+C(7)+C(8)+C(9) =0

F-statistic	1.093709	Probability	0.300310
Chi-square	1.093709	Probability	0.295651

Dependent Variable: DNDCP
Method: Least Squares
Date: 07/28/02 Time: 10:17
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.922105	6.552481	1.056410	0.2955
DNDCP(-1)	1.225014	0.253164	4.838827	0.0000
DNDCP(-2)	-0.131840	0.129436	-1.018571	0.3129
DNDCP(-3)	-0.073477	0.109544	-0.670752	0.5052
DNDCP(-4)	0.413439	0.133591	3.094801	0.0031
DNDCP(-5)	-0.640412	0.140791	-4.548660	0.0000
DNDCP(-6)	-0.310378	0.165337	-1.877239	0.0659
DNDCP(-7)	0.768430	0.225063	3.414289	0.0012
DNDCP(-8)	-0.008014	0.166095	-0.048249	0.9617
DNFR(-1)	-0.190223	0.074374	-2.557656	0.0134
DNFR(-2)	0.257450	0.076766	3.353685	0.0015
DNFR(-3)	0.133665	0.086171	1.551166	0.1267
DNFR(-4)	-0.109741	0.087771	-1.250304	0.2166
DNFR(-5)	-0.127112	0.086007	-1.477929	0.1452
DNFR(-6)	-0.201826	0.070874	-2.847686	0.0062
DNFR(-7)	0.412303	0.105724	3.899801	0.0003
DNFR(-8)	-0.198475	0.075776	-2.619245	0.0114
DP	-4.911549	3.376345	-1.454694	0.1515
DR	-2.580407	2.461826	-1.048168	0.2992
DY	-0.008546	0.002801	-3.050827	0.0035
ENDCP(-1)	-1.238081	0.287398	-4.307905	0.0001

R-squared	0.617524	Mean dependent var	11.19613
Adjusted R-squared	0.475866	S.D. dependent var	40.04770
S.E. of regression	28.99338	Akaike info criterion	9.803508
Sum squared resid	45393.27	Schwarz criterion	10.45240
Log likelihood	-346.6315	F-statistic	4.359261
Durbin-Watson stat	2.110303	Prob(F-statistic)	0.000008

Wald Test:
Equation: Untitled

Null Hypothesis: C(10)+ C(11)+ C(12)+ C(13)+ C(14)+ C(15)+ C(16)+ C(17)=0

F-statistic	0.086874	Probability	0.769319
Chi-square	0.086874	Probability	0.768189

Dependent Variable: DNFR
Method: Least Squares
Date: 07/28/02 Time: 10:18
Sample(adjusted): 1982:2 2000:4
Included observations: 75 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.123024	8.834791	-0.466680	0.6426
DNDCP(-1)	-0.203103	0.163436	-1.242702	0.2193
DNDCP(-2)	-0.075679	0.169187	-0.447309	0.6564
DNDCP(-3)	1.035345	0.151226	6.846363	0.0000
DNDCP(-4)	-1.271465	0.248385	-5.118928	0.0000
DNDCP(-5)	-0.497731	0.175475	-2.836480	0.0064
DNDCP(-6)	1.100653	0.233749	4.708697	0.0000
DNDCP(-7)	-1.106208	0.239678	-4.615389	0.0000
DNDCP(-8)	0.202576	0.237264	0.853802	0.3970
DNFR(-1)	1.246485	0.192830	6.464150	0.0000
DNFR(-2)	0.388036	0.101222	3.833520	0.0003
DNFR(-3)	-0.680955	0.149284	-4.561486	0.0000
DNFR(-4)	0.183812	0.106167	1.731352	0.0891
DNFR(-5)	-0.369854	0.114302	-3.235765	0.0021
DNFR(-6)	0.739640	0.122370	6.044298	0.0000
DNFR(-7)	-0.756913	0.144848	-5.225559	0.0000
DNFR(-8)	0.290309	0.104039	2.790372	0.0073
DP	6.362556	4.558608	1.395724	0.1685
DR	0.057156	3.358095	0.017021	0.9865
DY	0.027086	0.004089	6.624294	0.0000
ENFRNDCP(-1)	-1.370144	0.221888	-6.174946	0.0000

R-squared	0.860423	Mean dependent var	47.30400
Adjusted R-squared	0.808727	S.D. dependent var	91.77029
S.E. of regression	40.13551	Akaike info criterion	10.45390
Sum squared resid	86986.39	Schwarz criterion	11.10279
Log likelihood	-371.0211	F-statistic	16.64409
Durbin-Watson stat	2.113226	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Null Hypothesis: C(2)+C(3)+C(4)+C(5)+C(6)+C(7)+C(8)+C(9) =0

F-statistic	2.960808	Probability	0.091031
Chi-square	2.960808	Probability	0.085305