Issues On The Zambian Economy

Bank *of* Zambia

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Foreword

This is the second issue of the Bank of Zambia Reader Issues on the Zambian Economy, a publication aimed at providing national and international readership with analyses by economists and other social scientists in government, business, international agencies, academia and other research institutions.

In addition, the Reader continues to contribute towards the creation of economic literature and exchange of views on theoretical, policy and practical issues on the Zambian economy.

This issue has articles covering several topical subjects of current debate in the economy including: Macro-Prudential Analysis; Dynamic Model of Inflation Determination in Zambia; Relationship between Bank of Zambia (BoZ) Dealing and Commercial Banks Exchange Rates during the Auction Period; Fuzzy Analysis of the Zambian Consumer Price Index (CPI); and Learning and the Failure to Learn in Development Cooperation. Other topics are Choice of Exchange Rate Regime: and Asymmetric Effects of Monetary Policy in Zambia: A Structural VAR Analysis.

We wish to thank the contributors of these articles to the Reader and hope that this will encourage other economists and social scientists to put their ideas to paper as part of their contribution to the wealth of ideas and literature on the Zambian economy through this publication. In addition, we wish to take this opportune time to invite comments or brief notes on the articles in this Reader. Further, articles are invited from researchers and writers on various topics that are relevant to the Zambian economy. In this regard, all correspondence should be channelled to the Director, Economics Department, Bank of Zambia, P. O. Box, 30080, Lusaka Zambia. Comments and articles can also be sent via e-mail to pr@boz.zm.

The views and interpretations expressed in this reader are those of the authors and do not necessarily represent the views and policies of the Bank of Zambia. All errors and omissions are entirely due to the author.

Caleb M. Fundanga
Governor
Bank of Zambia
December 2004

CHAPTER 1

Macro-Prudential Analysis: Lessons for Zambia

Mwiza Mbewe[1]

Abstract

Macro-prudential analysis is a relatively new area in financial system supervision. The paper presents a synopsis of the main attributes of the area, noting that one of its main features is that it adds an element of dynamism to the existing framework of supervision. Based on these factors several lessons have been drawn which should have a bearing on establishing the macro-prudential analytical framework in Zambia. In conclusion, it is noted that being a new area, there is still a lot of work that needs to be done in order to have an adequate analytical framework in place.

1. Introduction

In the late 1990s, the world witnessed a series of financial crises; namely, the Mexican crisis of 1995, the Asian crisis of 1997 and the Russian crisis of 1998 (Davis, 1999). Notable traits of the crises were banking failures and currency depreciations in the affected countries. According to studies undertaken, a banking crisis can impose costs of 14% to 15% of gross domestic product (GDP) while the recovery process can take as long as 3 to 5 years (Davis, 1999). A banking crisis can also blunt the effectiveness of monetary and fiscal policies while, output and growth opportunities are foregone during the process (Borio, 2003).

The literature identifies three categories of triggers which have often coincided at the beginning of a financial crisis. These are a worsening of the ability to repay loans which effectively lessens the capacity of the banking profession as regards credit risk management; a rise in real interest rates which induces most solvent borrowers to leave the market; and volatility in the asset market which reduces the protection enjoyed by banks against credit risk (Timmermans, 2001).

Evidently, the triggers were such that they applied on a broad or macro basis and thus could not be said to distinctly apply to single financial institutions. Arising from this perspective and taking into account the importance of financial stability to macroeconomic performance, a relatively new element of financial system supervision has emerged. This element has been designated 'macro-prudential analysis'.

In addressing the issues related to macro-prudential analysis, the paper is organised as follows: the next section presents an outline of the main attributes of macro-prudential analysis; the third section discusses the analytical methodologies utilised under macro-prudential analysis while the fourth section provides the lessons for the Zambian financial system. The fifth section concludes the paper.

DISCLAIMER: The author is an Inspector in the Bank Supervision Department of the Bank of Zambia. The views expressed are those of the author and not necessarily those of the Department or the Bank of Zambia. *The author thanks the Working Paper Discussion Forum of the Bank of Zambia and Herbert Poenisch for critical and useful comments.*

2. Main Attributes of Macro-Prudential Analysis

According to Sundararajan *et al* (2002), macro-prudential analysis is 'the assessment and monitoring of the strengths and vulnerabilities of financial systems. This encompasses quantitative information from both financial soundness indicators and indicators that provide a broader picture of economic and financial circumstances, such as GDP growth and inflation, along with information on the structure of the financial system, qualitative information on the institutional and regulatory framework particularly through assessments of compliance with international financial sector standards and codes, and the outcome of stress tests.'

Meanwhile, financial soundness indicators (FSIs), which supervisory authorities have long utilised, are defined as 'indicators compiled to monitor the health and soundness of financial institutions and markets, and of their corporate and household counterparts. FSIs include both aggregated information on financial institutions and indicators that are representative of markets in which financial institutions operate.'

After substantial research and discussion with practitioners and academics, the International Monetary Fund (IMF) produced two sets of FSIs which are considered to be useful for the purpose of periodic monitoring, compilation and dissemination efforts by national authorities. The FSIs consist of a core set which basically relates to the deposit-taking industry through the utilisation of the CAMELS[2] analytical framework and an encouraged set for additional deposit-taking indicators as well as data on other institutions and markets that are relevant in assessing financial stability the corporate sector, real estate markets and non-bank financial institutions (NBFIs) and the related markets.

In identifying the core set of the FSIs, the IMF used six determinant criteria: focus on core markets and institutions; analytical significance; revealed usefulness; relevance in most circumstances (that is, not country specific); availability; and parsimony (that is, achieving the maximum information content with a limited number of FSIs).

A notable feature that emanates from utilizing the two sets of FSIs - that is, the core set and the encouraged set - is that a one-size-fits-all approach is avoided. This provides a degree of flexibility in the selection of the indicators that are deemed to be most relevant to assessing vulnerabilities in country-specific circumstances.

[2] capital adequacy, asset quality, management soundness, earnings and profitability, liquidity and sensitivity to market risk

Box 1: CORE AND ENCOURAGED SET OF FSIS.

Deposit-Taking Institutions Core Set	
	Capital Adequacy Regulatory capital to risk weightedassets
	Regulatory Tier I capital to risk weightedassets
Asset Quality	Nonperforming loans to total grossloans
	Nonperforming loans net of provisions to capital
	SectoralDistribution of loans tototal loans
	Large Exposures to capital
Management Soundness	Expense ratios
	Earnings per employee
Earnings and Profitability	Return of assets
	Return on equity
	Net interest margin to grossincome
	Non interest expenses to grossincome
Liquidity	Liquid assets to total assets (liquid assetratio)
	Liquid assets to short termliabilities
Sensitivity to market risk	Duration of assets
	Duration of liabilities
	Net open position in foreign exchange tocapital
Deposit-takingInstitutions	**EncouragedSet**
	Capital to assets
	Geographical distribution of loans to totalloans
	Gross asset position in financial derivatives tocapital
	Gross liability position in financial derivatives tocapital
	Trading income to total income
	Personnel expenses to non-interestexpenses
	Spread between reference lending and depositrates
	Spread between highest and lowestinterbankrate
	Customer deposits to total (non-interbank) loans
	Foreign currency-denominated loans to totalloans
	Foreign currency-denominated liabilities to totalliabilities
	Net open position in equities tocapital
Market Liquidity	Average bid-ask spread in the securitiesmarket
	Average daily turnover ratio in the securitiesmarket
NBFIs	Assets to total financial systemassets
	Assets to GDP
Corporate Sector	Total debt to equity
	Return on equity
	Earnings to interest and principalexpenses
	Corporate net foreign exchange exposure toequity
	Number of applications for protection fromcreditors
Households	Household debt to GDP
	Household debt service&principal payments toincome
Real Estate Markets	Real estate prices
	Residential real estate loans to totalloans
	Commercial real estate loans to totalloans

Source: International Monetary Fund, 2001

The monitoring and analysis of the FSIs is considered to be just one element in the overall assessment of financial stability. It must be noted that the objective of the FSIs is the limitation of the financial distress episodes at individual institutions, regardless of their impact on the overall economy.

The adoption of a macro-prudential analytical framework therefore allows for a broader analysis whose objective is to limit the risk of episodes of financial distress with significant losses in terms of real output for the economy as a whole (Borio, 2003).

The macro-prudential analysis objective is achieved because it provides national authorities a set of tools with which they are able to comprehensively assess their financial sectors and identify weaknesses at an early stage (Sundararajan *et al*, 2002).

In order to complete the macro-prudential analytical framework, an element of dynamism is added through the utilisation of macroeconomic and market-based indicators. Given a point in time, the macroeconomic and market-based indicators can be adjusted such that they provide the analyst the potential bearing with regard to the industry's FSIs.

Outlined in Box 2 are the macroeconomic and market-based indicators which have generally been deemed to be the main determinants in macro-prudential analysis.

Box 2: MACROECONOMIC AND MARKET-BASED INDICATORS

Macroeconomic based
- Economic Growth
  - Aggregate growth rates
  - Sectoral slumps
- Balance of payments
  - Current account deficit
  - Foreign exchange reserve adequacy
  - External debt (including maturity structure)
  - Terms of trade
  - Composition and maturity of capital flows
- Inflation
  - Volatility in inflation
- Interest and exchange rates
  - Volatility in interest and exchange rates
  - Level of domestic real interest rates
  - Exchange rate sustainability
  - Exchange rate guarantees
- Lending and asset price booms
  - Lending booms
  - Asset price booms
- Contagion effects
  - Financial market correlation
  - Trade spillovers
- Other factors
  - Directed lending and investment
  - Government recourse to the banking system
  - Arrears in the economy

Market-based
- Market prices of financial instruments including equity
- Indicators of excess yields
- Credit ratings
- Sovereign yield spreads

Source: IMF, 2000

3. Analytical Methods Under Macro-prudential Analysis

In order to add the said dynamism to the analysis, a prominent methodology that is utilised is that of stress testing the financial system. Stress testing basically provides information on the elasticity of a given FSI upon the application of macroeconomic or market-based shocks. The elasticity is thus an indicator of bank vulnerability to individual risks or a combination of risk factors. For instance, studies undertaken after the Asian financial crisis revealed that

macroeconomic shocks to output, exports, prices and the terms of trade, asset price booms and inappropriate monetary and exchange rate policies, all resulted in financial pressures and contributed to crises in financial systems that are inherently fragile (Davies, 1999).

The shocks can emanate from interest rate, exchange rate and asset price changes. The shocks arising from price changes ultimately impact on credit risk expansion and liquidity. Their impact on the FSI can be captured as it relates to the banks' exposure to that risk or to changes in the financial indicators. The application of stress tests is thus very much dependant upon the identification of relevant and suitable relationships in a relevant model (Sundararajan *et al*, 2002).

Issues to consider in identifying an appropriate model include:

(1) the type of risk or risks to be considered and appropriate models to use;
(2) the range of factors to be considered a single factor sensitivity test or the simultaneous movement in a group of risk factors as in scenario analysis;
(3) the specification of the type of shock (that is, whether the shock affects the level, volatilities and/or correlation of prices), the size of the shock, and the time horizon;
(4) the assets to be included;
(5) whether to use historical prices, hypothetical prices or Monte Carlo-simulated prices; and
(6) the aggregation (across business units and /or product lines) of the portfolio.

In the midst of the above considerations, there are several limitations that exist with regard to stress testing. Complex interlocking claims among financial institutions, a narrow focus on "systematically important" institutions and the inclusion of foreign-owned banks, requires a deeper analysis beyond the mere application of stress tests. Furthermore, the aggregated results could hide detailed vulnerabilities due to the consolidation of data.

Another methodology used in weighing the vulnerability of financial institutions is the Value-at-Risk (VaR) framework. This is a multivariate approach to risk assessments that is used to capture multiple risks arising under normal market conditions. The VaR is generally used by financial institutions as a risk management tool to set limits to the amount of risk that is undertaken in a trading book. The set limit is thus dependent on the correct specification and estimate of the underlying statistical model of returns (*ibid*, 2002).

The limitations faced by VaR arise from its inability to provide information on unlikely events and its sensitivity to the assumed distribution and underlying estimation techniques. Furthermore, given that the requirements for data and the level of detail are substantial, the VaR is more suitable to measuring individual institutions as opposed to aggregated situations (*ibid*, 2002).

Lastly, Sectoral Balance Sheet Analysis is also utilised as a means of identifying vulnerabilities or stresses in other sectors of the economy that may have a potential impact on the financial system (*ibid*, 2002). The Sectoral Balance Sheet Analysis emphasizes the linkages among the different sectors of the economy that could transmit financial disturbances as well as identifying the specific asset/liability components that may be particularly vulnerable to fluctuations in asset prices, interest and exchange rates and income flows. In addition, this method focuses on loan growth to enterprises, enterprise debt and interest rate burdens, sectoral trends in enterprise profits, profit margins and

dividend payments, debt and interest burdens of households, financial wealth of households and real income of households.

The Sectoral Balance Sheet Analysis method is limited by the unavailability of data with regard to most of the other sectors. Additionally, transactions based on balance sheet data cannot provide an accurate picture of asset price movements and would not capture off-balance sheet items (*ibid*, 2002).

Given the individual limitations of the three methods in undertaking sensitivity analyses of the financial system, it is generally recommended that all the three methods are utilised to some extent as a means of obtaining a broader view of the vulnerabilities facing the system. The literature also emphasises that while there is a broad variety of FSIs available for a thorough analysis of financial stability, a smaller, more manageable and analytically relevant subset should be utilised (IMF, 2001; Debbage, 2002; Davis, 2002).

It must be noted that experience with regard to statistical definitions is still very limited. Indeed, some of the central banks from developed countries rely on chart-based analysis as opposed to hard data within tables. Debagge (2002) states that charts have the advantage of not conferring a spurious level of accuracy upon the data, whereas tables with data quoted to three or four decimal places can lead the data user to assume a higher level of precision than is actually the case.

Accordingly, it is the change in the trend, rather than the magnitude of the movement at a particular point in time which is of interest to the analyst. Furthermore, a sudden change in a particular series will not necessarily signal stress within the financial system but should instead be seen as a trigger to instigate further research and investigation (Debbage, 2002).

To a large extent, the use of the macro-prudential analytical framework is dependent upon country-specific practices relating to the legal, institutional and operational frameworks in place. The utilisation of the framework in Zambia should thus be contextualised within the environment in which the financial institutions and other entities operate. The next section thus discusses issues of consideration in establishing the macro-prudential analytical framework for Zambia.

4. Lessons for Zambia

Following the liberalisation of the Zambian economy in the early 1990's, financial institutions became subject to increased market risks. The market risks pertaining to the Zambian financial institutions were signified by the rapid developments in the government securities yield rates and exchange rates once market participants were allowed to bid for the purchase of the government securities and foreign exchange at the Bank of Zambia dealing windows.

The entry of additional competitors in the financial system had a bearing on the individual income levels of participants as the limited market capacity for business effectively meant that there was increased competition for clients. The number of commercial banks increased from 4 prior to the liberalisation period to a number in excess of 15.

With specific regard to the banking industry, the collapse of 12 banks over the last 12 years could thus be attributed to macro factors that prevailed in the new environment as well as internal mismanagement by the said banks. This view is supported by the literature wherein

it is stated that banking crises are more likely to occur in liberalised financial systems. The Mexican, Asian and Russian financial crises occurred a few years after liberalisation and were linked to a decline in bank franchise value, possibly because monopoly power was eroded. With deregulation individual financial institutions were more willing to undertake greater risks (Davis, 1999).

It must be noted that the importance of the financial system in the economic environment arises from its decisive comparative advantage as regards credit risk management, which enables it to lessen the problem of asymmetric information. This advantage is as a result of the special relationships between credit institutions and their clients as well as the institutions' accumulated experience (Timmermans, 2001). This and the potential costs of a banking failure thus necessitate the establishment of a macro-prudential analytical framework.

Establishing the analytical framework for Zambia is obviously not an easy task. Given the structural changes that the economy has undergone, such as the privatisation of formerly state-owned companies and the liberalisation of the foreign exchange and money markets, setting up of relevant and appropriate model relationships becomes a greater challenge as the basic requirement for this would be stable relationships in the performance of the real and financial sectors. The absence of stable relationships between the real and financial sectors would impose great difficulty in undertaking statistical and econometric tests given that the historical data encompasses relationships and linkages in which the Government's role extended beyond that of regulator.

Specific lessons that are drawn from the literature include the establishment of a broad database which encompasses the macro-prudential indicators which have been provided in Boxes 1 and 2. This task has to be effected with prudence as one of the key issues consistently specified within the literature as well as the experience of other countries is that the establishment of a macro-prudential analytical framework should utilise a smaller, manageable and analytically-relevant subset from the broad indicators provided (Sundararajan *et al*, 2002).

The selection of a relevant subset for Zambia provides a key challenge as some of the factors that will have to be considered are the stability of the ratios in an inflationary environment. Furthermore, with regard to capital adequacy and asset quality, where real estate plays a significant role as collateral, adequate valuation becomes of prime importance. In line with this is the consideration of liquidity, particularly where a forced sale is in consideration. Whereas there may be a willing seller, there may not be a willing buyer. In such situations, the valuation of the property may become irrelevant to the transaction.

Intra-linkages within the Zambian financial system require a thorough understanding. Intra-linkages refer to the potential cross-ownership between, for instance commercial banks and insurance companies, as well as close business relationships such as the provision of insurance to specific industries, like agriculture, which may have borrowed significantly from the banking industry.

With regard to the requisite human resources, macro-prudential analysis thus requires a broad spectrum of analysts. In order to adequately provide a complete analysis, there is need to have personnel that understand the broad business practices in Zambia and are able to undertake financial analyses, econometric modelling, and research on a macro as well as a micro perspective.

There is also need to have an understanding of the overall environment in which the financial entities and other corporate entities operate such that developments that impact on their financial well-being can be captured within appropriate and relevant contexts.

The macro-prudential analytical framework for Zambia will need to undertake a critical assessment in respect of the informal sector's presence and linkages with the formal sector. The informal sector is of particular interest as it is a potential source of revenue inflows for the Government. There is a likelihood that the income flows pertaining to these entities ultimately end up in the financial sector despite there being an inadequate system of detecting their origin.

It is important to note that the issue of macro-prudential analysis is not solely a function of the financial system supervisory authority. Financial institutions are also encouraged to begin to undertake stress testing as well as applying other methodologies to assess the potential impact of macro activities on their incomes. In the event that the financial institutions detect potential vulnerabilities in their income flows, they are expected to undertake measures that will curb the negative effects of the identified shocks. The supervisory authority cannot be expected to manage the risks that impact on the individual institutions as that task belongs to the management personnel of the individual institutions.

Pronouncements by fiscal and monetary authorities provide a unique but important source of information to the financial and real sectors. With specific regard to Zambia, the Minister of Finance and National Planning announced that the Government would limit its domestic borrowing to 2.0% of GDP during the year 2004 (Budget Speech: 6th February 2004). Meanwhile, in October 2003, the Bank of Zambia reduced the statutory reserve requirements from 17.5% to 14.0%. As a result of these policy decisions, the weighted yield rate for Government securities declined from 36.0% in October 2003 to 8.5% in May 2004 before rising to 16.7% in September 2004. The end result of these developments was a reduction in commercial banks' income flows from Government securities investment from K38.2 billion in October 2003 to K24.9 billion in September 2004.

The principal lesson with regard to establishing the macro-prudential analytical framework is therefore a key understanding of developments within the economy and their potential impact on the financial and real sectors. For instance, the reduced borrowing by the Government and the reduced statutory reserve requirements by the Bank of Zambia has resulted in the commercial banks as a whole increasing their lending to the private sector by over 40% in the period October 2003 to September 2004.

On the other hand, the individual banks that have not restructured their credit portfolios will ultimately have to restructure other cost and income centres. With specific regard to cost centres, employee benefits or staffing levels could be affected. The cycle could thus be extended to potential losses of clientele for purveyors of goods and services, be it in the formal or informal sectors.

5. Conclusion

Borio (2003) recently stated, “the agenda is a full one, both for researchers and policy makers. For researchers, there is quite a lot to be done analytically and empirically to sharpen the macro-prudential perspective, to better understand what it can tell us about the dynamics of risk and financial stability, and to help develop the tools to address them. For

policymakers, the task is to turn the desirable into the feasible, to distinguish the feasible from the impracticable, and to make progress in implementing the shift. Success will also depend on the ability and willingness of market participants to incorporate more meaningfully the lessons of a macro-prudential perspective into their own assessment of risk."

This paper has provided a synopsis of the main attributes regarding macro-prudential analysis. It is envisaged that as more knowledge is acquired on the matter, issues relating to the tactical and operational perspective shall be easily identified by all participants in the financial sector and other related sectors. This is expected to lead to an adequate and sufficient set up of early warning systems in respect of the overall financial system.

The bank failures of the recent past in Zambia should serve as valuable lessons with regard to the magnitude with which the said failures can impact on the economy as a whole. It is thus hoped that a greater understanding of macroeconomic and market indicators will serve as the means to limit the negative impact of financial crises in future.

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Dynamic Model of Inflation Determination in Zambia

Hobby Simuchile and Emmanuel Mulenga Pamu

Abstract

The paper analyses inflation dynamics in Zambia using cointegration, equilibrium correction, impulse-response and variance decomposition analyses. The analysis uses both monthly and annual data. The cointegration results indicate that there is a long run equilibrium relationship between prices, money supply, and the exchange rate while the impulse response and variance decomposition analyses indicate that the money supply and the exchange rate account for a significant proportion of the variation in prices. These results suggest that targeting the growth rate of money supply is an appropriate instrument for controlling inflation and stabilising the exchange rate in Zambia. The findings of the study lend support to the conventional elements of stabilization packages, which emphasize reducing money supply growth and stabilising the exchange rate.

1. Introduction

After independence from Britain in 1964, Zambia experienced rapid economic growth not only in comparison with earlier periods but also in comparison with growth rates achieved in many sub-Saharan countries. This was because copper production and prices were high enough to earn foreign exchange and generate tax revenues on a scale that was not far short of the productive capacity of the economy. During this period, positive net foreign assets were accumulated. Zambia's economic fortunes were reversed in the early 1970s after the oil price shock of 1972 followed by the fall in the copper price in 1974. Since the negative copper price shock of 1974, Zambia has experienced twin problems of high inflation and deterioration in the balance of payments. In the expectation that the fall in the copper price was a temporary phenomenon, the authorities responded by borrowing from foreign and domestic financial markets. This led to the accumulation of unsustainable domestic and foreign debts. Government borrowing from the Central Bank contributed to chronic episodes of high inflation.

The objective of the paper is to contribute to the empirical work on the determinants of inflation in Zambia by developing a congruent model using the general to specific modelling approach. Previous work in this area include Mwenda (1997) and Mutoti (1999). Mwenda (1997) estimated a single equation error correction model (ECM) and found that in the short run, inflation is positively related to previous inflation rates, current and previous exchange rate depreciation rates, imported inflation and the excess money supply. Mutoti (1999) also estimated a single equation ECM and found a positive relationship between inflation and the money supply and the nominal exchange rate. This paper makes an

advance to the previous work by including impulse response and variance decomposition analyses.

The paper is organized as follows, section 2 describes the inflation trends in Zambia, section 3 describes the theoretical model, section 4 provides empirical results of econometric tests using monthly data, section 5 provides empirical results from annual data while section 6 concludes.

2. Inflation Trends In Zambia

Economic reforms in the post-liberalization period included the implementation of austere fiscal policies. In 1994, monetary conditions were tightened following the implementation of a cash budget, which saw the rate of money supply growth decline from 107.2 percent in 1993 to 36.8 percent in 1994 (see 1994 BoZ Annual Report). The rate of exchange rate depreciation also declined to 47.8 percent in 1994 compared to 69.9 percent in 1993, whilst the weighted Treasury bill rate declined to 21.2 percent from 70.7 percent at the beginning of the year. Consequently, the inflation rate declined to 118.6 percent at the beginning of the year to 38.3 percent at the end of 1994.

In March 1995, the Bank of Zambia introduced Open Market Operations (OMO), which signalled a shift from direct instruments of monetary policy to indirect ones. The OMO was aimed at keeping downward pressure on inflation and promoting stable monetary conditions. However, the reduction in the statutory reserve ratio from 27 percent to 3 percent, the reduction in the core liquid asset ratio from 35 percent to 20 percent, the collapse of three banks and the drought resulted in increased growth in the money supply. The exchange rate depreciated by 35.9 percent whilst inflation increased to 46.0 percent at end-December 1995 from 38.3 percent at end-December 1994 (Bank of Zambia 1995 Annual Report).

During 1996, money supply growth decelerated, with reserve money growth declining to 27.1 percent from 45.5 percent in 1995 whilst broad money growth declined from 40 percent to 34.4%. GDP showed positive growth of 3.5%, while the nominal exchange rate depreciated by 39.7%. The inflation rate declined to 35.2% in 1996 from 45.5% in 1995 (Bank of Zambia 1996 Annual report).

In 1997, three commercial banks collapsed. This resulted in adverse expectations and loss of confidence in the financial system, which led to the exchange rate depreciating by 23.2 percent and interest rates declining to 18.8 percent. Despite this development, there was improved performance in both the fiscal and monetary fronts. First, the fiscal budget recorded a surplus whilst broad money supply growth decelerated further from 34.4% in 1996 to 24% in 1997. Reserve money growth decreased too to 25.9%, an improvement over 1996. Consequently, inflation declined to 18.7 percent at end-December 1997 from 35.2 percent at end-December 1997 (Bank of Zambia 1997 Annual report).

In 1998, the monetary conditions loosened, partly due to drought and weak economic performance resulting from declining mining output and the East Asian financial crisis, which reduced demand for copper and cobalt on the world market. These factors contributed to GDP registering a negative growth of 2 percent whilst both reserve money and broad money registering growth rates of 31% and 22.6% respectively. The exchange rate

depreciated by 63.7 percent while the rate of inflation increased to 30.6 percent at end-December 1998 from 18.7 percent at end-December 1997 (Bank of Zambia 1998 Annual report).

In 1999, monetary conditions tightened. Reserve money growth declined from 31.0 percent in 1998 to 28.6 percent whilst broad money growth increased from 22.6 percent to 29.2 percent. At the same time, there was a rebound in agricultural production, which contributed to GDP registering positive growth whilst exchange rate depreciation slowed down to 13.8 percent from 63.7 percent the previous year. The inflation rate declined from 30.6 percent to 20.7 percent over this period (Bank of Zambia 1999 Annual report).

Due to the Bank of Zambia's financing of the Government deficit, which had widened to 7.8 percent of GDP in 2000 from 4 percent in 1999, monetary conditions loosened 2000. Broad money supply growth increased to 67.5 percent whilst reserve money grew by 49.8 percent. The exchange rate depreciated by 58.3 percent and inflation increased to 30.1 percent at end-December 2000 from 20.7 percent at end-December 1999 (Bank of Zambia 2000 Annual report).

During 2001, the loose monetary conditions that characterized 2000 were reversed. This followed a sharp decline in the growth of broad money supply to 10.0 percent from 67.5 percent. The rate of exchange rate depreciation, decelerated to 3.1 percent, whilst the weighted Treasury bill interest rate increased to 47.6 percent from 30.0 percent in 2000. In contrast, reserve money grew by 46.0 percent, reflecting an increase in the statutory reserve ratios from the previous year. In response to these developments, the inflation rate declined to 18.7 percent at end-December 2001 from 30.1 percent at end-December 2000 (Bank of Zambia 2001 Annual report).

In 2002, the monetary conditions were initially tight but eased from May onwards. The easing of monetary conditions emanated from liquidity injections as a result of Government fiscal operations, foreign exchange purchases by the Bank of Zambia and commercial banks Treasury bills rediscounts. Consequently, broad money supply growth increased to 31.5 percent in 2002 from 10.0 percent in 2001 whilst reserve money growth increased to 44.8 percent on account increases in both currency in circulation and commercial banks' current account balances. The exchange rate depreciated by 24.1 percent whilst the weighted Treasury bill rate declined to 31.1 percent at end-December 2002 from 47.6 percent at end 2001. Consistent with these developments, inflation increased to 26.6 percent from 18.7 percent (Bank of Zambia 2002 Annual report).

In 2003, broad money growth declined to 22.6 percent from 31.5 percent in 2002 whilst reserve money growth declined to 11.9 percent from 44.8 percent. The exchange rate depreciated by 7.5 percent whilst the weighted Treasury bill interest rate declined to 19.7 percent at end-December 2003 compared to 31.1 percent at end-December 2002. The economy also registered strong GDP growth of 5.1 percent. In line with these developments, the rate of inflation declined to 17.2 percent from 26.6 percent (Bank of Zambia 2003 Annual report).

The above analysis of the inflation trends suggests a relationship between inflation, the money supply, interest rates and the exchange rate. The purpose of this paper is to determine the nature of this relationship using econometrics. The theoretical model is described in the next section.

3. The Model

We assume Zambia to be a small open economy whose prices for non-traded goods are determined by the domestic money market whilst those for traded goods are determined on the world markets. Agents in the non-traded goods sector set their prices so as to protect their position relative to the traded goods sector and to respond to domestic demand shocks. The overall price level in Zambia can therefore be said to be a weighted average of the price of non-tradable goods (P^{NT}) and tradable goods (P^{T}).

$$P_t = \alpha P^{NT} + (1-\alpha) P^{T} \qquad (1)$$

Where $0 < \alpha < 1$.

The price of non-tradables is determined by domestic demand and supply conditions. On the demand side, conditions in the money market can have a significant effect. The price of non-tradables can therefore be modelled using the demand for real money balances function due to Keynes (1936) and Hicks (1937). The demand function for money is written as follows:

$$\frac{M_t}{P_t} = L(Y_t, I_{t-1}) \qquad (2)$$

Where M_t is the stock of money at time t P_t is the domestic price level, Y_t is real output and is the nominal interest rate. Equation (2) states that the demand for real balances is a function of real output, Y_t , and the nominal interest rate, I_t , which is the return on currency loans and deposits. A rise in aggregate real output, Y_t , raises the transactions demand for real balances and in contrast, a rise in the nominal interest rate raises the opportunity cost of holding money. We assume that the function in (2) takes the following log specification.

$$p_t = m_t - y_t + i_t \qquad (3)$$

which states that the domestic price level, Pt, is positively related to the money supply and the interest rate and negatively related to real output. A rise in the money supply and the interest will raise the price level, whilst a rise in real output will result into a fall in the price level and vice-versa. The domestic price level can therefore be said to be determined by domestic monetary conditions, real output and interest rates. Since money supply is set exogenously, a rise in real output raises the transactions demand for real balances therefore causing prices to fall.

The price of tradable goods is determined on world market and depends on the exchange rate (E_t) and the foreign price level (P_t^*), assuming that the Purchasing Power Parity condition holds:

$$P^{T} = E_t P_t^{*} \qquad (4)$$

where P_t is the domestic price level, E_t the nominal exchange rate and is the foreign price level. Taking logs of equation (4) yields,

$$p^T = e_t + p_t^* \quad (5)$$

which implies that the price of traded goods is positively related to the nominal exchange rate and to the foreign price level. This means that changes in the exchange rate and foreign prices will translate into domestic price changes. For example, Zambia relies heavily on importation of intermediate goods for inputs in industry as well as finished goods for consumption and durables. Changes in the exchange rate are translated into domestic prices pass through effects. Being an importer of oil and finished products, changes in foreign prices affect the domestic prices of these imported goods.

Combining equation (3) and (5) yields the Price Formation Function for Zambia:

$$p_t = m_t - y_t + i_t + e_t + p_t^* \quad (6)$$

Equation (6) states that domestic prices are positively related to money supply, interest rates, the exchange rate and foreign prices, whilst being negatively related to real output. In other words, increases in the money supply, normal interest rates and foreign prices and exchange rate depreciation will result into price increases whilst real GDP growth will lower prices.

Excessive money supply increases the demand for goods and services, thereby raising their prices. High interest rates reduce the demand for money creating excess supply of money and increase the cost of investment, thereby raising the cost of production and ultimately prices.

For Zambia, being an import dependant country, exchange rate depreciation increases the domestic price of imported intermediate inputs thereby raising the cost of production and ultimately producer prices. In addition, exchange rate depreciation raises the prices of finished goods imports. Foreign price increases are transmitted into the domestic economy via importation of goods and services imported inflation. Real GDP growth however increases the demand for real balances resulting in a fall in prices.

When we take first differences of all the variables in equation (6), we have;

$$\pi_t = \Delta m_t - \Delta y_t + \Delta i_t + \Delta e_t + \Delta p_t^* \quad (7)$$

Equation (7) expresses the rate of inflation () as a function of the changes in the money supply, output, the interest rate, the exchange rate and foreign price level. However, the equation only captures short-run dynamics of inflation since the process of substituting results into loss of long-run dynamics. To correct this, we add back the long run

$$\pi_t = (\Delta m_t - \Delta y_t + \Delta i_t + \Delta e_t + \Delta p_t^*) + (m_{t-1} + y_{t-1} + i_{t-1}) + (e_{t-1} - p_{t-1}^*) \quad (8)$$

This becomes an error correction model (ECM). The implications of equation (8) are that domestic prices not only depend on present values of money supply, interest rates and the

exchange rate, but also on the past deviations of inflation from its long run equilibrium. This study seeks to estimate equation (8) for Zambia in the form:

$$p_t = \alpha_0 + ECM_{-1} + \sum_{j=0}^{n} (\alpha_{ij} x_{t-j}) + \varepsilon_t \qquad (8)'$$

where is the vector of the regressors, is the error correction component, the lag length is chosen on the basis of a priori information and is an error term. Using a general to specific modelling procedure, a parsimonious and congruent model will be determined by carrying out a battery of econometric tests. In addition, a quantitative macroeconomic framework used in various forms by a number of authors to gauge the effect of stabilisation policies in developing countries is the monetary equilibrium model developed by Khan (1981). In this model the domestic rate of inflation relative to the foreign rate is assumed to be positively related to the excess supply of real money balances and a negative function of the deviation of the domestic prices from their purchasing power parity equilibrium level. This and the general model will be tested in the sections that follow.

4. Empirical Analysis (Monthly Data)

In this section, we use monthly data to carry out various econometric tests that will lead to the determination of an appropriate inflation model for Zambia. The econometric procedures adopted are cointegration, equilibrium correction, impulse response and variance decomposition analysis. Before we carry out these tests, we first analyse the statistical properties of the variables involved.

4.1 Statistical Properties of the Data

Equation (8)' is estimated on monthly data for the post liberalisation period (January 1994 to December 2003). Monthly data on money supply, weighted lending interest rate, the exchange rate and metal production are obtained from the Bank of Zambia whilst the data on the CPI are obtained from the Central Statistical Office (CSO). Due to lack of monthly GDP data, metal production is used as a proxy for GDP. Additionally, since changes in petroleum oil prices affect all domestic prices in Zambia, the Dubai Fateh crude oil price has been used to proxy foreign prices and is available from the IMF's International Financial Statistics (IFS).

4.2 Unit Root Tests

The time series properties of the six variables in equation (8) are examined. Firstly, the Augmented Dickey-Fuller (ADF) test, with a trend and without a trend is applied to all the data series in levels and first differences as specified in equation (8). The order of the ADF test is selected using the Akaike Information Criterion (AIC) and the Schwarz Bayesian criterion, starting with a maximum of 12 lags and working downwards to eliminate all insignificant terms until the best specification is reached.

The results of the ADF unit root tests suggest that except for the weighted lending interest rate, the null hypothesis of a unit root cannot be rejected for all series in levels at the 5% level of significance, both with and without a trend while it is rejected for the first differences. It is thus established that the series are integrated of the same order, I(1).

However, the ADF test for unit roots has low power over finite samples (see Kwiatkowski et al, 1992; Papell, 1997; Chinn and Meese, 1995). A second test, which is a test for stationarity, is therefore recommended. The KPSS test, due to Kwiatkowski et al (1992) is employed. This is a Maximum Likelihood (LM) test constructed by comparing the variance of the trend stationary component error with that of the random walk component error. In order to conduct the test, it is necessary to assume a serial correlation lag length to calculate a robust estimate of the variance for the trend stationary error. A lag of up to 12 was chosen for this purpose. Again, the results are not tabulated, but the null of trend stationarity could not be rejected for all series at the 5% level of significance. This provided strong evidence in favour of unit roots.

4.3 Cointegration Tests

Having established that all the series, except for the weighted lending rate, are I(1), the next step is to carry out cointegration tests for all the series. The multivariate technique developed by Johansen (1988) and extended by Johansen and Juselius (1990) is employed. This technique applies the maximum likelihood procedure to determine the presence of cointegrating vectors in non-stationary time series and expresses the possible relationships among the variables in as a vector autoregression of order k (VAR (k)). The Johansen approach is generally applied to I(1) variables but it is not a problem for some variables to be stationary (see Cushman et al.). However, the inclusion of a stationary variable adds one cointegrating vector to the cointegrating space. In error correction form, the model can be written as follows:

$$\Delta Y_t = \Gamma_1 \delta Y_{t-1} + ... + \Gamma_{k-1} \Delta Y_{t-k+1} + \mu_0 + \mu_1 t + \Phi D_t + \epsilon_t \qquad (9)$$

Where $t = 1,....,T, D$ give centred seasonal dummies, is a deterministic time trend and ϵ_t are $IIN_p(0, \Lambda)$. The term $\mu_1 t$ in equation (9) allows for trend in both the possible cointegrating vector and in first differences (see for example, Case 2 in Osterwald-lenum (1992). The rank of Γ gives the number of cointegrating vectors (r) and if greater than zero, $\Gamma = \alpha\beta' : \beta'$ is the $r \times p$ matrix of cointegrating vectors and α the $p \times r$ matrix of adjustment or error correction coefficients. Consequently, equation (9) indicates that a given variable y moves in response to changes in itself and other variables, to deviations from r long run equilibrium conditions (the cointegrating vectors), to seasonal and other deterministic factors and to random factors. The equation is written so that the sign of α_{ij} will be the same as that of β_{ij} if the adjustment of y_i to deviations in vector j is stabilising.

Johansen and Juselius (1990) present several likelihood ratio tests for their estimation of equation (9), the most important being the trace and maximal eigenvalue tests. The trace test for the null r of or fewer cointegrating vectors versus that of more than r cointegrating vectors is written as:

$$TR_r = -T \sum_{i=r+1}^{p} \ln\left(1 - \hat{\lambda}_i\right) \qquad (10)$$

This is a function of the squared canonical correlations $\left(\hat{\lambda}_i\right)$ between the first differences and the levels of the variables, having factored out dynamic and deterministic factors.
The maximal eigenvalue test statistic of the null that there are cointegrating vectors against

the alternative that there are is written as:

$$MAX_r = TR_r - TR_{r+1} \qquad (11)$$

Asymptotic critical values for the two tests are given in Osterwald-lenum (1992) and are automatically supplied by Eviews 4, the econometric package used by this study.

Before proceeding with the cointegration tests, the lag structure of the VAR has to be determined. A general lag of 6 is chosen, with the primary goal of eliminating serial correlation while avoiding the power-draining presence of too many lags. Using the Unrestricted VAR Multivariate procedure, and employing the AIC and SBC selection procedures, several tests are applied to equation (8). This is done with a trend and a variation of a number of seasonal dummies, without the trend but a varied number of seasonal dummies and without the trend and seasonal dummies. In all instances, the order of the VAR chosen for the sample is four.

The next step is to establish the rank of , the number of cointegrating vectors. Table 1 shows the results of applying the Johansen technique to equation (8) in EViews. The results show that other than for the cointegration test with an intercept but no trend, the trace and maximal eigenvalue tests give contradicting results, with the trace statistic indicating 3 cointegrating relations and the maximal eigenvalue statistic indicating two. This means that the cointegrating vector cannot be identified. It therefore becomes necessary to impose identifying restrictions, which can be imposed on the cointegrating vectors (elements of the coefficient () matrices) and /or on the adjustment coefficients (elements of the matrix) (see Eviews 5 User's Guide). This procedure identified two cointegrating relations for equation (8). It can therefore be stated that the variables in equation (8) are cointegrated of order 2.

TABLE 1: COINTEGRATION RESULTS

Date: 06/16/04 Time: 10:02					
Sample: 1994M01 2003M12					
Included observations: 115					
Series: CPI ZMM2 MPRDN ZLR K_US$ COPI					
Lags interval: 1 to 4					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	2	3	3	3	2
Max-Eig	1	3	2	2	2

4.4 Vector Error Correction Model (VECM) Estimation & Results

On the basis of the Unit root and cointegration tests, a general to specific modelling approach is followed under which a general dynamic error-correction model is estimated. As indicated above, the general specification of the dynamic model takes the form of an autoregressive distributed-lag model of the type

$$p_t = \alpha_0 + ECM_{-1} + \sum_{j=0}^{n} (\alpha_{ij} x_{t-j}) + \epsilon_t \qquad (8)'$$

In estimating the model, different parameterisations and lag lengths were considered during the process and model reduction with the final objective of a parsimonious and congruent model was the guiding rule used to reach the final specification.

The empirical counterpart of the theoretically derived equation (8) has been estimated with monthly data for the period 1994:1 to 2003:12. The general specification included all the variables in levels with up to 12 lags and its final specification appears in table 32, column 1. Several normality and heteroskedasticity tests were also carried out to ensure that the residuals were well behaved. The results in table 2 indicate that:

- Money supply has no contemporaneous effects on inflation, but has a significant effect after six lags for M2 and five lags for reserve money.
- The exchange rate has a significant effect on inflation, both contemporaneous and lagged. As expected, the coefficient on the exchange rate is positive reflecting pass-through effects to inflation via imports.
- The interest rate has no contemporaneous effects but has significant effects after three lags. The coefficient on the interest rate is positive and significant, as predicted in the model.
- Although correctly signed, output and foreign prices are insignificant, implying zero or very little effect on the domestic price level. For the crude oil prices, this is expected due to the small weight (0.9 percent) assigned to petroleum prices in the CPI basket.

The estimated long run equations show a significant relationship between prices, money supply, the exchange rate and the lending interest rate, whose coefficients have the expected signs and are significant at the 5% level. The coefficient (0.04) of the error correction (ECM) term shows the speed of adjustment of inflation towards its equilibrium, which is quite rapid.

The above results are broadly consistent with those obtained by Mwenda (1996) and Mutoti (1999) for the same topic. Mwenda estimated a single equation ECM and found that short run inflation is positively related to previous inflation rates, current and previous exchange rate depreciation rates, imported inflation and the excess money supply. Mutoti (1999) also estimated a single equation ECM and found a positive relationship between inflation, money and the nominal exchange rate. In terms of the ECM, Mutoti found a correction coefficient of 0.06, which suggested that about 6 percent of discrepancies in previous periods are corrected in the current period. This is comparable to the findings of this study, which found an adjustment rate of 4 percent. Econometric estimates by Sgherri (2002), using Kalman Filter or stochastic trend approach, found similar results and attributed the increases in money supply to fiscal deficits.

4.5 Impulse-Response and Variance Decomposition Analysis

To robustify the results obtained above, we go a step further to determine the extent to which the individual independent variables explain domestic price fluctuations. To do this, impulse-responses of the CPI to the money supply, interest rate and the exchange rate are forecasted over a period of 24 months (2 years) horizon to assess the impact of the three variables on the domestic prices.

The impulse- response results are standardized to correspond to a 1 percent increase in the independent variables so as to allow for comparison of domestic price sensitivity amongst the independent variables. The shocks of the independent variables are estimated given the past values of all other variables plus the current values of oil prices and the output gap, i.e. the crude oil price and output gap enter as exogenous variables in the vector equilibrium correction model (VECM).

Under the assumptions of the model, the reduced form of residuals of the VECM is orthogonalised using the Cholesky decomposition to identify the structural shocks. Then variance decompositions are used to assess how much of the variance in domestic price indices over the forecast period can be attributed to the money supply, interest rates and the exchange rate, respectively.

The impulse-response results are presented in figure 1 below. As expected, the response of inflation to a one-percentage change in the money supply is positive, rises gradually and peaks to about four percent around the eighth month, then slows down to about two percent up to the thirteenth month and then rises again. The response of inflation to a one-percentage change in the exchange rate follows a similar pattern to that of the money supply, increasing from zero to peak around four percent within the first four months and then slowing down to about two percent before increasing again. This reflects complete pass-through of exchange rate changes to domestic prices, a result that is consistent with findings of Simuchile (April 2003). In terms of the response of the CPI to interest rates, Figure 1 shows that a one-percentage change in the interest rate translates into a two-percentage change in the domestic prices within the first four months. However, the influence of the interest rate tends to zero and becomes negative after the sixth month, implying that economic agents adjust their prices to respond to the increase in the interest rates, but as it becomes expensive to borrow, demand for goods is diminished resulting in the rate of inflation slowing down.

FIGURE 1: IMPULSE-RESPONSE RESULTS

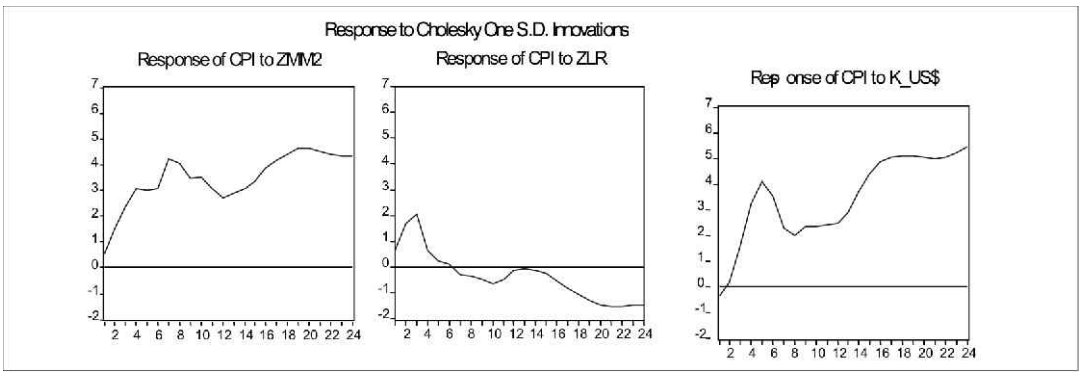

Table 2 below depicts the percentage variation of the CPI inflation that can be attributed to money supply, lending rates, the exchange rate and CPI inflation itself. Money supply explains about 35 percent of the inflation variation whilst the lending rate and the exchange rate contribute 2.7 and 38.5 percent respectively. The remainder, 24 percent is explained by inflation feeding on itself and other variables that are not captured here.

TABLE 2: VARIANCE DECOMPOSITION OF CPI:

Period	S.E.	CPI	ZMM2	ZLR	K_US$
24	549.8165	23.81617	34.99905	2.693023	38.49175
Cholesky Ordering: ZMM2 ZLR K_US$ CPI					

The implication of the impulse-response and variance decomposition result is that excessive increases in the money supply and lending rates and exchange rate depreciation will result into domestic prices rising, both in the short and the long run. In addition, the effects of the increases in the money supply and the exchange rate will be permanent whilst those due to the lending rates die out after six months and become negative.

The results of the impulse-response and the variance decomposition are consistent with those of the VECM estimation. The results are also broadly consistent with those of Mwenda (1996) and Mutoti (1999).

5. Empirical Analysis (Annual Data)

In this section we use annual data to analyse inflation in Zambia based on the monetary equilibrium model developed by Khan (1981). In this model, the domestic rate of inflation relative to the foreign rate is assumed to be positively related to the excess supply of real money balances and a negative function of the deviation of the domestic prices from their purchasing power parity equilibrium level. Formally, Khan's specification is written as follows:

$$\Delta \log P = \lambda_0 \left[LogM_{T-1} - \log M^{*}_{t-1} \right] - \lambda_2 \left[\log P_{T-1} - \left[\log \left(e_{t-1} p^{*}_{T-1} \right) - \log \beta_0 \right] \right] + \lambda \qquad (12)$$

P is the domestic price level, e is the exchange rate in units of domestic currency per unit of foreign currency and P* is the foreign price level. M is the stock of real money balances deflated by the domestic price level. ë. is a constant, reflecting the steady state properties of the system.

In applying this model for Zambia, we focus on three variables; the logarithms of the money supply (measured by M1), the exchange rate and inflation. All these variables are non-stationary so that their first difference is used in the analysis. The sample used in this analysis covers annual data for the period 1965 to 1999. This is the period over which data is available for all the variables of interest. For some variables, data goes as far back as 1964 and for some it goes beyond 1999. All the data used in this analysis was obtained from the International Financial Statistics (IFS) of the IMF.

We use a three variable cointegrated VAR model including the growth rate in money supply ($\triangle$ lM1, the exchange rate (lER) and the inflation rate ($\triangle$ lP). The variables lM1 and lP are 1(2) and are therefore differenced for inclusion in the cointegration analysis. The cointegration results show the existence of two co integrating vectors. The results of variance decompositions from the cointegrated VAR model at a fifty-year horizon are presented in Table 3.

TABLE 5: ORTHOGONALISED FORECAST ERROR VARIANCE DECOMPOSITION FOR VARIABLE LER AND △LP COINTEGRATION WITH UNRESTRICTED INTERCEPTS AND RESTRICTED TRENDS IN THE V AR

Source of Variation

Dependent Variable	△ Lm1	IER	△ IP
IER	0.52	0.42	0.06
△LP	0.66	0.07	0.26

6. Conclusion

This paper analyses inflation dynamics in Zambia using cointegration, equilibrium correction, impulse-response analyses and variance decomposition. The results obtained indicate that money supply, interest rates and the exchange rate have significant influence on domestic prices. Results of the cointegration and error-correction tests indicate that there is a long run equilibrium relationship between prices, money supply, and the exchange rate. In line with theory, the findings demonstrate that in the long run, inflation is positively related to money supply and the exchange rate. The above results are reinforced using annual data, which show a strong relationship between money supply on one hand, and inflation and the exchange rate on the other. The money supply growth accounts for 52 percent of the variation in the exchange rate and 66 percent of the variation in inflation.

These results suggest that targeting the growth rate of money supply is an appropriate instrument for controlling inflation and stabilising the exchange rate in Zambia. The findings of the study lend support to conventional elements of a stabilization package, which emphasizes reducing money supply growth and stable exchange rate.

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APPENDIX

APPENDIX 1: COINTEGRATION RESULTS

Date: 06/16/04 Time: 10:02

Sample: 1994M01 2003M12

Included observations: 115

Series: CPI ZMM2 MPRDN ZLR K_US$ COPI

Lags interval: 1 to 4

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	2	3	3	3	2
Max-Eig	1	3	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or	No Intercept	Intercept	Intercept	Intercept	Intercept
No. of CEs	No Trend	No Trend	No Trend	Trend	Trend
Log Likelihood by Rank (rows) and Model (columns)					
0	-4221.631	-4221.631	-4215.841	-4215.841	-4206.075
1	-4192.633	-4191.838	-4186.147	-4182.601	-4172.875
2	-4177.447	-4167.145	-4161.798	-4158.148	-4148.468
3	-4168.047	-4152.672	-4148.844	-4145.180	-4138.737
4	-4162.125	-4143.823	-4142.211	-4136.928	-4131.424
5	-4160.099	-4138.821	-4137.276	-4130.712	-4125.935
6	-4159.966	-4136.844	-4136.844	-4125.804	-4125.804

Akaike Information Criteria by Rank (rows) and Model (columns)					
0	75.92402	75.92402	75.92767	75.92767	75.86218
1	75.62840	75.63197	75.61994	75.57567	75.49348
2	75.57298	75.42860	75.40518	75.37648	75.27770*
3	75.61820	75.40300	75.38859	75.37704	75.31716
4	75.72391	75.47518	75.48193	75.45961	75.39868
5	75.89737	75.61428	75.60479	75.57760	75.51191
6	76.10375	75.80599	75.80599	75.71833	75.71833

Schwarz Criteria by Rank (rows) and Model (columns)					
0	79.36116	79.36116	79.50802	79.50802	79.58574
1	79.35196*	79.37940	79.48671	79.46631	79.50347
2	79.58297	79.48633	79.55839	79.57742	79.57411
3	79.91462	79.77102	79.82822	79.88828	79.90001
4	80.30675	80.15350	80.20798	80.28114	80.26795
5	80.76664	80.60290	80.61728	80.70943	80.66761
6	81.25945	81.10490	81.10490	81.16045	81.16045

APPENDIX 2: VECM ESTIMATION RESULTS

Vector Error Correction Estimates

Date: 06/28/04 Time: 14:27

Sample (adjusted): 1994M08 2003M12

Included observations: 113 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
CPI(-1)	1.000000
ZMM2(-1)	-0.000123
	(2.7E-05)
	[-4.48975]
ZLR(-1)	1.791276
	(1.43528)
	[1.24803]
K_US$(-1)	0.081023
	(0.04511)
	[1.79594]
@TREND(94M01)	-4.266883
	(1.36860)
	[-3.11770]
C	-242.2877

Error Correction:	D(CPI)	D(ZMM2)	D(ZLR)	D(K_US$)	
CointEq1		-0.043758	715.8053	-0.002819	-0.359458
		(0.01095)	(199.816)	(0.00438)	(0.42405)
		[-3.99491]	[3.58231]	[-0.64438]	[-0.84767]
D(CPI(-1))		0.505508	-1761.619	0.062172	-0.300748
		(0.10025)	(1828.79)	(0.04004)	(3.88109)
		[5.04245]	[-0.96327]	[1.55267]	[-0.07749]
D(CPI(-2))		-0.245804	-3584.629	-0.066750	-6.469946
		(0.11449)	(2088.50)	(0.04573)	(4.43225)
		[-2.14699]	[-1.71636]	[-1.45969]	[-1.45974]
D(CPI(-3))		0.060822	-365.6962	-0.001082	3.960987
		(0.11745)	(2142.62)	(0.04691)	(4.54710)
		[0.51784]	[-0.17068]	[-0.02307]	[0.87110]
D(CPI(-4))		-0.185734	-663.3972	0.029417	6.554968
		(0.11213)	(2045.56)	(0.04479)	(4.34111)
		[-1.65637]	[-0.32431]	[0.65680]	[1.50997]
D(CPI(-5))		-0.201884	370.9645	0.089400	0.352780
		(0.11659)	(2126.92)	(0.04657)	(4.51378)
		[-1.73152]	[0.17441]	[1.91971]	[0.07816]
D(CPI(-6))		-0.263706	-3245.411	-0.072226	-3.392059
		(0.10587)	(1931.28)	(0.04229)	(4.09859)
		[-2.49088]	[-1.68045]	[-1.70804]	[-0.82762]
D(ZMM2(-1))		9.99E-06	-0.224435	5.57E-06	0.000284
		(7.0E-06)	(0.12842)	(2.8E-06)	(0.00027)
		[1.41930]	[-1.74769]	[1.98107]	[1.04057]
D(ZMM2(-2))		-1.80E-06	-0.025972	1.96E-06	0.000185
		(6.7E-06)	(0.12292)	(2.7E-06)	(0.00026)
		[-0.26667]	[-0.21128]	[0.72849]	[0.70960]
D(ZMM2(-3))		-6.32E-06	0.101302	3.22E-06	0.000264
		(6.7E-06)	(0.12240)	(2.7E-06)	(0.00026)
		[-0.94213]	[0.82762]	[1.20259]	[1.01526]
D(ZMM2(-4))		-5.56E-08	0.059604	-4.91E-06	-0.000185
		(6.8E-06)	(0.12372)	(2.7E-06)	(0.00026)
		[-0.00820]	[0.48178]	[-1.81379]	[-0.70456]
D(ZMM2(-5))		1.49E-05	0.252996	2.24E-06	0.000193
		(6.6E-06)	(0.11984)	(2.6E-06)	(0.00025)
		[2.26926]	[2.11117]	[0.85477]	[0.75928]
D(ZMM2(-6))		2.77E-05	0.257178	-5.75E-06	0.000247
		(7.0E-06)	(0.12782)	(2.8E-06)	(0.00027)
		[3.94737]	[2.01205]	[-2.05619]	[0.90928]
D(ZLR(-1))		0.514705	2701.828	0.337349	-2.408609
		(0.25765)	(4700.10)	(0.10291)	(9.97463)

	[1.99769]	[0.57484]	[3.27809]	[-0.24147]
D(ZLR(-2))	-0.081994	1934.604	0.141703	3.092732
	(0.25516)	(4654.75)	(0.10192)	(9.87839)
	[-0.32134]	[0.41562]	[1.39037]	[0.31308]
D(ZLR(-3))	-0.774806	-4069.059	0.250935	7.908004
	(0.24406)	(4452.27)	(0.09748)	(9.44867)
	[-3.17460]	[-0.91393]	[2.57411]	[0.83694]
D(ZLR(-4))	0.498408	-1537.395	0.092474	0.415111
	(0.24922)	(4546.25)	(0.09954)	(9.64813)
	[1.99990]	[-0.33817]	[0.92899]	[0.04303]
D(ZLR(-5))	0.053620	2823.271	-0.105884	-6.783935
	(0.24066)	(4390.14)	(0.09612)	(9.31683)
	[0.22280]	[0.64309]	[-1.10153]	[-0.72814]
D(ZLR(-6))	-0.089445	1410.248	-0.226175	5.524369
	(0.22070)	(4026.05)	(0.08815)	(8.54415)
	[-0.40528]	[0.35028]	[-2.56574]	[0.64657]
D(K_US$(-1))	0.003735	10.41113	-0.001533	-0.312739
	(0.00302)	(55.1820)	(0.00121)	(0.11711)
	[1.23476]	[0.18867]	[-1.26906]	[-2.67051]
D(K_US$(-2))	0.009171	13.19188	0.000961	-0.120847
	(0.00317)	(57.8530)	(0.00127)	(0.12278)
	[2.89171]	[0.22802]	[0.75867]	[-0.98428]
(K_US$(-3))	0.008321	8.600080	0.002788	-0.097061
	(0.00320)	(58.3191)	(0.00128)	(0.12377)
	[2.60291]	[0.14747]	[2.18340]	[-0.78423]
D(K_US$(-4))	-0.000297	-51.07945	0.002096	-0.058876
	(0.00310)	(56.5393)	(0.00124)	(0.11999)
	[-0.09575]	[-0.90343]	[1.69287]	[-0.49068]
D(K_US$(-5))	-0.003754	-168.9634	-0.001789	-0.110071
	(0.00287)	(52.3531)	(0.00115)	(0.11110)
	[-1.30802]	[-3.22738]	[-1.56091]	[-0.99069]
D(K_US$(-6))	-0.002267	-105.7852	0.001219	-0.098724
	(0.00298)	(54.3678)	(0.00119)	(0.11538)
	[-0.76080]	[-1.94573]	[1.02407]	[-0.85564]
C	7.568309	99144.13	-0.575746	28.71926
	(1.32736)	(24214.0)	(0.53017)	(51.3873)
	[5.70177]	[4.09450]	[-1.08596]	[0.55888]
R-squared	0.728697	0.339506	0.585204	0.226982
Adj. R-squared	0.650737	0.149709	0.466010	0.004850
Sum sq. resids	1537.757	5.12E+11	245.3272	2304733.
S.E. equation	4.204209	76693.93	1.679242	162.7611

F-statistic	9.347008	1.788786	4.909669	1.021834
Log likelihood	-307.8442	-1416.543	-204.1391	-720.9945
Akaike AIC	5.908746	25.53173	4.073259	13.22114
Schwarz SC	6.536287	26.15927	4.700799	13.84868
Mean dependent	7.369912	36032.04	-0.273451	33.36912
S.D. dependent	7.113903	83172.02	2.297982	163.1573

Determinant resid covariance (dof adj.)	5.62E+15
Determinant resid covariance	1.98E+15
Log likelihood	-2631.286
Akaike information criterion	48.50064
Schwarz criterion	51.13148

Relationship between Bank of Zambia (Boz) Dealing and Commercial Banks Exchange Rates during the Auction Period

Chipili Jonathan Mpundu[3]

Abstract

The paper examines empirically the assertion that the BoZ dealing rate influenced commercial bank exchange rates during the auction period (February 2001, to June 2003). The study results confirm this assertion evidenced by the existence of cointegration. The cointegration results suggest the existence of arbitrage opportunities in the foreign exchange market during the auction period as banks used the BoZ dealing rate in determining transaction rates with their clients. Further, it is established that while banks depended on the BoZ dealing rate, a bulk of the foreign exchange was transacted outside the BoZ dealing window contrary to the to the existing official rules.

1. Introduction

On 18 January 2001, the government through the Minister of Finance and Economic Development announced measures to stabilize the foreign exchange market necessitated by the conduct of the private sector towards foreign exchange transactions. Specifically, the government observed that banks were reluctant to intervene in the foreign exchange market despite having foreign currency deposit holdings in excess of US$200 million and that major exporters were auctioning foreign currency instead of transacting through established channels. This generated speculative behaviour and led to excessive depreciation of the exchange rate. For instance, in 2000, the Kwacha/US dollar exchange rate depreciated by about 58% against 14% depreciation in the previous year.

To compliment the announced foreign exchange measures, the Bank of Zambia (BoZ) introduced a transparent allocation mechanism of foreign exchange in February 2001 by making the BoZ dealing window (wholesale market) available to major suppliers of exchange to sell foreign exchange to the market on a daily basis through a wholesale foreign exchange auction conducted by the BoZ. The new allocative measure was aimed at stemming the speculative behaviour that emerged in the foreign exchange market as suppliers of foreign exchange exhibited 'rent-seeking' behaviour observed through higher rates when transacting directly in the interbank market. Further, the measure intended to at least give all banks equal access to the foreign exchange as some exporters had in the past preferred to deal with fewer banks effectively shutting out others.

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Some market analysts argued that the rate struck at the BoZ foreign exchange auction acted as a benchmark rate for transactions conducted by banks amongst themselves and their clients. Further, it was presupposed that banks waited for the results of the auction for them to determine the rate for their transactions. This argument was premised on the fact that since a substantial amount of foreign exchange was traded through the BoZ dealing window, the exchange rate struck at the auction would reflect the true competitive price that should effectively influence the price or value of other transactions in the market.

In this paper, we test empirically the hypothesis that the BoZ dealing rate influenced commercial bank exchange rates during the auction period running from February 2001 to February 2003 using daily data. The rest of the paper is organized as follows. The next section provides a description of the operations of the BoZ dealing window. Section 3 examines the foreign exchange data transactions while section 4 provides a graphical analysis of the relationship between the BoZ dealing and commercial bank exchange rates. Literature review is given in section 5. The results of the formal tests of the relationship between the BoZ dealing and commercial bank exchange rates is presented in section 6. Section 7 concludes the discussion.

2. Definition and Operations of the BoZ Foreign Exchange Dealing Window

Following the announcement of the foreign exchange measures by government, the BoZ revised the dealing window guidelines[4] to include all major foreign exchange earners (suppliers) to transact through the BoZ (dealing window) if the amount exceeded a set threshold amount per week (see Guidelines for Major Foreign Exchange Suppliers, February 2001). Previously, foreign exchange earners were allowed to transact directly in the interbank market.

When the auction resumed in February 2001, a threshold of US$200,000.00 per week was set as the minimum amount of foreign exchange suppliers could transact through the dealing window. The threshold was later reduced to US$100,000.00 to broaden participation by as many suppliers of foreign exchange in the wholesale market. Suppliers with less than the threshold amount were allowed to deal directly with commercial banks. Eligible participants in this wholesale foreign exchange dealing arrangement were registered commercial banks and major suppliers of foreign exchange.

With respect to the auction process, the suppliers of foreign exchange were required to submit to the BoZ the amount of foreign exchange they intended to sell to the market by 12.30 hours on the business day immediately preceding the auction day. The BoZ then invited commercial banks to submit sealed bids for foreign exchange indicating the volume and price at which they wished to transact by 09:30 on the auction day. Initially, there was no limit on the amount of foreign exchange a bank could bid for. However, a maximum cap on the amount each bank could be bid for in every auction was later introduced and set at 40% of the announced amount on offer to ensure that as many banks accessed the foreign exchange. The bids were processed in the descending order starting with the highest price until the amount on auction was exhausted. Initially, foreign exchange was allocated at the

[4]The BoZ Dealing Window was established in December 1993 as a channel through, which foreign exchange was allocated by the BoZ to the banks through an auction process. The foreign exchange main source of the foreign exchange allocated at the auction was from ZCCM as part of the retention arrangement. Commercial banks were the only the participants at the auction (dealing window) then.

cut-off weighted average rate to all successful bidders. On 20 March 2001, the allocation method was change to the marginal (uniform price) cut-off rate to all the successful bidders. The auction results were communicated on the auction day to the suppliers of foreign exchange in full and commercial banks were informed of the amount allocated and the rate struck (dealing rate) in the auction, which became the BoZ official buying rate. The official exchange rate remained fixed until the next auction was held.

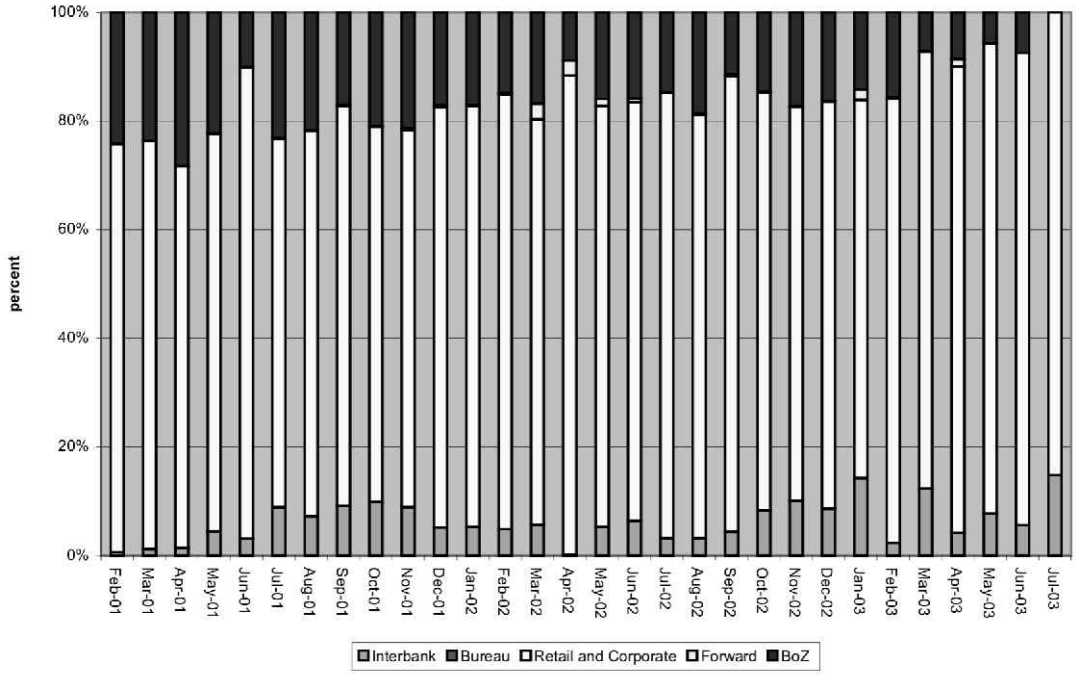
3. Commercial Banks' Foreign Exchange Transactions

The foreign exchange market in Zambia comprises the interbank market, retail, corporate, forward, bureau and the BoZ dealing window (wholesale). During the review period (February 2001 to June 2003), the market turnover was about US$4.6 billion. The major source of foreign exchange for the banks were retail and corporate customers, who accounted for about 78% (US$3.6 billion) of the total foreign exchange purchased, followed by the BoZ dealing window with about 15% (US$0.7 billion). The interbank market provided only about 6% (US$0.3 billion) of the total supply of foreign exchange to the banks while a paltry 0.5% (less than US$22 million) came from the forward market with virtually nothing from the bureaus (see Table 1 in the appendix). On the demand side, retail and corporate customers dominated with a total of about US$4.1 billion (90%), followed by interbank market with about US$0.3 billion (6%) and forward market customers with about US$0.1 million (2%) as shown in Table 2 in the appendix. Bureaus demanded less than US$40 million in total representing about 1%. Commercial banks sold about US$50 million to the BoZ (1%).

An attempt was made to disaggregate the retail and corporate transactions in order to establish how much was traded in each sub-market. Unfortunately, disaggregated data for this category was not readily available for the entire study period. Nonetheless, the available disaggregated data between August and December 2001 as well as between January and February 2003 period revealed that corporate transactions accounted for about 55% of the total transactions reported in the retail and corporate sub-market. This implies that the remaining 45% of the foreign exchange purchased by commercial banks over the sample period came from retail customers. The disaggregation of the foreign exchange transactions reveal an important finding that a significant amount of foreign exchange was traded outside the BoZ dealing window, with the BoZ providing only about 15% of total commercial banks' supply. This finding is contrary the assertion that major earners of foreign exchange channeled a bulk of foreign exchange through the BoZ dealing window.

A closer look at the BoZ dealing window transactions reveal that participation by major exporters at the BoZ increased steadily during the first three months and reached peaked (see figure 1). Thereafter, the amount of foreign exchange transacted by the major suppliers gradually declined from as high as 28% to as low as 7% at the time the dealing window was suspended on 23 July 2003 as shown in figure 1 below. It is clear from the statistics presented in this study that major foreign exchange earners circumvented the BoZ dealing window guidelines and dealt directly with commercial banks. The critical question that arises from the transaction numbers thus far is why the major foreign exchange earners shunned the dealing window. Nyimba-Ng'ambi (2004) attributes the reduction in the amount of foreign exchange offered by suppliers to the perception that the BoZ manipulated the dealing rate.

FIGURE 1 DISTRIBUTION OF COMMERCIAL BANKS' FOREIGN EXCHANGE BY SOURCE



4. Graphical Analysis of the BoZ Dealing and Commercial Bank Exchange Rates

Graphical analysis in figures 2, 3 and 4 reveals that the commercial banks' retail and corporate buying exchange rates tracked the BoZ dealing rate closely except for the period between October 2001 and May 2002 as well as during the first quarter of 2003 when the former diverged substantially from the latter. Further, from March 2003 onward, both retail and corporate buying exchange rates trended below the BoZ dealing rate. Similarly, the interbank rate also diverged substantially from the BoZ dealing rate around October 2001 to May 2002 and the first quarter of 2003.

FIGURE 2 BOZ DEALING AND INTERBANK RATES

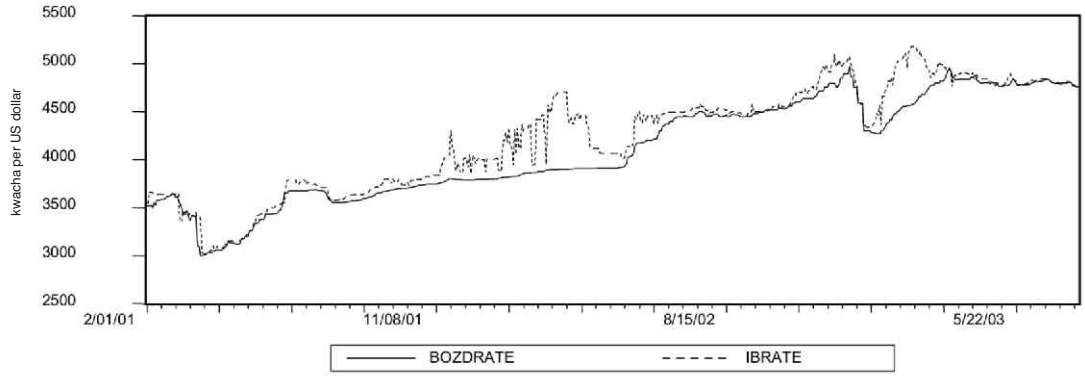


FIGURE 3. BOZ DEALING AND CORPORATE BUYING RATES

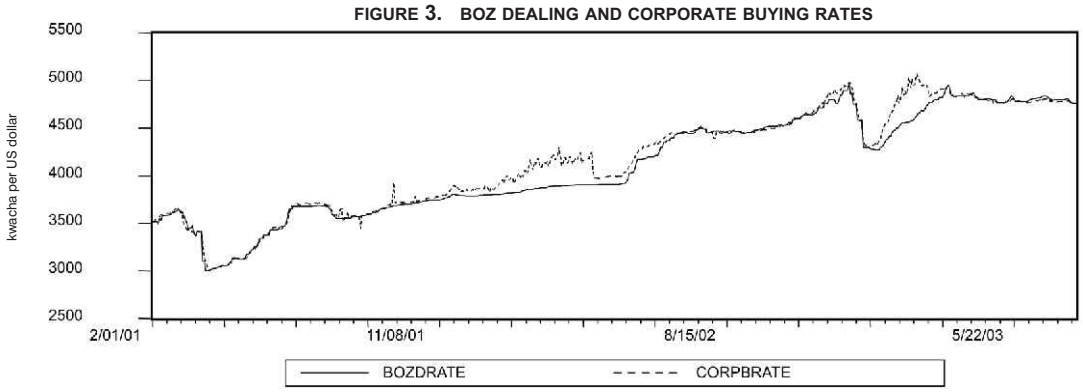
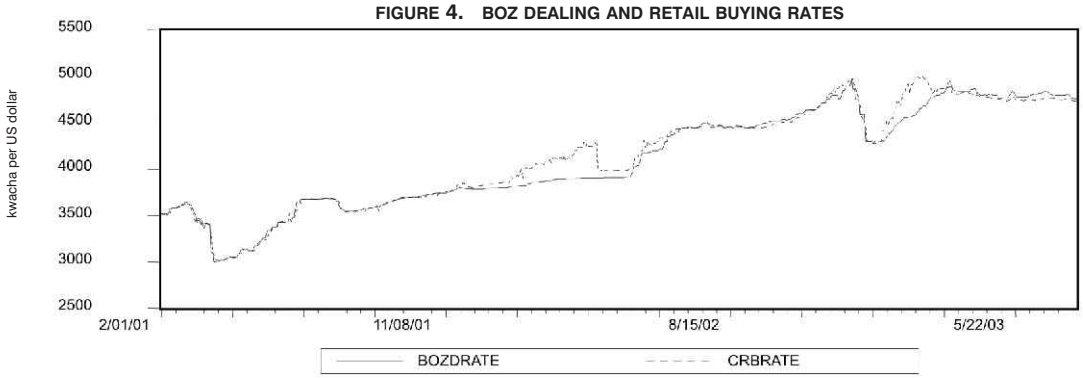


FIGURE 4. BOZ DEALING AND RETAIL BUYING RATES



The interbank rate, while it tracked the BoZ dealing rate, it generally trended above the latter over the study period by a higher margin than the retail and corporate buying rates did (see figure 5). The interbank rate exhibited more variability than the retail and corporate rates during the divergent period while the BoZ dealing rate was generally stable over the study period. The relatively higher interbank rate could be explained by the fact that banks traded amongst themselves at rates quoted or revealed in the auction that gave them a margin or consumer surplus over the marginal rate struck in the auction. Further, commercial banks purchased relatively cheaper funds in both retail and corporate markets by offering lower rates for a profit.

The margin between the BoZ rate and commercial bank rates increased during the divergent period as shown in figure 5 below. One possible explanation for the divergence in the exchange rates could be attributed to the reduction in the frequency and availability or supply of foreign exchange at the dealing window as can be discerned from figure 6. Further during periods when there were no offers by suppliers at the dealing window commercial banks continued to trade with suppliers at rates that reflected activity (supply and demand conditions) in the interbank as well as retail and corporate markets and not the dealing rate where there was no trade, hence the divergence. It appears that during the October 2001 to May 2002, offers and frequency of dealing sessions reduced at the dealing window and the exchange rate remained virtually unchanged over that period and as such the banks' rates diverged from the former to reflect what was going on in this market. With respect to the divergence in the exchange rates observed during the first quarter of 2003, the possible

explanation is that, while the BoZ rate was steadily moving upward (depreciating), the market may have perceived the rate of adjustment of the BoZ dealing rate to be slow, and so depreciated their rate faster until the former somewhat converged to the rate the market regarded to reflect the prevailing conditions. The rate of depreciation of the BoZ dealing rate accelerated in the third week of March 2003 before converging with the banks' rates. Thereafter, the banks' rates tracked the BoZ rate rather closely.

FIGURE 5 SPREAD BETWEEN COMMERCIAL BANKS' BUYING AND BOZ DEALING RATES

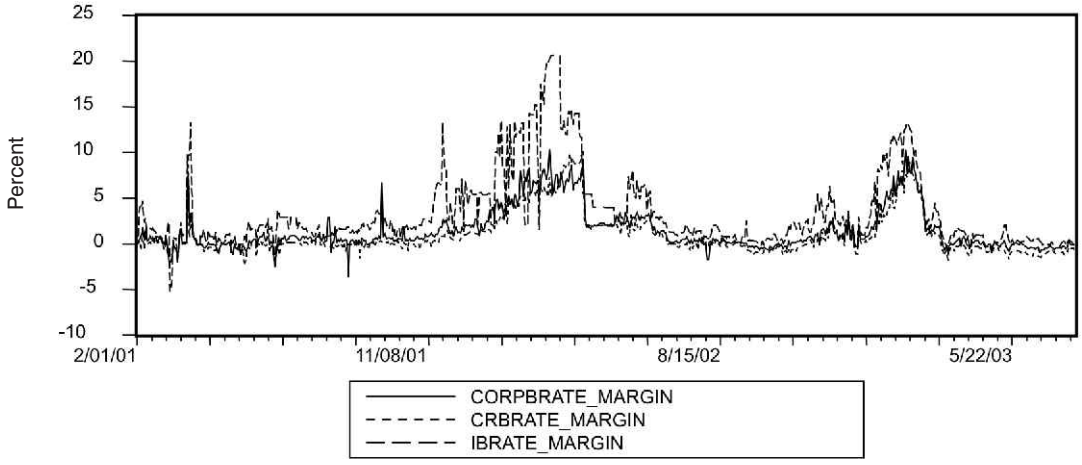
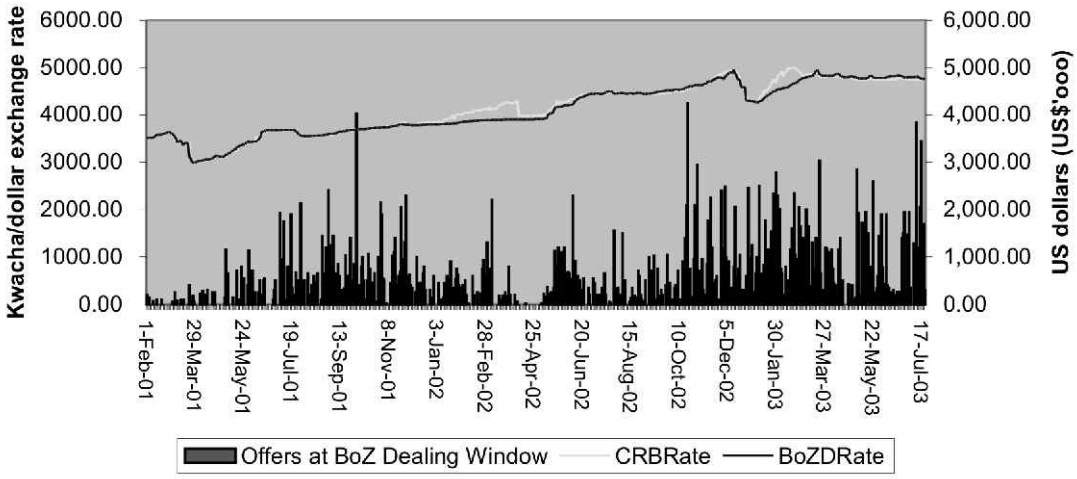


FIGURE 6 TRANSACTIONS AT BOZ DEALING WINDOW AND EXCHANGE RATE MOVEMENT



5. Literature Review

Studies that have examined the relationship between the official and free-market as well as black market exchange rates such as Coleman (1990), Booth and Mustafa (1991), Mukesh et.al (1996) and Muco et.al (1998) have employed a cointegration technique. Cointegration methodology provides a computationally convenient way of testing for asset market efficiency. The application of cointegration tests indicates that the two exchange rate markets are efficient information processors. In providing the meaning of cointegration and the rationale for using this estimation technique, Booth and Mustafa (1991) citing Campell

and Shiller (1998) argue that cointegration obtains as a result of one time series anticipating another. Cointegration methodology is able to measure the long-run co-movement of time series. Market efficiency requires that all arbitrage opportunities be exploited if they can be. On the other hand, cointegration implies the existence of unexploited opportunities except that this may be due to institutionally imposed constraints such as those on the amount of capital that can be transferred through official channels (Booth and Mustafa, 1991)

Coleman (1990) quoting MacDonald and Taylor (1989) argues that two spot exchange rates cannot be cointegrated if they are determined in an efficient market. This is based on the fact that if a pair of spot rates are cointegrated, then by the Granger Representation Theorem[5], there exists an error correction representation, which implies that at least one exchange rate can be used to forecast (i.e Granger-cause) the other, which is inconsistent with the weakly efficient market hypothesis. In a weakly efficient exchange market, current prices are assumed to reflect all available information such that the best predictor of a spot rate is its own lagged value (Coleman, 1990). The forecastability due to cointegration among spot rates implies the existence of arbitrage opportunities, which earn positive profits. Lack of cointegration pairwise among spot rates is a necessary but not sufficient condition for weak efficiency. Booth and Mustafa (1991) report that there is consensus in the literature that most exchange rate markets are informationally efficient in that an exchange rate's past values or past values of other exchange rates cannot assist in forecasting the next period's value. This worthlessness of past values is due to the fact that information is widely disseminated and quickly acted upon.

Examining the pairwise relationship among 18 currencies for developed countries, Coleman (1990) found little evidence of cointegrating relationship and concluded that spot exchange rates are determined in a weakly efficient market. Muco et. al. (1998) analyzing the relationship between the free-market and official exchange rates in Albania using high frequency data found strong support for no cointegration between the two exchange rate series implying market efficiency i.e. one cannot use past movements in one currency to predict future movement in another. However, the authors established partial support for the view that movements in the free-market precede those in the official market (i.e. free market rate Granger- causes the official rate) while the official rate does not Granger-cause the free market rate or does so to a lesser extent (i.e. established at least some degree of two-way causality between them).

Booth and Mustafa (1991), investigating the relationship among black and official foreign exchange rates in Turkey for US dollars and West German marks in the mid 1980s using cointegration tests found that black market exchange rates are efficient information processors and thus behave independently of each other. However, for both currencies, the black and official rates were found to be cointegrated suggesting that they tend toward an equilibrium position in the long-run.

6. Empirical Estimation and Results

In this study, we analyse econometrically, using daily data the relationship between the BoZ dealing and commercial bank exchange rates specified in equation 1 below by adopting the Johansen cointegration test. Muco et. al (1998) argue that testing for efficiency and

[5] See Engle and Granger (1987).

Causality in exchange rate markets using high frequency data has become increasingly common for both established and developing currencies. Tests are conducted for pairwise combinations of the BoZ dealing and commercial bank exchange rates. The hypothesis tested is that commercial bank exchange rates were influenced by the BoZ dealing rate during the auction period alluded to earlier.

$$Combankrate_t = \alpha_0 + \alpha_1 BoZdealrate_t + \varepsilon_t \qquad 1$$

where

- $Combankrate_t$ represents commercial banks' buying retail and corporate exchange rates as well the interbank rate denoted as CRBRATE, CORPBRATE and IBRATE, respectively, and
- $BoZdealrate_t$ is the BoZ dealing rate denoted as BOZDRATE

The log levels of daily average of all spot rates is used. Data was obtained from the BoZ Statistics Fortnightly.

Before performing the cointegration test, the order of integration of the exchange rate data series is determined. This is achieved by the application of the test for unit roots as described by Dickey and Fuller (1979) and its augmented version (ADF).

Before equation 1 is tested empirically, we begin by performing some basic tests (i.e. correlation and Granger-causality) are performed to examine the statistical relationship between the BoZ dealing and commercial banks' corporate, retail buying and interbank exchange rates. The correlation test presented in Table 1 below indicate very strong positive statistical association between the BoZ and commercial bank exchange rates evidenced by correlation coefficients of over 0.94.

TABLE 1 CORRELATION TEST

	CORPBRATE	CRBRATE	IBRATE
BOZDRATE	0.98	0.98	0.94

Correlation between the official and commercial bank exchange rates does not necessarily imply causation. Further, evidence of correlation between these exchange rates does not violate market efficiency. It is only when the exchange rates are cointegrated that market efficiency hypothesis is rejected.

Granger causality tests reported in Table 2 indicate that the BoZ rate had strong predictive power for the movement in commercial bank exchange rates. Specifically, the direction of causation runs from the BoZ dealing rate to the interbank as well as the commercial bank retail and corporate buying exchange rates. However, two-way causation exists between the BoZ dealing and the banks' retail buying rates.

TABLE 2 PAIRWISE GRANGER CAUSALITY TESTS

Date: 08/16/04 Time: 17:07
Sample: 2/01/1901 7/22/1903
Lags: 30

Null Hypothesis:	Obs	F-Statistic	Probability
LCORPBRATE does not Granger Cause LBOZDRATE	614	0.75705	0.82273
LBOZDRATE does not Granger Cause LCORPBRATE		5.42804	0.00000
LCRBRATE does not Granger Cause LBOZDRATE	614	1.57220	0.02848
LBOZDRATE does not Granger Cause LCRBRATE		10.0106	0.00000
LIBRATE does not Granger Cause LBOZDRATE	614	0.88288	0.64829
LBOZDRATE does not Granger Cause LIBRATE		2.80217	1.8E-06

Having established that a relationship exists between the BoZ dealing rate and commercial banks exchange rates, more robust tests are conducted to establish the strength of this relationship. We estimate impulse response and variance decomposition and later undertake cointegration test to robustify the results. Variance decompositions show the importance of the BoZ dealing rate to movements in the commercial bank exchange rates while impulse response shows the direction of these movements. Variance decomposition results presented in the appendix reveal that the BoZ dealing rate accounts for about 50 per cent variation in retail and corporate rates whereas about 30 percent of the variation in the interbank rate is accounted for by the BoZ dealing rate. Further, the impulse response results also shown in appendix indicate that the BoZ dealing rate has an immediate positive impact on the commercial bank exchange rates under study. The impact on these exchange rates remains permanent. However, the responsiveness of the interbank rate to the innovations in the BoZ dealing rate is smaller than that of retail and corporate exchange rates. This observation is similar to the variance decomposition results, which show a smaller influence of the BoZ dealing rate on the interbank rate than the retail and corporate rates.

The first step in investigating the long-run relationship between the BoZ dealing and commercial bank exchange rates is to determine their order of integration. An appropriate lag length of 30 in the ADF test is determined based on Schwert's (1989)[6] recommendation. The unit root test results are reported in Table 3 below.

TABLE 3 UNIT ROOT TEST RESULTS

Augmented Dickey-Fuller (ADF) Test Results

	With Intercept	With Trend and Intercept
Levels		
LBOZDRATE	-0.62	-4.47*
LCRBRATE	-0.77	-5.39*
LCORPBRATE	-0.92	-5.50*
LIBRATE	-1.06	-4.44*
First Difference		
LBOZDRATE	-4.77*	
LCRBRATE	-5.18*	
LCORPBRATE	-5.05*	
LIBRATE	-4.85*	

Source: Statistics generated using EViews 4.0 package

[6] Schwert recommended the following formula for setting the lag length in the unit root test. Note: All the variables in Table are measured in logarithm.

* indicate rejection of the null hypothesis of unit root at 1% level of significance

Augmented DickeyFuller:

$$\Delta Y_t = \hat{\alpha} + \hat{\beta}\hat{Y}_{t-1} + \sum_{i=1}^{30} \hat{\theta}_i \Delta Y_{t-1} + \varepsilon_t$$

The reported unit root test statistics in Table 5 above indicate that the null hypothesis of a unit root in all the exchange rate series cannot be rejected, implying that all the exchange data series are integrated of order one [~ I(1) series]. Having established that each spot exchange rate s_i is $I(1)$ as defined in equation 1 above, cointegrating vectors for various subsets of S_t (i.e. $nx1$ Vector of spot exchange rates) are estimated by running the following cointegrating regression

$$s_{1t} = \alpha_0 + \alpha_2 s_{1t} + \alpha_2 s_{2t} + \ldots + \alpha_{i-1} s_{t-1t} + \alpha_{i+1} s_{t+1t} + \alpha_k s_{kt} + v_t \quad 2$$

for $2 \le k \le n$ and testing whether the residual v_t (i.e. a linear combination of elements in S_t) is stationary. If the residual series rejects the null of $I(1)$, then the series used in equation above are cointegrated and are inconsistent with weak efficiency. Two lags were included in the estimation of each of the cointegrating equations based on the **Schwartz Beysian** Criteria and Akaike Information Criteria.

Both the trace and max-eigenvalue tests indicate no cointegration at 5 per cent significance level between the BoZ dealing and retail as well as corporate exchange rates. However, one cointegrating equation is found between the BoZ dealing and the interbank exchange rates as reported in the equation 1.1 below with standard errors in parenthesis.

$$LIBRATE_t = \underset{(0.07)}{0.98} LBOZDRATE_t \qquad 2.1$$

the non-existence of cointegration between the BoZ dealing and commercial bank retail and corporate exchange rates imply market efficiency. This result is similar to the evidence provided by Muco et.al (1998) for Albania, a developing country like Zambia.

A dummy was included in the cointegrating equation to determine the significance of the factors that led to the divergence in the commercial bank exchange rates from the BoZ dealing rate. The dummy took the value of 1 for the period of exchange rate divergence and 0 otherwise. Both the trace and max-eigenvalue tests indicate one cointegration equation at 5 per cent significance level between the BoZ dealing and interbank, retail as well as corporate exchange rates as reported below with standard errors in parenthesis.

$$LIBRATE_t = \underset{(0.05)}{1.02} LBOZDRATE_t + \underset{(0.01)}{0.06} IBRATE\_D \quad 2.2$$

$$LCRBRATE_t = \underset{(0.02)}{0.99} LBOZDRATE_t + \underset{(0.01)}{0.05} CRBRATE\_D \quad 2.3$$

$$LCORPBRATE_t = \underset{(0.02)}{1.01} LBOZDRATE_t + \underset{(0.01)}{0.05} CORPBRATE\_D \quad 2.4$$

The pairwise results presented in the above equations find evidence of a cointegrating relationship between the BoZ and commercial bank exchange rates suggesting that they

tend toward an equilibrium position in the long-run. Given the evidence of cointegration, it implies that one exchange rate can be used to forecast or anticipate the other, creating opportunities for arbitrage. In terms of the hypothesis tested in this study, it can be concluded on the basis of evidence of cointegration that commercial banks tended to use BoZ dealing rate as a reference or benchmark in setting transaction rates. Evidence of cointegrating is stronger between the BoZ and the interbank exchange rates, where arbitrage opportunities appear to be considerable justified by higher margins shown in figure 5 above.

7. CONCLUSION

The econometric test support the view that both the BoZ and commercial bank exchange rates were cointegrated during the auction period under study and as such the former was used to predict future movements of the latter. This evidence suggests the existence of arbitrage opportunities during the auction. While the bulk of the foreign exchange was traded outside the BoZ dealing window contrary to the existing official rules, the pricing of such foreign exchange transactions in the interbank, retail and corporate sub-markets depended on the BoZ dealing (auction) rate. This results would suggest that, although not formally tested, it can be deduced from the study results that the marginal pricing probably provided an incentive for arbitrage as it generated consumer surplus to the successful bidders who later exploited this information in other sub-markets. The study results therefore suggests the success of the auction process depends on the design of the system itself with respect to the pricing or allocation mechanism that does not generate any suspicion in order to realise the intended objective.

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Appendix

APPENDIX 1. COMMERCIAL BANKS' SOURCE OF FOREIGN EXCHANGE(IN US$'000)

Date	Interbank	Bureau	Retail and Corporate	Forward	BoZ	Total
Feb-01	620.00	5.00	78,669.00	0.00	25,340.00	104,634.00
Mar-01	1,249.00	0.00	80,913.00	0.00	25,450.00	107,612.00
Apr-01	1,777.00	64.00	90,750.92	30.00	36,500.00	129,121.92
May-01	6,789.00	108.00	113,028.95	200.00	34,327.00	154,452.95
Jun-01	4,200.00	83.00	119,630.76	0.00	13,850.00	137,763.76
Jul-01	12,720.00	78.00	97,278.80	95.00	33,240.00	143,411.80
Aug-01	11,927.00	0.00	117,778.85	0.00	36,000.00	165,705.85
Sep-01	11,754.00	0.00	94,228.47	350.00	21,700.00	128,032.47
Oct-01	17,000.00	0.00	118,742.28	197.00	35,850.00	171,789.28
Nov-01	14,526.00	0.00	113,468.93	604.00	34,850.00	163,448.93
Dec-01	6,625.00	5.00	98,844.41	480.00	21,800.00	127,754.41
Jan-02	6,929.00	0.00	101,536.64	199.00	22,300.00	130,964.64
Feb-02	5,245.00	0.00	86,694.99	300.00	16,000.00	108,239.99
Mar-02	6,930.00	0.00	91,138.88	3,550.00	20,430.00	122,048.88
Apr-02	270.00	0.00	122,210.20	3,805.00	12,300.00	138,585.20
May-02	9,060.00	0.00	132,954.63	2,250.00	27,300.00	171,564.63
Jun-02	8,490.00	0.00	102,568.34	908.00	21,100.00	133,066.34
Jul-02	5,181.00	0.00	133,089.69	100.00	23,900.00	162,270.69
Aug-02	5,150.00	0.00	126,104.87	358.00	30,100.00	161,712.87
Sep-02	6,378.00	0.00	122,351.85	450.00	16,700.00	145,879.85
Oct-02	19,470.00	0.00	181,298.59	210.00	34,300.00	235,278.59
Nov-02	18,823.00	0.00	135,776.66	290.00	32,199.00	187,088.66
Dec-02	15,725.00	0.00	136,975.71	200.00	29,800.00	182,700.71
Jan-03	25,734.00	0.00	125,788.58	3,498.00	25,600.00	180,620.58
Feb-03	3,429.00	0.00	121,502.00	200.00	23,200.00	148,331.00
Mar-03	20,740.00	0.00	135,117.00	50.00	11,990.00	167,897.00
Apr-03	9,045.00	0.00	186,269.00	3,000.00	18,650.00	216,964.00
May-03	21,903.00	0.00	245,670.00	0.00	16,300.00	283,873.00
Jun-03	12,803.00	0.00	198,566.00	0.00	17,000.00	228,369.00
Total	**290,492.00**	**343.00**	**3,608,948.00**	**21,324.00**	**718,076.00**	**4,639,183.00**

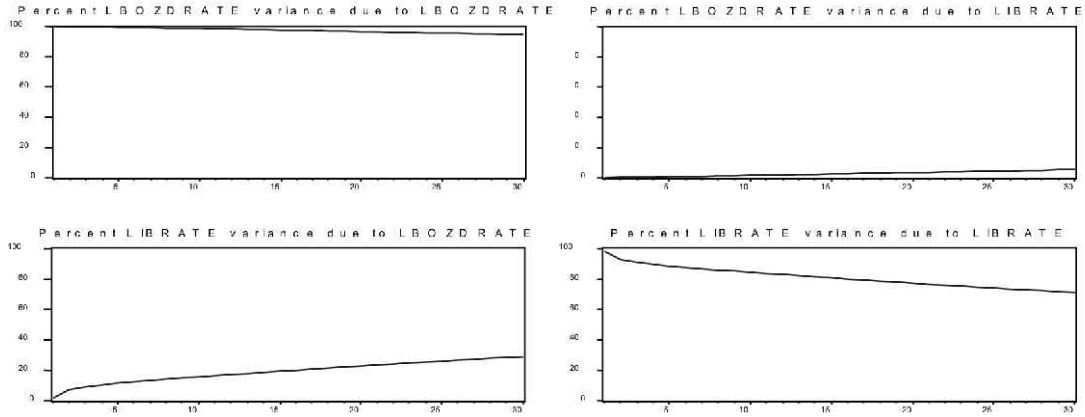
Source: BoZ Statistics Fortnightly and author computations

APPENDIX 2. DEMAND FOR FOREIGN EXCHANGE FROM BANKS (US$'000)

Date	Interbank	Bureau	Retail and Corporate	Forward	BoZ	Total
Feb-01	620.00	539.00	101,333.00	90.00	0.00	102,582.00
Mar-01	1,249.00	996.00	97,016.00	1,524.00	4,790.00	105,575.00
Apr-01	1,777.00	1,932.00	112,593.30	2,967.00	300.00	119,569.30
May-01	6,789.00	2,353.00	144,498.88	5,750.00	0.00	159,390.88
Jun-01	4,200.00	1,220.00	91,380.33	12,425.00	0.00	109,225.33
Jul-01	12,720.00	2,186.00	124,152.92	3,275.00	5,800.00	148,133.92
Aug-01	11,927.00	2,936.00	139,944.43	2,680.00	3,600.00	161,087.43
Sep-01	11,754.00	1,950.00	114,756.50	1,901.00	0.00	130,361.50
Oct-01	17,000.00	2,440.00	151,111.78	4,915.00	0.00	175,466.78
Nov-01	14,526.00	816.00	141,710.09	4,254.00	0.00	161,306.09
Dec-01	6,625.00	1,539.00	117,797.81	2,391.00	0.00	128,352.81
Jan-02	6,929.00	785.00	122,739.43	1,175.00	3,600.00	135,228.43
Feb-02	5,245.00	1,599.00	99,443.69	630.00	0.00	106,917.69
Mar-02	6,930.00	397.00	108,851.90	1,837.00	0.00	118,015.90
Apr-02	270.00	378.00	132,770.46	4,759.00	0.00	138,177.46
May-02	9,060.00	959.00	154,891.73	5,422.00	0.00	170,332.73
Jun-02	8,490.00	1,332.00	111,536.05	3,749.00	400.00	125,507.05
Jul-02	5,181.00	1,654.00	152,187.18	7,029.00	350.00	166,401.18
Aug-02	5,150.00	1,860.00	144,064.91	4,098.00	3,500.00	158,672.91
Sep-02	6,378.00	2,556.00	134,467.97	3,854.00	7,300.00	154,555.97
Oct-02	19,470.00	1,572.00	204,703.85	1,137.00	1,100.00	227,982.85
Nov-02	18,823.00	922.00	161,973.33	7,402.00	0.00	189,120.33
Dec-02	15,725.00	1,695.00	170,122.51	2,200.00	0.00	189,742.51
Jan-03	25,734.00	1,211.00	149,744.11	651.00	0.00	177,340.11
Feb-03	3,429.00	571.00	140,815.00	669.00	300.00	145,784.00
Mar-03	20,740.00	1,049.00	143,720.00	2,342.00	1,000.00	168,851.00
Apr-03	9,045.00	620.00	196,478.00	488.00	8,100.00	214,731.00
May-03	21,903.00	590.00	255,352.00	400.00	6,700.00	284,945.00
Jun-03	12,803.00	498.00	215,639.00	0.00	3,500.00	232,440.00
Total	**290,492.00**	**39,155.00**	**4,135,796.16**	**90,014.00**	**50,340.00**	**4,605,797.16**

Source: BoZ Statistics Fortnightly and author computations

Variance Decomposition



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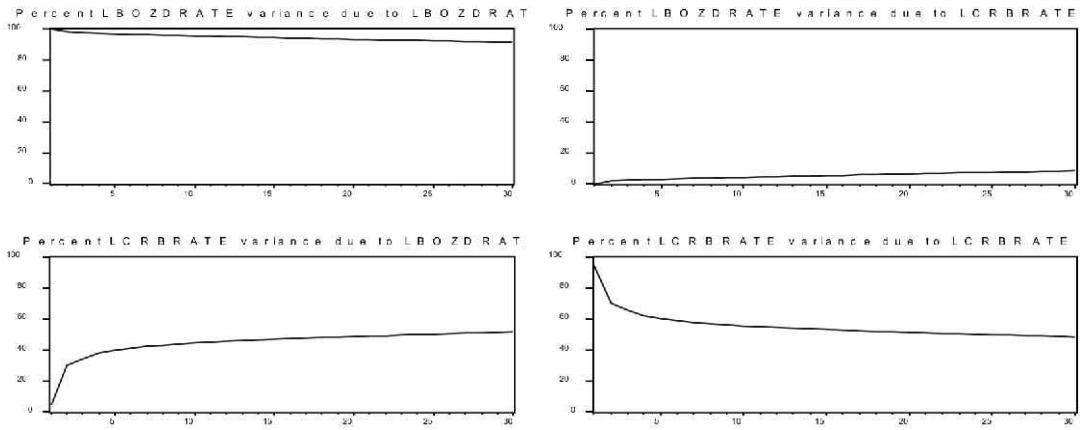

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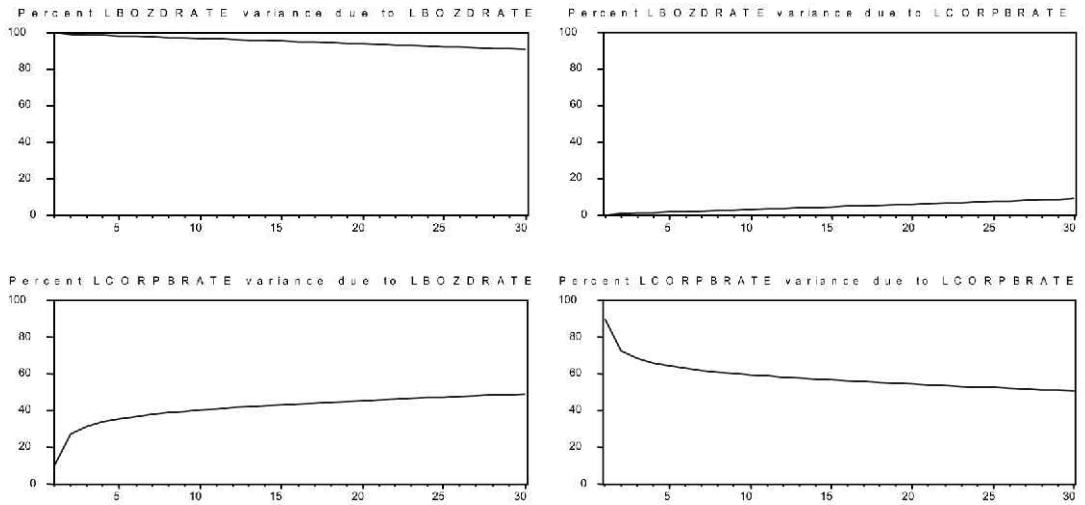
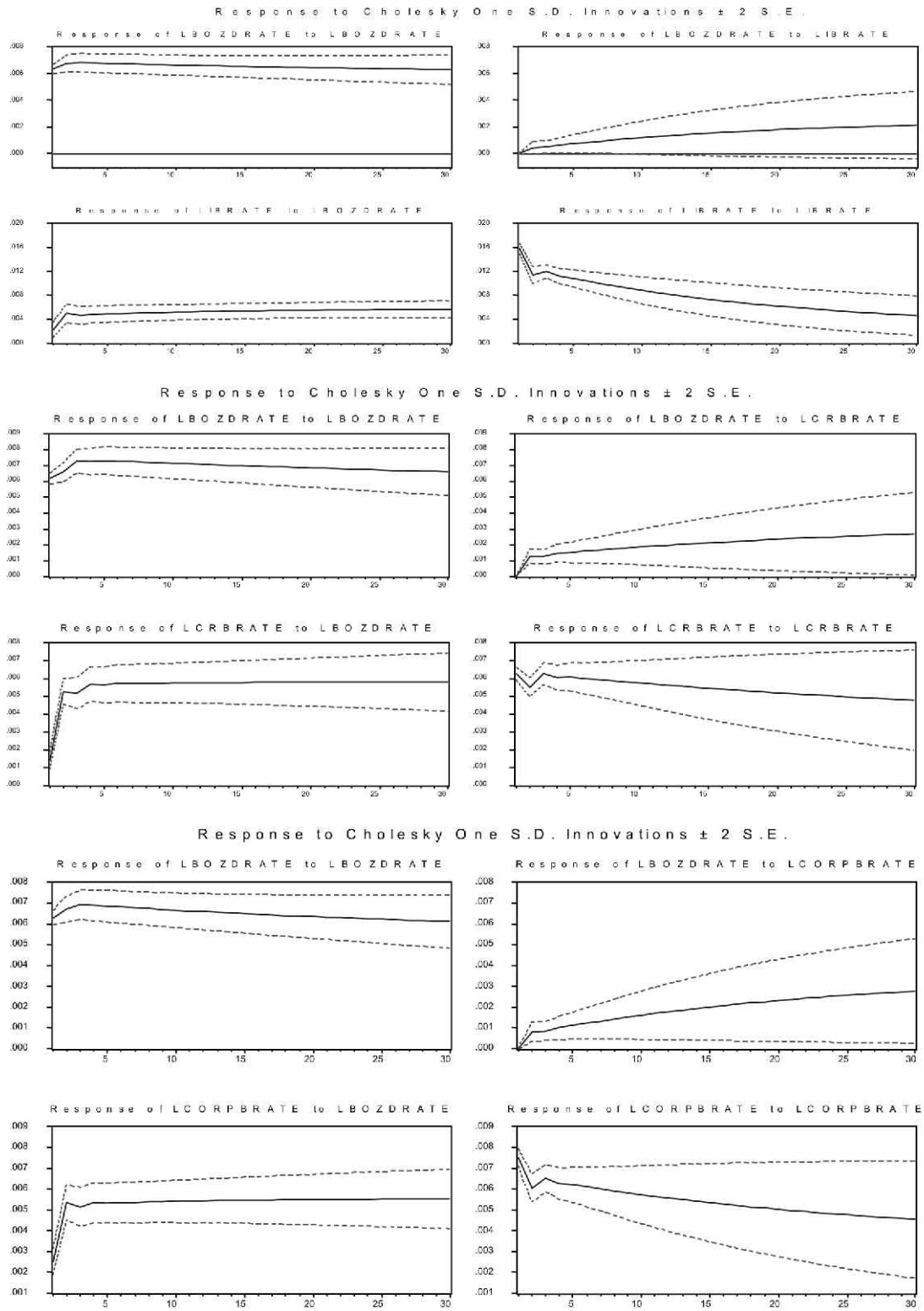


Impulse Response



CHAPTER 4

Fuzzy Analysis of the Zambian Consumer Price Index (CPI)

Chibelushi M Musongole

Abstract

In this paper, we observe that the Consumer Price Index is an aggregation of information from various consumer items. Thus the information provided by the index should be fuzzy in nature although a crisp number represents the index itself. Based on this observation, the consumer price index for the periods January 1999 to February 2004 is analysed using Fuzzy set theory techniques. The possibility distribution is computed to investigate the vagueness of the index. The coherence between the possibility distribution and the probability distribution of the index is investigated. The vagueness of the Consumer Price Index is also measured. The meaning of the Consumer Price Index numbers has been achieved via the possibility grades. The results also show that the coherence between possibility and probability is high. It is further found that the vagueness in the Consumer Price Index is small indicating that ambiguity in the movement of the CPI is minimal.

1.0 Introduction

The Consumer Price Index (CPI) compiled by the Central Statistics Office (CSO) is the official price index in Zambia. The index measures the average change in prices over time in a market basket of goods and services. Thus, it provides important information about the movement of prices in the economy. Approaches to estimate price indices have been discussed widely in the literature (Vogt and Barta 1997). The progression of the CPI may be linked to the underlying economic fundamentals. The index is shown as a crystal clear number though the information provided by the index is characterised by vagueness. The CPI is normally described using natural language using phrases such as the "change to the CPI is low" or "the change to the CPI is high", etc. These phrases constitute linguistic variables and as such are fuzzy and possibilistic in nature (Zadeh, 1978, Dubois and Prade 1988). The information summarised by linguistic variables is imprecise and intrinsic to human thinking. Thus, it can be thought that natural language, human thinking and other factors induce vagueness in the in the CPI. To our knowledge, such vagueness in the CPI has not been investigated before in Zambia.

In this paper, fuzzy logic and the possibility theory techniques are used to analyse the vagueness of the Zambian CPI data for the periods January 1999 to February 2004. The theory of possibility (Zadeh 1978) is related to the theory of fuzzy sets by defining the concept of a possibility distribution as a fuzzy restriction which acts as an elastic constraint on the values that may be assigned to a variable. The fuzzy logic and possibility theory techniques have been used in a wide range of applications. These include for example, portfolio selection (Tanaka and Guo 1999), analysis of the mood of investors (Musongole 2002), regression analysis (Kacprzyk and Feddrizzi eds, 1992) etc. In industry, fuzzy logic and possibility techniques have been used extensively as well (Yen et al. 1998, Chen and

Hwang 2000). The techniques have also been used in economic and financial problems as well as in the analysis of vagueness in expected returns (Meres and Mesiar 1999, Meres 1999). In this paper fuzzy logic and possibility theory techniques will be applied on the Zambian CPI data. The possibility distribution will be computed to reveal the meaning of the CPI to enhance understanding of price developments.

This paper consists of eight sections. After the introduction, the second section discusses the sources of vagueness and ambiguity in the CPI while in section three Fuzzy logic and Possibility theory are explained. The concept of membership function is explained in section four. A brief discussion of the possibility probability consistency is given in section five. In section six, the data used in the analysis is described. Data analysis is carried out in section seven and the possibility distribution, the possibility probability consistency and the vagueness of the CPI are computed. The findings of the analysis are also presented in section seven. The conclusion of the paper is given in the last section.

2.0 Sources of Vagueness in the CPI

In this section, sources of vagueness in the CPI are explored. The economic thinking surrounding the CPI is based on quantitative conception, and as such, the CPI is generally processed using probability techniques. The formulation of the CPI may not only depend on numerical data but also on information conveyed verbally, such as comments from government agencies, business sector, economists and other stakeholders and these induce vagueness in the CPI.

Other sources of vagueness in the CPI can be identified. For example, the use of non-exact verbal expressions in describing the CPI induces vagueness regarding the index. Vagueness also stems from the uncertain knowledge of the exact values of the index. Vagueness due to the interpretation of the meaning of the numerical values in the right context (Tano, 1999) also affects the CPI. More sources of fuzziness in the CPI include: vagueness and ambiguity in economic knowledge used in the understanding and interpretation of the CPI values, difficulty to completely grasp and describe events causing changes in the prices of commodities and changes in the items to be included in the food basket. There is also vagueness due to the interrelations between the items in the food basket. Vagueness due to the fact that the CPI concerns the movement in the average prices of all goods and services in the economy and not the movement in the relative prices of individual goods and services. A change in the price of a key good can initiate a trend in the CPI and this too induces some vagueness in the CPI. In transition economies, the structural changes and the reforms that take place from time to time and usually induce discrete adjustments in the prices of many goods and services (IMF 2004) can be sources of vagueness in the CPI. Vagueness in the CPI is also due to the not very clear relationships between taxes, the exchange rate and price levels. Clearly, the CPI is characterised by vagueness. Such vagueness is modeled by fuzzy set theory (Zadeh 1965, Dubois and Prade 1998, 1991, Mesiar 1996) and this paper attempts to do that.

3.0 Fuzzy Logic and Possibility Theory

In this section, the concepts of fuzzy logic and possibility theory are described in general terms. Zadeh (1965) introduced fuzzy set theory to translate mental representations into

computable entities to deal with some limitations of the traditional models. The theory of possibility (Zadeh 1978) is related to the theory of fuzzy sets by defining the concept of a possibility distribution as a fuzzy restriction which acts as an elastic constraint on the values that may be assigned to a variable. Possibility theory deals with forms of uncertainty which are not probabilistic in nature. That is, it deals with the possible rather than the probable variables with possibility being a matter of degree (Zadeh 1978, Dubois and Prade 1988, Tanako and Guo 1999).

3.1 Definition of Possibility Distributions

Possibility can be interpreted in terms of physical or epistemic i.e. subjective judgment (Dubois and Prade 1988) and it may also be understood as fuzziness and lacking specificity (Yager, 1986). In possibility theory, fuzzy variables are associated with possibility distributions in much the same way as random variables are associated with probability distributions. Possibility distributions are applied to data analysis where the problem is to deal with uncertainty due to subjective belief rather than randomness.

The fuzzy concept of a possibility distribution (Zadeh, 1978) is appreciated once the notion of membership function is understood. The definition of a membership function is given as:

Definition 1: *A fuzzy set (Zadeh, 1965) F in a given set U is characterised by a membership function which associates with each point u in U a real number in the interval [0,1], with the value representing the grade of membership of u in F.*

The concept of possibility distribution bears close relation to the concept of fuzzy restriction (Zadeh 1978a). Let *X* be a variable which takes values in a finite set *U* and suppose we have fuzzy information about the values of *X*, that is a fuzzy restriction "*X is F*", where *F* is a fuzzy subset of *U*. In this situation the fuzzy information is associated with a possibility distribution which coincides with the membership function of *F* (Moral 1986). According to Zadeh (1978a) a formal definition of a possibility distribution is given as:

Definition 2: Let be a fuzzy subset of a universe of discourse $U = \{u\}$ which is characterised by its membership function, μ_F with a grade of membership, $\mu_F(u)$ interpreted as the compatibility of *u* with the concept labeled *F*. Let *X* be a variable taking values from *U*, and let F act as a fuzzy restriction, *R(X)*. Then the proposition *"X is F"*, which translates into

$$R(X) = F \qquad 1$$

associates a possibility distribution, , with *X* which is postulated to be equal to *R(X),* i.e.

$$\Pi_x = R(X) \qquad 2$$

Correspondingly, the possibility distribution function associated with *X* (or the possibility distribution function distribution of Π_x) is denoted by π_X and is defined to be numerically equal to membership function of *F* i.e.

$$\pi_X = \mu_F \qquad 3$$

Thus, $\mu_F(u)$, the possibility that $\mu_F(u)$, is postulated to be equal to $\mu_F(u)$. And $\mu_F(u)$ is interpreted as the degree to which the constraint represented by *F* is satisfied when *u* is

assigned to *X*. Equivalently 1 - $\mu_F(u)$ is the degree to which the constraint in question must be stretched in order to allow the assignment of *u* to *X*.

If $A(X)$ is an implied attribute of taking values in , then is written

$$R(A(X)) = F \qquad 4$$

In this paper, the procedure used to compute the possibility distribution of the CPI is based on extracting membership functions from a histogram and is given as follows:

Let the $w_i's$ be reordered such that $p_1 \geq p_2 \geq \ldots \geq p_n$ and

$$A_j = \{w_1, w_2, \ldots, w_n\} \text{ For } j = 1,\ldots,n; \; A_0 = \varnothing \; .$$

The possibility distribution of is such that the are computed by

$$\pi_i = \sum_{k=1}^{n} \min(p_i, p), \quad i = 1,2,\ldots,n \qquad 5$$

A detailed exposition of the procedure is given in Dubois and Prade (1983, 1986, 1988).

4.0 Membership Function

In this section, the membership function of a fuzzy set is described. The membership function is pivotal in the analysis of vagueness or fuzzy sets. The definition of the membership function is given in Zadeh (1965) as follows:

Define the indicator function

$$I_A = \begin{cases} 1 \; for \; x \in A \\ 0 \; for \; x \notin A \end{cases} \qquad 6$$

of a crisp set *A* assigning a value of either 1 or 0 to each individual in the universal set, thereby discriminating between members and non-members of the crisp set under consideration. This function can be generalised such that the value assigned to elements of the universal set fall within a specified range and indicate the membership grade of these elements in the set in question. Such a function is called a membership function and the set defined by it a fuzzy set.

Let *X* denote a universal set. Then, the membership function by which a fuzzy set *A* is usually defined has the form

$$\mu_A : X \rightarrow [0,1], \qquad 7$$

where [0,1] denotes the interval of real numbers from 0 to 1 inclusive.

Informally, fuzzy sets are equated with their membership functions. When *X* is finite, say,

$X = \{x_1, x_2, \ldots, x_n\}$, a fuzzy set is written as $A \subseteq X$

$$A = \frac{\mu_A(x_1)}{x_1} + \frac{\mu_A(x_2)}{x_2} + \cdots + \frac{\mu_A(x_n)}{x_n} \qquad 8$$

where, + is meant in the set-theoretical sense (Zadeh 1973, Kacprzyk 1986).

The process of generating a membership function varies from situation to situation. The membership functions generating techniques are discussed widely in the literature (Nowakowska 1977, Zadeh 1978a, 1978b, Dubois and Prade 1980, Civanlar and Trussel 1986, Klir and Folger 1988, Zimmermann 1991, Ramer and Kreinovich 1994, Mares and Mesiar 1999, Tanaka and Guo 1999).

5.0 Possibility Probability Consistency

In order to measure coherence between randomness and vagueness, possibility probability consistency is used. The possibility probability consistency is defined by Zadeh (1978). If a variable can take the values $w_1,...,w_n$ with respective possibility $\Pi = (\pi_1, \pi_2, ..., \pi_n)$ and probability distribution $P = (p_1, p_2, ..., p_n)$ then the degree of consistency of the possibility distribution Π with the probability distribution P is expressed by

$$\lambda = \sum_{i=1}^{n} \pi_i p_i \qquad 9$$

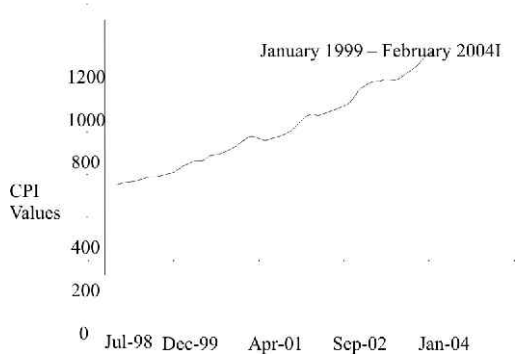
It is also described as the coherence between information provided by the possibility distribution, Π and the probability distribution P (Moral 1986).

In this paper, in order to measure the coherence between subject belief and probability of the events about the CPI, the possibility probability consistency will be computed.

6.0 Data

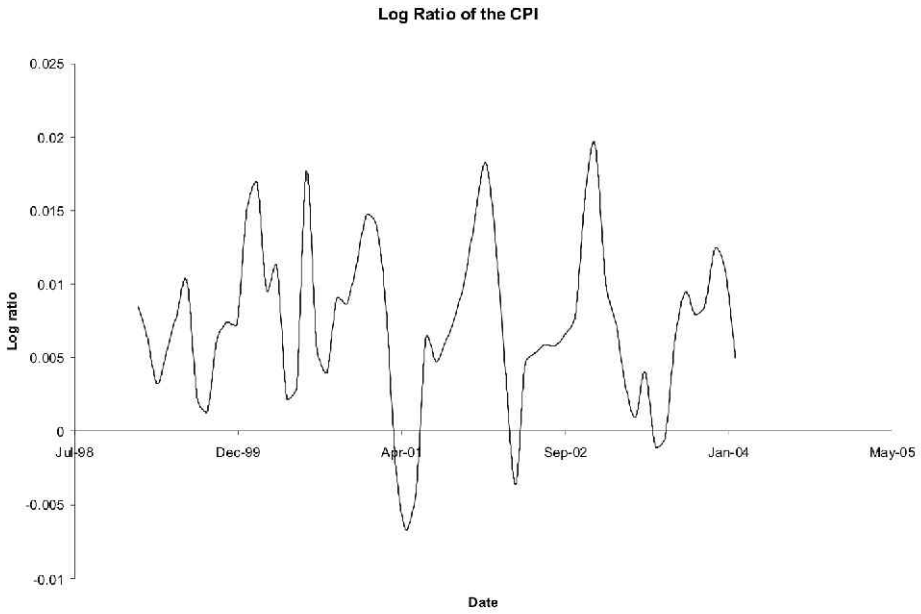
In this section, the data used in the analysis is described. Figure 1 shows the plot for the CPI data for the period January 1999 to February 2004. The graph shows some interesting features. The CPI shows an upward trend over the data period.

***FIGURE 1**: CPI PLOT FOR THE PERIODS JANUARY 1999 TO FEBRUARY 2004*



In order to remove the trend characterizing the CPI data, the log ratio i.e. $u_t = \log\left(\frac{S_t}{S_{t-1}}\right)$ of the data is computed. is the CPI at time *t*. Figure 2 shows the plot of the log ratio of the CPI u_t. The graph shows no visible trend as expected from the log ratio.

***FIGURE.2**: PLOT OF THE CPI LOG RATIO FOR JANUARY 1999 TO FEBRUARY 2004*



6.1 Frequency distribution table of the CPI log ratio

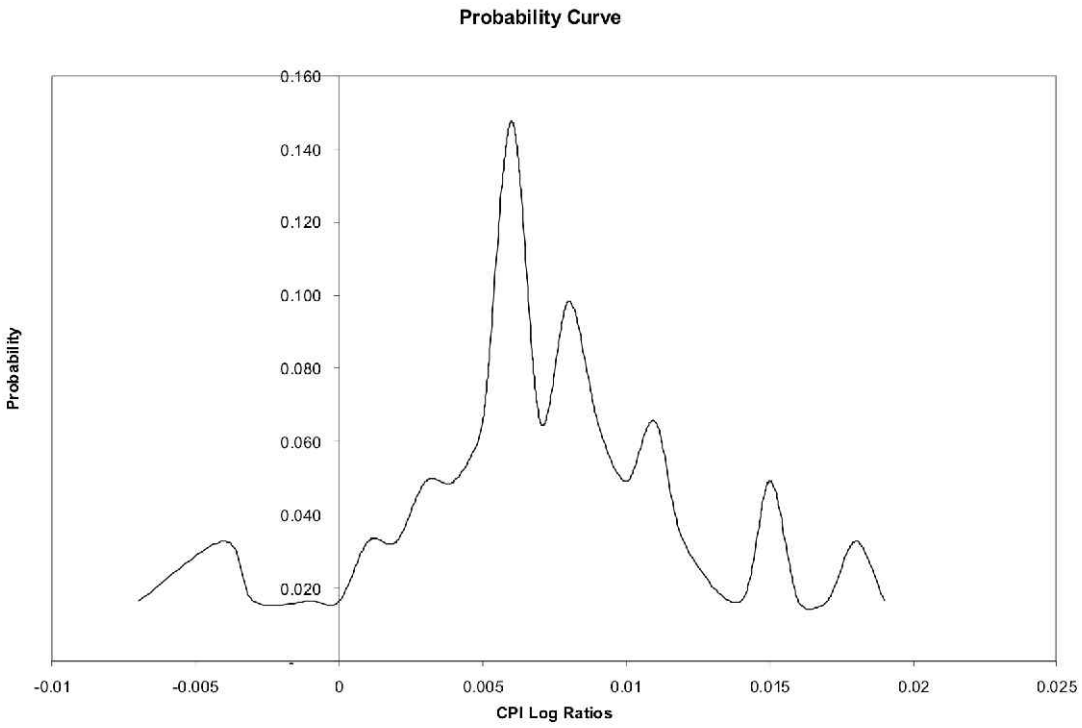
The following Table 1 gives the probability frequency distribution of the log ratio data from which the possibility distribution is computed. In the table, X is the log ratio (u_t), F the frequency and P the probability

***TABLE 1:** FREQUENCY TABLE FOR THE LOG RATION IF THE CP*

X	*F*	Probability *P*
-0.007	1	0.016
-0.004	2	0.033
-0.003	1	0.016
-0.001	1	0.016
0	1	0.016
0.001	2	0.033
0.002	2	0.033
0.003	3	0.049
0.004	3	0.049
0.005	4	0.066
0.006	9	0.148
0.007	4	0.066
0.008	6	0.098
0.009	4	0.066
0.010	3	0.049
0.011	4	0.066
0.012	2	0.033
0.014	1	0.016
0.015	3	0.049
0.016	1	0.016
0.017	1	0.016
0.018	2	0.033
0.019	1	0.016

The plot of the log ratio probability distribution is shown in Figure 3

FIGURE 3: *PROBABILITY CURVE OF THE CPI LOG RATIOS*



7.0 Data Analysis

In this section, the possibility distribution, possibility-probability consistency and the fuzziness of the CPI are computed.

7.1 The possibility distribution

The possibility distribution of the CPI log ratio data is computed using equation (5) as:

$$\Pi_{CPI} = \frac{.38}{-.007} + \frac{.62}{-.004} + \frac{.38}{-.003} + \frac{.38}{-.001} + \frac{.38}{0} + \frac{.62}{.001} + \frac{.62}{.002} + \frac{.79}{.003} + \frac{.79}{.004} + \frac{.89}{.005}$$

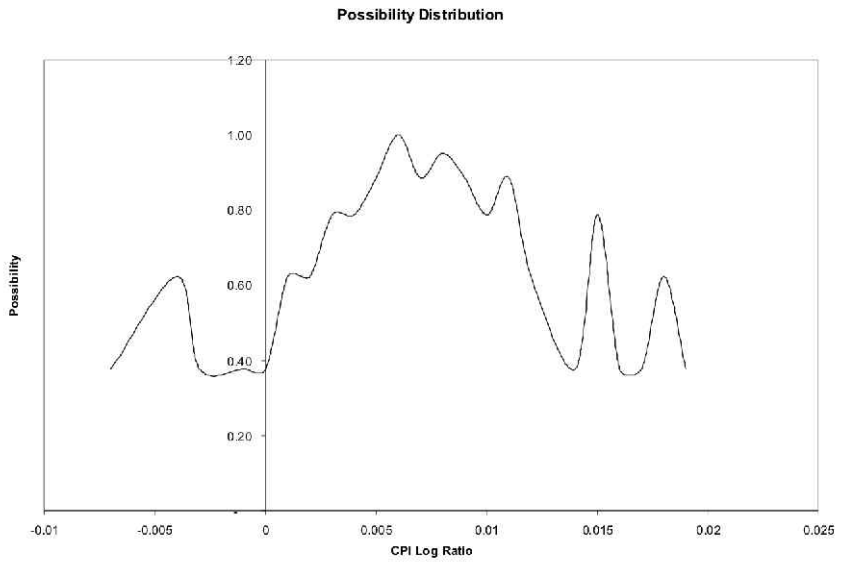
$$+ \frac{1}{.006} + \frac{.89}{.007} + \frac{.95}{.008} + \frac{.89}{.009} + \frac{.79}{.01} + \frac{.89}{.011} + \frac{.62}{.012} + \frac{.38}{.014} + \frac{.79}{.015} + \frac{.38}{.016} + \frac{.38}{.017}$$

$$+ \frac{.62}{.018} + \frac{.38}{.019}$$

The possibility distribution gives the degree of possibility of each CPI value. The results of the computed possibility distribution show that the possibility grades of the log ratios of the CPI are not the same. This shows that the subjective beliefs about the numbers and meaning differ for different CPI numbers.

The possibility distribution plot for the CPI log ratio is given in Figure 4.

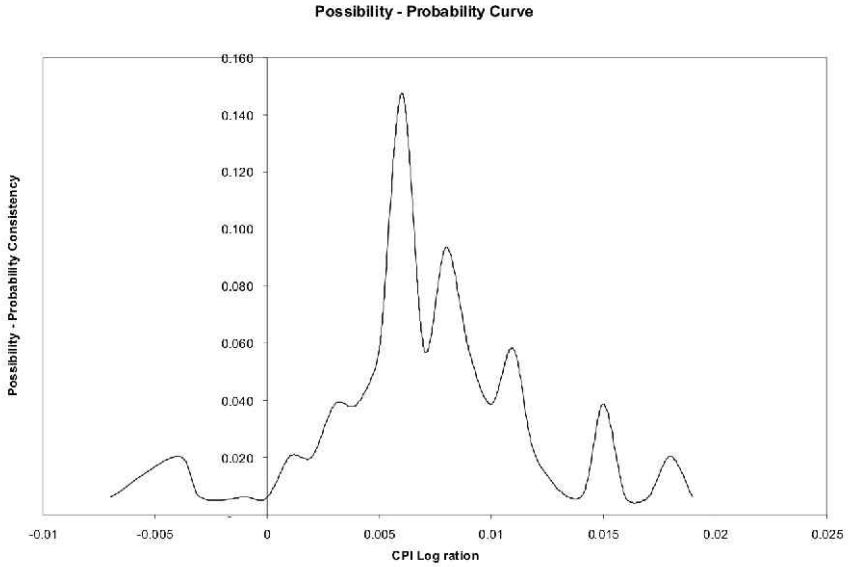
***FIGURE 4**: POSSIBILITY DISTRIBUTION CURVE FOR THE CPI LOG RATIOS*



7.2 Possibility Probability Consistent

The possibility probability consistent is computed to measure the coherence between subjective belief and randomness of the CPI. Using the equation for the possibility probability consistent the computed value for the CPI is 0.78. This implies that there is high coherence between the subjective belief and the random occurrence of events of the index. The individual $\pi_i p_i$ values are plotted in Figure 5.

***FIGURE 5:** PLOT OF THE INDIVIDUAL POSSIBILITY-PROBABILITY CONSISTENCY VALUES*



7.3 Fuzziness of the CPI

In order to investigate how obscure the CPI can be, the fuzziness of the CPI is measured. The measure of the fuzziness is given by the area under the possibility distribution graph (Tanaka and Guo 1999). The estimated area under the possibility distribution curve given in Figure 7.1 is approximately 0.018 square units. This area is relatively small. This implies that the difficulty to understand the movement of the CPI is little. This only applies for the series of the CPI used in this study.

8.0 Conclusion

In this study, the possibility distribution of the Zambian CPI from January 1999 to February 2004 has been computed. The distribution gives the degree of easy with which the CPI values may occur. The possibility distribution also gives meaning to the CPI. The study also reveals a high coherence between information provided by possibility distribution and the probability distribution of the CPI. The fuzziness of the CPI was approximated by measuring the area under the possibility distribution. The approximated area was small indicating that ambiguity in the movement of the CPI is minimal. This may indicate that factors affecting the movement of the CPI are known and understood.

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Learning and the Failure to Learn in Development Cooperation

Caleb Fundanga[7]

1. Where We Are Today

Aid or development co-operation as it is known today finds its origins in the Post Second World War period. The United States of America under its Marshall plan transferred a lot of capital to Europe to help in the reconstruction of war-torn countries there. The success of the Marshall plan led to the creation of the International Bank for Reconstruction and Development (now commonly known as the World Bank) whose initial objective was the reconstruction of war-torn Europe but which later assumed the role of principal channel of development resources to the developing world.

The apparent success of intervention in Europe must have led to the general belief that the channelling of resources along similar lines to countries of the Third World would achieve the same positive results. This was not to be. With the change in the direction of flow of resources it also became apparent that apart from shortage of capital, Third World countries were also terribly short of skilled human resources.

For the capital being transferred to become productive it had to be accompanied by skilled manpower from donor countries and development institutions. For instance, Germany transformed its devastated economy into "the Germany wonder" because it had all the technical manpower it required. The Third World and Africa in particular did not. The need to transfer skills as part of the aid process led to the creation of a "cadre of development experts". In 1988 I had this to say about this development:

> "This approach, which started only as a trickle has now developed into a flood as more countries and institutions have jumped on the Aid Band-Wagon. Due to the large number of participating countries and institutions, it has now become even necessary for each participant to let known which country or institution they originate from by indication on their vehicles or gates of their homes the name of their donor agency. It is as if each institution is showing off".[8]

This process regrettably often leads to endangering the lives of the same experts. The writing of names of donor agencies on the entrances for homes of experts often attracts the attention of thieves who raid their homes to take away valuables that are often associated with highly paid expatriate staff. This process may also be reducing development co-operation to something like selling Coca-Cola, which involves a lot of expenditure on media adverts. Recently a number of international development agencies have started placing advertisements on television.

[7]The views expressed in this paper are personal and do not in anyway reflect the official views of my current and past employers.
[8] Fundanga C.M "Some Aspects of the Economics of Donor Assistance" paper presented at the Nordic Seminar 1988, Lusaka.

Donor assistance or development assistance, which is also called official aid, consists of loans and grants from government institutions (bilateral aid) and loans and grants from international agencies (multilateral aid). Hayter (1981) noted that relative to private capital flows, official aid is mainly provided in the form of loans, usually at relatively low rates of interest, for specific projects the money is usually tied. Since the time of the Marshall plan a lot of resources have been transferred to the less developed countries. From the bilateral donor side a number of countries that were initially recipients of aid are now donors. Countries like Japan, for example, which originally used to borrow from the World Bank, are today its major financiers but by and large the main donors have principally been confined to Europe and North America with Japan, South Korea and China joining. Africa unfortunately has remained the principal recipient of donor resources.

Appendix 1, which shows net financial flows to developing countries by source from 1985 to 1997, confirms this pattern. The US followed by Japan, Germany, France and UK in that order, are the major donors. Over the same period the World Bank with its affiliates was by far the largest multilateral conduit for development finance followed by the European Development Fund and the Asia Development Bank (see appendix 2). Hayter (1981) noted that official aid constituted about a third of the total flow of capital to underdeveloped countries. The other two thirds consisted mainly of private Bank Loans, direct investment and private export credits. Unfortunately Africa got a very small portion of these resources which in most cases are autonomous capital flows and therefore non-debt creating. Instead it relied on official aid with its attendant conditionalities. Table 1 below shows an aggregate net resource flows to developing countries. It shows that while dependence on official flows or aid by developing countries as a whole was roughly 20.57% or one fifth of aggregate net resource flows per annum between 1992 and 1996, this dependence was much higher for low-income countries at 67.69%. Within this group the severely indebted low-income countries were dependent on official flows by 80.18% as compared to 50.33% for the moderately indebted low-income countries.

TABLE 1. AGGREGATE NET RESOURCE FLOWS (LONG TERM) (MILLION US$) ANNUAL AVERAGE 1992-96

GROUP OF COUNTRIES	AGG.NET RESOURCE FLOWS	FOREIGN DIRECT INVESTMENTS	PORTFOLIO EQUITY	BONDS	BANK AND TRADE RELATED LENDING	OFFICIAL FLOWS (INCLUDING GRANTS)
Low Income	34,147	6,034	3,607	173	1,218	23,115
Severely indebted low-income	17,609	3,383	397	74	- 363	14,119
Moderately indebted low-income	14,710	2,498	3,210	100	1,493	7,404
Middle income	197,726	80,660	33,417	32,824	26,133	24,693
Severely indebted middle income	45,687	14,671	10,204	9,551	6,512	4,750
Moderately indebted middle-income	43,935	17,597	7,176	9,669	7,222	2,270
All developing	231,753	86,694	37,024	32,997	27,350	47,688

Source: World Bank: Global Development Finance, country tables, 1999

Although it is common to mourn about the dwindling donor budgets, it is also important to accept that already a lot of resources have been transferred to the poor countries. While some evidence of human progress is discernible in a number of corners of the World, it is also increasingly being admitted that many parts of the globe, unfortunately, may not be progressing at all, especially in Africa where even at the dawn of the new millennium there are perhaps more Africans without food than there were some thirty to forty years ago. With

the on-slaught of the AIDS pandemic, the life expectancy in a number of African countries has fallen rapidly to levels far below what it used to be some ten to twenty years ago. These are happening in spite of the enormous gains made in food production through the Asian Green revolution and the huge gains made in medical science in recent decades. This has led some people to refer to "AID" as Acquired Immunity to Development[4]. Can't Africa's development learn from the successes elsewhere?

Indeed, the persistence of poverty, in spite of development assistance has led some people to harbour statements similar to the ones expressed in the Economist magazine of 11th September 1999 in an article entitled " Free to be poor" which states thus:

> "the dirty truth is that people in the west worry more about the poor becoming rich and competing with them than the poor staying poor. One reason for this, though misconceived, is understandable, however: the fear that economic growth in the poor countries means a dirtier world".

This view is sometimes reinforced by the protectionism of some developed countries. There are still a number of countries that hinder free trade in those goods where developing countries hold comparative advantage.

In the rest of this paper, we argue that while opportunities for learning are abound and while efforts to share knowledge have been made as well as the infrastructure for learning created, we do not seem to be getting the right lessons. While some thirty years ago African Ministers of Finance were globe trotting contracting loans aimed at ushering their newly independent countries into the golden age, today many of the same ministers are visiting the same capitals pleading to be forgiven from repaying the same loans. Today the struggle to cancel third world debt has reached such a critical stage that some advocates of debt cancellation are equating the struggle to that launched to end slavery many years ago.

2. The Key Players

Development co-operation as discussed involves bilateral and multilateral donors and the recipient countries. Each of these plays a crucial role and their interaction as well as how they learn from each other could have important consequences to the outcome of the co-operation. Each of these is examined in detail below.

2.1 Bilateral Donors

Individually the donor countries are key in the delivery of aid. Although this may not be very obvious in the case of relatively small players like Ireland it is very obvious for big players like USA. While donor countries may appear to operate individually in their interaction with recipient countries their actions are in fact well co-ordinated through the Organisation of Economic Co-operation and Development (OECD) (see Table 2). The OECD has been called a think tank, monitoring agency, rich man's club, an unacademic university. The OECD is a club of like-minded countries. It is rich, in that OECD countries produce two thirds of the world's goods and services. The OECD groups 29 member countries in an organisation that, most importantly provides governments a setting in which to discuss, develop and perfect economic and societal policy. (OECD)

[4] Term coined by Rosario Fundanga (Source)

TABLE 2: MEMBERS OF OECD YEAR OF ENTRY

Australia	1971	Austria	1961	Belgium	1961
Canada	1961	Czech Rep.	1995	Denmark	1961
Finland	1969	France	1961	Germany	1961
Greece	1961	Hungary	1961	Iceland	1961
Ireland	1961	Italy	1961	Japan	1964
Korea	1996	Luxembourg	1961	Mexico	1994
The Netherlands	1961	New Zealand	1973	Norway	1961
Poland	1996	Portugal	1961	Spain	1961
Sweden	1961	Switzerland	1961	Turkey	1961
United Kingdom	1961	United States	1961		

Source: OECD website

With a workforce of over 1,800 mainly professional staff the OECD is an intellectual powerhouse.

The OECD operates through various committees that report to its council. The Development Assistance Committee (DAC) handles development issues. By the admission of OECD itself, DAC is an influential committee whose distinct features are that:

(i) It meets more frequently than other committees (at least 15 times a year) and the chair of DAC is full time at OECD;

(ii) It has the power to make recommendations in matters within its competence directly to countries on the committee as well as to the council and

(iii) The Chair issues an annual report on its efforts and policies of DAC members. This report has become a standard reference in the field of development co-operation.

In fact if one were to follow the evolution of major policy initiatives in the field of development in recent times, one inevitably will find their origins at DAC. Issues such as governance, environment and gender for example were all hatched at DAC[6]. Bilateral and multilateral donors all develop their own policies on the basis of ideas originating from OECD. The dominant economic influence of OECD members in all institutions dealing with economic and financial issues guarantees that whatever they decide must be followed by everyone else. Through this power, OECD can be a tool for positive learning. Its power can be used to influence many good decisions and therefore help to steer world development in the right direction. This same power can have devastating consequences if not properly used.

This collective and co-operative approach to dealing with development co-operation issues can be contrasted to earlier perceptions of bilateral assistance. In the earlier days, aid was seen as an instrument for global domination and/or the maintenance of colonial dominance. The British, French, Portuguese and Spanish channelled their aid to former colonies while the Americans who were without colonial territories sought to conquer new lands with their ideology and dollars. Hayter (1981) has provided a number of quotations, which tend to reinforce this view of the objectives of American aid:

[6] DAC's influence in the development of Governance policy can be discerned from the following documents: DAC, (1993) Orientation on participatory development and Good Governance;World Bank (1994) Governance: the World Bank experience; andIMF (1996) The Role of the Fund in Governance issues.

(a) The former President of the World Bank, Mr. Eugene Black, drumming up support for aid in the 1950s, said:

> "Our aid programmes constitute a distinct benefit to American business. The three benefits are:
>
> (i) Foreign aid provides a substantial and immediate market for United States goods and services.
>
> (ii) Foreign aid stimulates the development of new overseas markets for United States companies
>
> (iii) Foreign aid orients national economies towards the free enterprise system in which United States firms can prosper.

(b) President Kennedy (1961) said the following about aid:

> "Foreign aid is a method by which the United States maintains a position of influence and control around the world and sustains a good many countries, which would definitely collapse or pass into the communist block".

(c) President Nixon during the 1968 Presidential campaign said:

> "Let us remember that the main purpose of American aid is not to help other nations but help ourselves".

(d) Senator Hubert Humphrey later Vice President of USA in 1957 said:

> "I have heard that people may become dependent on us for food. I know that was not supposed to be good news. To me, that was good news, because before people can do anything they have got to eat. And if you are looking for a way to get people to lean on you and be dependent on you, in terms of their co-operation with you, it seems to me that food dependence would be terrific".

(e) On the same issue of food the Central Intelligence Agency (CIA) office of Political Research are quoted to have said:

> "In a cooler and therefore hungrier world, the United States near monopoly as a food exporter could give the United States a measure of power it never had before. Possibly an economic and political dominance greater than that of the immediate post World War II period. Washington could acquire virtual life and death power over the fate of multitudes of the needy".

While the five views are all from the USA, they do raise a lot of concerns about the motives of aid in those early days. The views also reflect the thinking of a global power player at the height of the cold war. Were the other aid givers moved by the same motives? As we have already noted above, former colonial powers still had ambitions of maintaining their traditional territories of influence. What is not clear is whether the new donors, especially the Nordic countries could have been similarly influenced in those early days. Fundanga (1988) observed:

> "Being non-colonial and small nations Nordic countries are not involved in the global power game and therefore their aid could be said to be free from world domination motivations of the big powers. Nordic aid is targeted at critical sectors such as agriculture, education and health. These are the sectors of great need and further, the projects themselves service the needs of the poor. In the area of import support there has been no tying of aid to Nordic sources of supply. In fact, Nordic companies have to struggle to obtain foreign

> exchange at the time when Nordic countries are providing considerable foreign exchange support. Nordic import support has in fact been used to good cause in the struggle against racist South Africa through the conditionality that import support funds may not be used to import goods from racist South Africa".

At that time, the biggest threat to Nordic aid policy was their membership in International Financial Institutions whose policies may have not been as sympathetic as those of the Nordic countries. This threat was evidenced by the fact that Nordic countries were coming under increasing pressure to reduce financial assistance to Zambia which had just announced a go alone economic policy. The Nordic countries agreed with Zambia's complaint that its debt burden was too heavy to be serviced normally. The Zambian argument, which was heretic at the time is today the basis for the Highly Indebted Poor Countries (HIPC) Debt Initiative.

Although, thanks to OECD and DAC, we can say that international action in the field of development co-operation is now less identified with global and colonial ambitions, we are perhaps still far from resolving this problem. For example, when we examine the tables of recipients of aid from each major donor in appendix 3, it is very difficult to find a rational criterion which determines why the USA gives its highest aid to one country and France gives its highest aid to another.

The tables in appendix 3 reveal some interesting information. Tanzania for example tops the lists of Finland, Denmark, Netherlands, Norway, Sweden and comes second on the tables of UK and Canada but fails to make it amongst the first ten recipients on the table for USA and France. Egypt is on the top of the tables for USA, German, Japan and Canada. Although this might make it look like number 2 to Tanzania, in reality the amount of money from the USA to Egypt alone dwarfs all what Tanzania receives from all the countries that give it number 1 ranking. It is also important to observe that the top ten recipients of French aid are French speaking countries, the majority of recipients of British aid are English speaking while the top five recipients of Portuguese aid are former colonies of Portugal.

2.2 MULTILATERAL DONORS

There are two types of Multilateral donors - multilateral Development Banks (MDBs) and United Nations agencies:

IBRD	-	International Banking for Reconstruction and Development
IDA	-	International Development Association
IMF	-	International Monetary Fund
AfDB	-	African Development Bank
AfDF	-	African Development Fund
AsDB	-	Asian Development Bank
AsDF	-	Asian Development Fund
EBRD	-	European Bank for Reconstruction and Development
EDF	-	European Development Fund
IDB	-	Inter-American Development Bank
IFC	-	International Finance Corporation

The second group of multilaterals consists mainly of United Nations agencies such as:

UNDP	-	United Nations Development Programme;
WFP	-	World Food Programme; and
UNHCR	-	United Nations High Commission for Refugees.

United Nations agencies are not financial institutions as such but specialised international agencies through which technical assistance to developing countries is channelled. For our purpose, however, we will concentrate our analysis on the Multilateral Development Banks but without loosing sight of the fact that the activities of the other multilaterals are important to the development process.

Mistry[9] has characterised MDBs as "the Premier, Specialised long term lending intermediaries for developing countries at global and regional levels. Structurally they usually comprise a core bank or hard window with a number of affiliates attached (e.g. soft loan window, private sector financing arm, and guarantee agencies)."

In terms of hierarchy the World Bank and IMF, commonly known as the Bretton Woods institutions are at the top of the MDBs and the regional Banks often look to these institutions for guidance. Over the years the IMF and World Bank's operations have converged as the IMF's role in the policy area has increasingly become recognised as primordial for any meaningful development to take place. Today it is not possible for any developing country to receive credits from any of the MDBs if the IMF has not given a seal of approval to its development policy framework. The key to understanding the functioning of MDBs is through their ownership structures.

The MDBs are owned by governments, which hold shares in each one of them. By and large the size of shareholding is determined by a formula which takes into account the economic size of each country. The soft loan windows operate on resources provided mainly by OECD countries. Contributions are determined by a cost sharing formula which is again based on economic size. On this account, OECD members exercise greater influence in all these organisations and by extension decisions made at OECD and DAC in particular are the critical determinants of policy. The only MDB, in which OECD members did not predominate was AfDB. However, but even there recent changes in the capital structure suggest that this Bank is also moving in a similar direction. During the negotiations for the fifth General Capital Increase, AfDB agreed to increase the shareholding of non-African shareholders (mainly OECD) from 33.33% to 40%. Although this change is good from the point of view of enhancement of the bank's capacity to raise capital from the capital markets some regional members initially opposed it as they saw the move as reducing the "African Character" of the bank.

Since the main contributors of resources to MBDs also happen to be the largest bilateral donors, questions have been raised about the motivation of these contributions. MDBs are certainly big business and they serve as a direct link between the sophisticated capital markets and the poor peasants in remote parts of the world. The raising of development resources by MDBs through Bond issues in the financial capitals of the rich countries is an activity that is so advanced that one would not remotely connect it to assistance to poor villagers in Africa. This activity on its own represents a lot of business to finance houses and experts in developed countries and is an activity in which developing countries provide no competition. Most important, however, is that MDBs provide numerous opportunities for procurement of goods and services on all the loans given to borrowing member countries.

[9] Percy S. Mistry (1995) Multilateral Development Banks, FONDAD. P 1

This is where the real benefits of participating in the financing of these institutions lies. The principal beneficiaries of all MDBs are USA, Germany, France, UK, Japan and other OECD members. Even the provision of services such as audits, are all monopolised by these countries. In looking at Canada's benefits from membership of MDBs (Canada is the only country with a seat on the Executive Board of all MDBs), Calpeper (1998) takes procurement per dollar contributed to each Bank as a benchmark. He has calculated that during the period 1986-91 Canadian firms obtained $1.17 at the World Bank and $1.53 at the Inter American Development Bank. This compared to the return of $0.75 from Canada's highly tied bilateral aid program. Thus, it can be seen that doing business through MDBs is even more profitable than doing business through bilateral aid. Countries that are more active in procurement such as USA, France, UK and Germany are most likely benefiting even more than Canada.

The need to benefit from MDBs through procurement has not been lost even to those countries regarded as well intentioned such as Sweden. Rudengren et al (1998) have noted that one of Sweden's main motives for joining the regional banks has been to gain access to procurement opportunities of their development projects. They note that it has done well supplying goods in IDB and AsDB and in procuring contracts with the IDB. A worrying phenomenon in the way developed countries seek to influence their business with MDBs relates to how they use bilateral funds, which they grant to MDBs. Although these funds are relatively small in volume their application could have implications for the way the general funds of these institutions are used in the long run. Typically the countries donating them control these funds. While the developed countries have been the strongest advocates for the application of "International competitive bidding" procedures in all procurements of MDBs, they have mostly preferred to restrict competition to firms from their countries when it came to the use of bilateral funds. This application of double standards has distorted procurement standards at many MDBs. Sometimes these bilateral funds have been used to push nationals of developed countries into jobs at MDBs. Staff seconded to MDBs as experts and paid for from bilateral funds come mainly from the countries providing the funds and are not subject to normal recruitment procedures. A large part of bilateral funds to MDBs are used for various studies required in these institutions. The use of companies or individuals from countries providing the funds has the danger that recommendations arising from these studies are likely to favour processes, methods and/or technologies from the countries funding the studies. This could constitute one clever way of cornering future MDB business.

The MDBs today provide some of the best institutions for sharing of knowledge. While the IMF has traditionally been secretive in its operations, a practise that is now being broken, the World Bank has been more open. Its publications have provided valuable insights into development work. More recent publications such as "Findings" and "Indigenous Knowledge Notes" have been very helpful in the dissemination of "best practice" in various fields. Increasing collaboration between the World Bank and regional MDBs is also helping these institutions to learn from each other. Sharing of information even on such issues as which countries are in arrears on loan repayment, for example, is also helping the smaller MDBs in particular, to improve their financial performance.

In spite of these positive observations MDBs still come under a lot of criticism:

(i) Critics argue that these institutions are under too much influence of the OECD

countries and therefore may not be very realistic in their various approaches to development. The predominance of OECD thinking for example means that only those approaches, which are acceptable to OECD, will stand the chance of being funded. In this regard, it may be mentioned that most observers on development have often wondered why approaches to development along the Japanese model have not been attempted even though most people admire the Japanese recent and rapid emergence as an industrial giant and the fact that increasingly Japanese money is funding development.

(ii) Current arrangements for funding of MDBs place the USA in a very dominant position, which at times has proved to be detrimental to resource mobilisation. The burden sharing formula used in mobilising resources to the soft loan windows of MDBs has been blamed for decreases in recent replenishments. The US Congress has been tight-fisted in its contributions to various international organisations. This has resulted in other countries automatically reducing their contribution, as they are not allowed to contribute beyond a certain proportion of the USA contribution. During the negotiations for the seventh replenishment of the African Development Fund, for example, additional funds could only be mobilised through the establishment of a 'special fund' to which the USA did not contribute (site source).

(iii) Many of the MDBs have continued to adhere to the traditional concepts of resource mobilisation and therefore are reluctant to take advantage of new opportunities. Opportunities for new contributors to development funds may sometimes be blocked because existing funds were created with a view that no poor country will ever make it as a contributor to these resources. Further, opportunities to exploit resource mobilisation through instruments like bond issues in developing countries are sometimes blocked by developed countries themselves.

(iv) Perhaps one of the biggest weaknesses of MDBs is their privileged financial position. For a long-time it was argued that all MDBs debt had to be paid when it was due. This to a large extent contributed very significantly to poor loan portfolios in most MDBs. Project quality was not given high priority because the repayment of loans was not dependent on the performance of the project. Even if the project achieved absolutely nothing the loan would be repaid in full. Under this situation performance was judged mainly on the size of the loan portfolio. Those who gave out the largest amounts in loans were the good performers. It is this culture which led to over-lending to most of the countries that are debt distressed today.

(v) Co-ordination between MDBs and other multilateral institutions especially UN institutions had been poor in the past. This sometimes led to a situation where the UN agencies would be promoting something that the Bretton Woods Institutions were opposed to. A good example of this has been in the field of development planning. While UNDP has tried to assist countries in their planning, these efforts have often gone to waste each time the Bretton Woods institutions assumed influence in the countries concerned.

2.3 Recipients

While recipients of development co-operation resources have traditionally come from Africa, Asia and Latin America, the countries of Eastern Europe have recently also joined the group. Of the continents with the large number of recipients, it is Africa, which by far presents the biggest challenge. While one can point to countries in Asia and Latin America that have recently moved out of poverty, conditions in Africa seem to be getting worse. Africa is the single continent which displays greatest resistance to advancement even at the individual level. In spite of its enormous wealth not one African qualifies to the list of the world's richest individuals that are published annually. The list of Africa's rich must probably contain more people with wealth acquired through some dubious activities such as corruption rather than through industrious work. It is this failure at the individual level that explains why nations cannot be expected to prosper. It is the collective wealth of individuals that constitutes the wealth of a nation. Why has Africa remained perpetually backward?

Historically several explanations have been offered. There is, for example, the explanations of the negative impact of slave trade which took away all the able bodied individuals who should have been responsible for developing the continent. Then there is the explanation of colonialism with its related issues of plunder of African economies (source). These, however, ended with the assumption of independence from the 1950s onwards. With independence the destinies of Africans were now in their own hands and yet things have not changed much (source). In some countries politics has degenerated into civil war thus excluding the possibility of meaningful development. In others in spite of relative political peace and stability economies have simply collapsed because of poor economic policies. These failures have made Africa the prime recipient of aid. What is important here is to realise that although in absolute terms Africa does not get the lion's share of the aid, the limited aid it gets is very vital for the sustenance of the majority of African economies.

Aid given to African countries during the period of the cold war was perhaps not intended to assist most of these countries to develop but to keep them within a particular ideological block. Many known dictators were the principal recipients of aid and nobody raised questions about the use and misuse of these resources. To some extent, donor countries should be thankful for the end of the cold war because under the new dispensation donors can question what happened to donated resources without the risk of losing the offending country to rival camps. Similarly it is possible to raise issues about the governance of a recipient country without the risk of losing the country to competitors.

The biggest weakness of the recipient countries seems to be a lack of collective approach to dealing with donors and a failure to define concisely what they want. While the donors are well co-ordinated through the OECD and DAC, there is no single organisation that can be said to represent the interests of recipients in a similar manner. Instead, individual countries compete with each other in attracting the interests of donors. Even when forums are organised to articulate their problems, such forums are organised and funded by the donor countries that also determine the agenda. For example, it has been noted that when deputies meet to determine levels of new replenishment for the soft loan windows of MDBs they meet on their own without involving the recipient countries. These gatherings apart from determining new resource levels even determine sectoral priorities a clear demonstration of the know-it all attitudes that pervade the capitals of most donor countries.

It is also now generally accepted that the policy environments in which donor funded projects were implemented were not appropriate. Donors only continued to pump resources into these inappropriate environments because the aid was politically motivated. We know that institutions like the World Bank were instrumental in pushing the argument that countries can achieve rapid industrialisation with state participation in industry [12] . The World Bank and the other MDBs subsequently gave huge loans to state enterprises but turned around to blame the borrowing countries when things did not go well. Part of the blame seems to lie in the lack of ideas in local leadership of recipient countries. When they fail to provide ideas the World Bank and IMF take advantage of the situation and impose their own ideas which they even factor into their conditionalities as Cavallo (1999), the former Economics Minister of Argentina has observed that:

> "There are several ways in which IMF or World Bank have gone wrong in the past. For one thing, these institutions should not be substitutes for local leadership or ideas. They should complement them. Too often when the locals lack ideas about how to face the challenges ahead, the IMF and World Bank volunteer their own. Furthermore, they make these ideas part of the conditions for lending".

3. Are There Lessons To Be Learnt?

In the information age that we live in today there is a lot of data readily available on virtually all subjects and people can communicate with each other in seconds. This in itself presents enormous opportunities for perfecting everything we do by learning from others on how best we can do our work.

In the field of development co-operation we have seen that the work has not been perfected yet. There is clear admission that inequality between the rich and poor countries is increasing. Balls (1999) has noted that

> "The Gap between the worlds richest and poorest country was 3 to 1 in 1820, 11 to 1 in 1913 and 72 to 1 in 1992".

Inequality has been increasing at the time when development co-operation activity has been going up thus suggesting that work in this field has not achieved its intended goals. Although there are now more pronouncements about ending poverty there are more poor people than ever before. This is the first lesson from our experience in development co-operation.

As we have seen in the earlier part of this paper there are various explanations for the failure of the aid delivery system. At the bilateral level there have been complaints about development co-operation being politically motivated. On the OECD, Adams (1999) has made the following observation:

> "Founded in 1961 by Western Countries as a bulwark against the communist block, the OECD has underpinned the development of free market ideology. Through analysis and as a forum for policy debate, sustainable economic growth, better living standards, financial stability and the expansion of World trade, its aims are laudable now, as they were 40 years ago. The problem is that the world has changed and the OECD has not kept pace. Despite the growing importance of emerging markets, the 29 strong membership is still dominated by rich industrialised countries in Europe and North America, with only two Asian members and one from Latin America"

[12] Kuznet who was influential in the World Bank at the time was instrumental in selling this policy as is demonstrated in this work: Kuznet S. (1996) Modern Economic growth; Rate, structure and spread Yale University Press.

Critics of bilaterals suggest that a lot could be gained if they consulted more with recipients of their aid and also that amongst themselves they can learn a lot from the best practises of fellow members of OECD. They should listen and learn more than they have been dictating. Is it possible for bilaterals to do this? One view is that bilateral co-operation is by nature political. This is the reason why all development agencies are part of their countries' ministries of Foreign Affairs or ministries of Development Co-operation, which are recent spin offs from ministries of Foreign Affairs. It is this, which has led Nancy Birdsall, formerly number two at the Inter-America Development Bank to say,[16]

> "The poor performance of many government bilateral aid programmes suggests help for development is best channelled through multilateral institutions. These are freer (though not completely free) from domestic political considerations that have made much bilateral aid ineffective".

Compared to multilateral agencies, bilateral donors are too many and therefore present a lot more work to the bureaucracies of poor countries. The annual review of each bilateral donor's programme is a very important exercise, which occupies a considerable time of each treasury department regardless of the size of the individual donor. Sometimes and rather regrettably, it is precisely those donor countries that contribute the least that want to gain even greater political capital out of the exercise. A consolidation of these donors would certainly go a long way towards reducing the workload of bureaucracies in developing countries. The multiplicity of donors also means that bureaucracies of developing countries have to cope with the different systems of each donor, an onerous task given the evident lack of capacity in all these countries. Even with the best of intentions it is difficult to imagine that all the individual donor countries would follow similar procedures in the implementation of their aid programmes. This problem was recently acknowledged by the World Bank President Mr. James D. Wolfensohn who in an article in the International Herald Tribune of Wednesday, December 8 1999 wrote:

> "The current development architecture is poorly adapted to the needs of poor countries. Transaction costs are excessive. Co-ordination is poor. As the volume of aid declined, the number of donors grew from seven in 1960 to more than 50 in the 1990s. International non-governmental organisations registered in developed countries have increased from 1,600 in 1980 to 2,970 in 1993. This results in administrative overload".

This is one of the stronger reasons for preferring multilateral development banks to bilateral donors. Although they bring together resources from different donors, the resources are pooled and subjected to the same administrative procedure thus saving the borrowers a lot of time and pain. Although major donors still play an important role in the decision making process in all multilateral development banks the impact of individual donors on poor nations is not a direct one to one affair experienced under bilateral aid programmes.
Multilateral Development Banks on the other hand are not without their own problems, but, these institutions are more open to learning. As the Development Committee's own Task Force on Multilateral Development Banks observed:[17]

[16] Steven Fidler " A crucial role to play in the 21 century" Financial Times survey World Economy and finance, 24th September 1999.

[17] Development Committee (1996) serving a changing World: Report of the Task Force on Multilateral Development Banks, p18.

> "All MDBs have tried in the past few years to improve the design, implementation and results of their operations, by changing the project cycle to make it more dynamic and responsive to local circumstances, they have also tried to open the institutions to the views and ideas of others, especially those affected by development activities, to incorporate past lessons into future work, and to account for better performance".

In recent times MDBs collaborative work has increased. The establishment of joint institutes for Europe in Vienna, for Asia in Singapore and now for Africa are testimony to this. Joint missions and sharing of policy documents are all testimony to the culture of learning that is taking root in these institutions. It must, however, be emphasised that many of these positive developments have occurred because the bigger Bretton Woods institutions have been willing to co-operate. This unfortunately, also suggests that unless this process is well managed it could lead to the predominance of the Bretton Woods institutions or the so-called 'Washington consensus'. Since these institutions have more resources, are bigger and have a better image in the market, their views might tend to over-ride those of their smaller brothers. In fact one of the biggest fears is precisely that as the World Bank and regional MDBs intensify their collaboration they might look so much alike that questions might start being asked on why they should remain separate entities at all. Birdsall in Fidler (1999) argues that there is a strong case for there to be more than one of these institutions as a World Bank monopoly on development would be dangerous. Indeed the larger MDBs should perhaps have done more to help their smaller brethrens.

In the on-going discussions on co-operation amongst MDBs there are serious attempts at identifying areas of comparative advantage for each institution. For example it has been recognised that in Africa, AfDB is best placed to handle issues on governance. If the World Bank were to champion this issue it would easily be accused of imposing western norms on African countries. The same cannot be said about AfDB because it is based in Africa and staffed mainly by Africans. Although the message is the same it matters who delivers it.

The MDBs however, are by no means assured of a future. They must convince the world of their relevance to the future. In particular the increasing role of the private sector in the infrastructure field as well as the provision of social services such as health and education suggests a shrinking role for MDBs or their transformation into institutions that will deal more with the private rather than the public sectors.

The passivity of the recipient countries is a matter of great concern. While both bilateral and multilateral lenders have put in place mechanisms for client consultations these are still ineffective. In some cases it is difficult to have meaningful dialogue if the client does not understand the project fully or if they do not have adequate information at their disposal to be able to make an informed judgement about particular choices. Attempts at incorporating civil society into consultations on development co-operation are welcome and sometimes produce positive results. These groups in most developing countries have their origins in human rights organisations. In nations where political governance issues are not fully resolved, NGOs may be regarded suspiciously. They are sometimes regarded as agents of some foreign political power set up to undermine the regime. In some cases there may indeed be good reason to be cautious of some NGOs established by individuals purely as a way of sustaining themselves. In many developing countries there is need for home grown NGOs deeply involved in development work who can be able to assist the grassroots to articulate their positions as well as identify opportunities. The challenge here is how to facilitate for the development of these home grown NGOs.

Above all this, it is very important that governments in the recipient countries assume the drivers' position in the process of development co-operation. The development process requires that Third World leaders are able to define what their countries need and how these needs can be satisfied. It should be the responsibility of recipients to ensure that resources donated are properly utilised and not the donor to play the role of Policeman. It is the responsibility of Third World leaders to ensure that the economic environment in which aid resources are employed is right.

The recognition that the donor countries with recipient countries merely playing a passenger role have in the past driven aid has led to new thinking on the nature of the relationship. Increasingly most of the donor countries and development agencies are talking of a partnership in development. Countries like Sweden have recently completed extensive consultative processes to redefine their development co-operation policy with Africa (Kayizzi-Mugerwa et al 1998). In the new Swedish Policy, African ownership of the development programme is being emphasised. The relationship is also being shown as mutually beneficial rather than benefiting only the recipient. Karlsson (1998) in proposing modalities for the new partnership has included aid pooling and sectoral approaches as one of the necessary changes:

> "It must be possible to cut administrative overhead. If there is a reliable process that leads to, say a primary education programme in a country, a lead set of donors should negotiate the terms of support with the government. An additional donor should then basically not have to do more than write a cheque. Financial control, follow-up and evaluation procedures must be acceptable and valid for all donors".

This approach is based on the admission that current approaches where each donor is doing something on their own are wasteful. There are however, doubts about whether all donors will be willing to just sign the check. Experience with sector investment programmes under which all donors are expected to pool resources has shown that most donors still want to be able to report home to their parliaments about specific roads they have constructed in developing countries. This, unfortunately, has been at the centre of the problems of bilateral aid all along.

This idea of pooling of resources by different donors has recently received support in a paper by Kanbur et al (Year). The authors note that on the part of donors the common pool approach would greatly reduce the need for staff to develop, monitor and evaluate individual projects, or to monitor adherence to conditions. Thus, although staff would still be needed by each donor to assess a country's program and dialogue with the government, the overall number of staff would probably decrease.

All these observations suggest that all levels of the development co-operation chain need to be responsive to change. They should be what Braham (1995) has called "the learning organisation". Braham has observed that, "learning is important because things are changing so fast today that it is difficult to keep up the pace of change. People who can't keep up with changes may find themselves 'downsized' or right sized' or some other euphemism for out of work"

For institutions in development co-operation, coping with change is even more challenging because the process itself induces more changes and therefore greater challenges. All institutions involved in development co-operation must fully equip themselves with the tools of learning organisations. In recent times, MDBs seem to have picked up the concept of

learning organisation and there is common talk of knowledge among institutions.. This is a positive development if it indeed results in these institutions becoming truly open to ideas, if they invest in creating learning environments, if they treat errors as opportunities for learning how to do things better in future and if they are ready to put ideas from their staff to work as well as learn from clients. Bilateral agencies could also benefit a lot from embracing the learning culture especially if this can help them to increasingly question why they are doing what they do instead of doing something else. Above all else all aid organisations must learn to accept mistakes. It is only when they start to agree that some of the things they have been doing are not effective that they can start to design programmes that really work. The previous culture where donors turned around to blame the recipient each time something went wrong and to congratulate themselves each time something went right should be discarded.

Development co-operation has persisted because of its failure to transform poor countries into developed countries. As long as there is poverty there will still be need for aid resources to flow to the poor of the world. The future of aid therefore depends very much on the effectiveness of current aid. On a realistic note, one does not see the transformation of all poor countries in the next few years. While there is greater hope today than ever before that some African countries can make a break-through, the outbreak of civil strife in a number of countries also suggests that some African countries will still be passing the begging-bowl around many years from now.

Global aid trends suggest that, increasingly there will be fewer aid resources because it will be difficult to convince electorates in donor countries on the need for more aid resources. This in itself is likely to force poor countries to do more for themselves.

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APPENDIXES

APPENDIX 1. NET TOTAL FINANCIAL FLOWS TO DEVELOPING COUNTRIES: BY SOURCE, 1985-97

(Billions of US Dollars)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1985-97
BILATERAL	**30.25**	**53.30**	**49.29**	**61.48**	**70.19**	**59.93**	**77.01**	**88.56**	**112.89**	**142.77**	**139.88**	**195.64**	**170.51**	**1,251.72**
AUSTRALIA	0.94	0.69	0.84	3.05	1.14	1.37	-2.53	3.67	1.75	1.79	2.40	2.35	2.15	19.61
AUSTRIA	0.08	0.07	0.19	0.15	0.05	0.41	0.50	0.44	0.35	0.67	0.46	1.31	1.12	5.78
BELGIUM	0.89	-1.16	-0.72	1.64	1.04	-0.22	1.19	1.85	0.33	1.81	-0.80	5.03	-12.04	-1.16
CANADA	0.68	0.75	2.09	1.86	1.74	2.43	2.87	3.09	4.20	4.52	4.15	5.98	8.95	43.31
DENMARK	0.31	0.14	0.44	0.29	0.45	0.53	0.56	1.02	0.78	0.71	0.99	1.24	1.13	8.59
FINLAND	0.15	0.26	0.37	0.49	0.66	0.60	0.65	0.51	0.22	0.47	0.43	0.94	0.23	5.98
FRANCE	6.31	6.02	5.52	3.35	4.07	4.16	4.86	8.87	9.21	10.58	10.60	15.78	11.67	101.01
GERMANY	3.98	5.65	6.60	9.03	9.17	10.17	11.54	7.26	10.39	19.72	16.55	16.69	15.82	142.58
IRELAND	0.05	0.06	0.03	0.00	0.05	0.02	0.03	0.03	0.04	0.06	0.08	0.11	0.12	0.67
ITALY	1.58	1.35	0.82	4.03	4.01	1.71	6.12	4.41	1.07	2.47	1.84	2.82	7.12	39.33
JAPAN	7.52	11.15	14.46	14.69	18.50	13.81	22.92	15.23	15.74	25.53	37.15	57.61	27.70	282.02
LUXEMBOURG	..	..	0.00	..	0.00	0.01	0.03	0.02	0.03	0.04	0.04	0.05	0.06	0.30
NETHERLANDS	1.41	1.51	1.97	2.09	1.98	3.22	3.97	2.24	4.25	3.76	5.47	7.05	8.18	47.10
NEW ZEALAND	0.07	0.09	0.09	0.12	0.08	0.08	0.08	0.07	0.07	0.09	0.10	0.11	0.11	1.17
NORWAY	0.30	0.36	0.50	0.48	0.52	0.64	0.80	0.85	0.70	0.95	1.17	1.16	1.08	9.49
PORTUGAL	..	..	0.02	0.07	0.10	0.21	0.11	0.33	0.18	0.17	0.28	0.87	1.25	3.59
SPAIN	0.67	0.10	1.11	-0.25	0.14	0.59	0.72	1.10	0.93	2.95	1.36	3.76	6.81	19.97
SWEDEN	1.07	1.31	1.16	1.72	1.69	2.04	1.05	2.08	1.78	1.69	1.59	1.31	1.48	19.96
SWITZERLAND	1.05	0.80	-0.71	1.28	1.42	2.96	2.21	1.88	3.33	0.15	1.49	-1.37	-3.53	10.96
UNITED KINGDOM	1.63	5.86	2.44	2.95	7.63	4.58	3.56	7.29	5.42	9.94	11.16	20.61	16.70	99.76
UNITED STATES	-1.16	14.34	9.261	2.92	14.25	4.80	13.36	25.56	51.24	53.96	42.88	51.68	74.03	367.11
ARAB COUNTRIES	2.72	3.96	2.82	1.52	1.52	5.81	2.42	0.77	0.88	0.76	0.50	0.54	0.38	24.59
of which														
NORDIC														
COUNTRIES	1.83	2.07	2.46	2.99	3.31	3.81	3.06	4.46	3.47	3.82	4.17	4.65	3.91	44.02

Sources: OECD, Reporting System Division, January 1999 and ADB Statistics Division Databases.

APPENDIX 2. NET TOTAL FINANCIAL FLOWS TO DEVELOPING COUNTRIES: BY SOURCE, 1985-97

(Billions of US Dollars)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1985-97
MULTILATERAL	**15.57**	**16.65**	**16.72**	**18.04**	**19.55**	**23.60**	**23.37**	**21.02**	**23.04**	**22.33**	**22.88**	**23.19**	**27.38**	**273.36**
AfDB	0.24	0.28	0.42	0.62	0.81	1.00	1.20	1.18	1.07	0.92	0.47	0.29	-0.03	8.47
AfDF	0.21	0.27	0.37	0.35	0.49	0.60	0.63	0.68	0.68	0.59	0.57	0.59	0.59	6.63
AsDB	0.79	0.78	0.79	1.30	1.59	2.30	2.56	2.27	2.19	2.47	2.30	1.32	4.98	25.65
CARRIBEAN DEV.	0.03	0.04	0.05	0.06	0.06	0.06	0.04	0.04	0.03	-0.03	0.01	0.01	0.02	0.44
EDF (EEC)	1.47	1.61	1.80	2.56	2.49	2.68	3.59	4.60	3.72	4.40	4.69	5.20	5.61	44.40
EBRD	..	..	..	..	..	..	..	..	0.01	0.09	0.15	0.16	0.12	0.52
IBRD	4.94	5.44	4.52	3.73	3.55	5.15	2.08	-0.70	1.60	-2.07	-0.59	-0.27	3.03	30.39
IDA	2.60	3.33	3.53	3.57	3.27	3.91	4.32	4.82	4.47	5.57	4.89	5.57	5.12	54.96
IDB	1.75	1.51	1.05	1.23	1.40	1.21	1.45	0.91	2.17	2.47	1.62	1.81	2.99	21.57
IFAD	0.27	0.29	0.37	0.10	0.12	0.25	0.12	0.08	0.08	0.07	0.09	0.15	0.12	2.08
IFC	0.02	0.11	0.20	0.38	0.39	1.36	0.54	0.52	1.05	1.36	1.63	3.11	..	10.66
IMF	-0.30	-0.54	-0.19	-0.12	0.72	0.32	0.97	0.73	0.19	0.98	1.60	0.33	0.15	4.86
UNDP	0.63	0.77	0.79	0.91	0.97	1.13	1.23	1.16	1.20	1.24	1.25	1.46	1.61	14.35
UNTA	0.30	0.25	0.31	0.27	0.24	0.23	0.28	0.24	0.34	0.26	0.56	0.24	0.31	3.84
UNICEF	0.28	0.33	0.36	0.40	0.50	0.58	0.59	0.73	0.78	0.78	0.77	0.66	0.64	7.40
UNRWA	0.19	0.19	0.21	0.23	0.27	0.29	0.31	0.31	0.30	0.33	0.35	0.24	0.26	3.46
UNHCR	0.42	0.38	0.40	0.47	0.49	0.46	0.78	0.73	0.73	0.81	0.70	0.59	0.53	7.49
WFP	0.78	0.65	0.72	0.88	0.76	0.93	1.33	1.56	1.30	1.24	1.00	0.94	1.02	13.12
Other Multilateral	0.76	0.76	0.93	1.03	1.27	1.06	1.24	0.94	0.92	0.60	0.83	0.79	0.29	11.42
Arab Agencies	0.21	0.21	0.10	0.06	0.16	0.07	0.12	0.24	0.21	0.26	0.00	0.00	0.00	1.64
UNSPECIFIED	..	..	..	..	..	..	-0.38	0.42	0.06	-0.10	0.24	0.17	0.00	0.40
TOTAL	**45.83**	**69.95**	**66.01**	**79.52**	**89.74**	**83.54**	**100.00**	**110.00**	**136.00**	**165.00**	**163.00**	**219.00**	**197.89**	**1,525.48**

Sources: OECD, Reporting System Division, January 1999 and ADB Statistics Division Databases.

APPENDIX: 3
TEN MAJOR AFRICAN RECIPIENTS OF NET TOTAL OFFICIAL DEVELOPMENT ASSISTANCE FROM INDIVIDUAL DAC MEMBER (1985 - 97) (MILLIONS OF US$)

USA

Recipients	Amount	% of Total Africa
1. Egypt	15,728.0	53.7
2. Somali	1,525.0	5.2
3. Sudan	1,143.0	3.9
4. Ethiopia	964.0	3.3
5. Mozambique	746.0	2.5
6. Kenya	601.0	2.1
7. Senegal	488.0	1.7
8. Morocco	474.0	1.6
9. Rwanda	463.0	1.6
10.South Africa	421.0	1.4

UK

Recipients	Amount	% of Total Africa
1. Zambia	714.9	18.7
2. Tanzania	644.5	4.6
3. Kenya	637.2	4.5
4. Uganda	566.4	4.3
5. Malawi	539.6	4.2
6. Mozambique	491.3	3.6
7. Ghana	475.4	3.4
8. Zimbabwe	432.8	3.4
9. Sudan	387.7	3.0
10. Ethiopia	367.8	2.9

FRANCE

Recipients	Amount	% of Total Africa
1. Côte d'Ivoire	4,062.6	11.7
2. Egypt	2,635.4	7.6
3. Cameroon	2,536.3	7.3
4. Senegal	2,535.3	7.3
5. Morocco	2,463.3	7.1
6. Algeria	1,738.9	5.0
7. Madagascar	1,588.0	4.6
8. Congo	1,548.9	4.5
9. Mali	1,147.9	3.3
10. Gabon	1,113.4	3.2

GERMAN

Recipients	Amount	% of Total Africa
1. Egypt	3,401.3	18.7
2. Zambia	840.0	4.6
3. Ethiopia	824.5	4.5
4. Tanzania	784.3	4.3
5. Kenya	758.8	4.2
6. Mozambique	660.1	3.6
7. Morocco	625.3	3.4
8. Congo Dem. Rep.	621.2	3.4
9. Ghana	543.8	3.0
10. Zimbabwe	534.3	2.9

JAPAN

Recipients	Amount	% of Total Africa
1. Egypt	2,406.9	16.8
2. Kenya	1,486.0	10.4
3. Ghana	1,014.8	7.1
4. Tanzania	918.7	6.4
5. Zambia	890.2	6.2
6. Senegal	606.8	4.2
7. Malawi	486.2	3.4
8. Morocco	478.5	3.3
9. Sudan	431.0	3.0
10. Nigeria	397.0	2.8

CANADA

Recipients	Amount	%of Total Africa
1. Egypt	442.3	9.0
3. Tanzania	329.9	6.7
4. Ghana	323.7	6.6
5. Ethiopia	271.0	5.5
6. Senegal	263.6	5.3
7. Mozambique	259.1	5.2
6. Cameroon	247.7	4.9
7. Mali	225.3	4.6
8. Zambia	223.1	4.5
10.Zimbabwe	204.8	4.1

SPAIN

Recipients	Amount	% of Total Africa
1. Morocco	457.9	23.5
2. Algeria	288.9	14.8
3. Angola	189.2	9.7
4. Equatorial Guinea	152.2	7.8
5. Congo	113.8	5.8
6. Mozambique	104.2	5.4
7. Madagascar	79.6	4.1
8. Cameroon	70.3	3.6
9. Côte d'Ivoire	62.1	3.2
10.Uganda	50.1	2.6

PORTUGAL

Recipients	Amount	% of Total Africa
1. Mozambique	675.7	50.4
2. Guinea Bissau	210.9	15.7
3. Angola	175.0	13.0
4. Sao Tome & Prin.	137.9	10.3
5. Cape Verde	130.6	9.7
6. Namibia	3.3	0.2
7. Egypt	2.8	0.2
8. Morocco	1.0	0.1
9. Algeria	0.8	0.1
10. Senegal	0.6	0.0

ITALY

Recipients	Amount	% of Total Africa
1. Egypt	1373.0	11.6
2. Mozambique	1273.9	10.7
3. Ethiopia	1267.6	10.7
4. Somalia	1131.4	9.5
5. Tanzania	652.5	5.5
6. Tunisia	596.3	5.0
7. Morocco	491.3	4.1
8. Sudan	426.5	3.6
9. Senegal	415.4	3.5
10.Congo Dem. Rep.	338.8	2.9

SWEDEN

Recipients	Amount	% of Total Africa
1. Tanzania	1112.6	18.8
2. Mozambique	1027.5	17.3
3. Zambia	526.1	8.9
4. Ethiopia	509.6	8.6
5. Zimbabwe	416.9	7.0
6. Angola	373.3	6.3
7. Kenya	300.6	5.1
8. Uganda	242.5	4.1
9. Botswana	186.9	3.2
10.South Africa	161.5	2.7

NORWAY

Recipients	Amount	% of Total Africa
1. Tanzania	876.0	20.6
2. Mozambique	666.7	15.7
3. Zambia	497.0	11.7
4. Ethiopia	262.8	6.2
5. Zimbabwe	247.0	5.8
6. Botswana	190.9	4.5
7. Kenya	184.7	4.3
8. Uganda	138.7	3.3
9. Angola	133.4	3.1
10.Sudan	107.9	2.5

NETHERLANDS

Recipients	Amount	% of Total Africa
1. Tanzania	841.0	11.9
2. Kenya	571.9	8.1
3. Sudan	542.9	7.7
4. Mozambique	542.0	7.7
5. Zambia	392.7	5.6
6. Burkina Faso	381.8	5.4
7. Mali	359.6	5.1
8. Zimbabwe	350.5	5.0
9. Ethiopia	337.9	4.8
10.Egypt	281.0	4.0

DENMARK

Recipients	Amount	% of Total Africa
1. Tanzania	932.4	23.0
2. Uganda	415.7	10.2
3. Kenya	330.0	8.2
4. Mozambique	329.4	8.1
5. Egypt	251.3	6.2
6. Zimbabwe	221.3	5.4
7. Zambia	195.2	4.8
8. Ghana	173.5	4.3
9. Burkina Faso	152.9	3.8
10.South Africa	104.0	2.6

FINLAND

Recipients	Amount	% of Total Africa
1. Tanzania	395.4	21.5
2. Zambia	245.4	13.3
3. Kenya	201.7	11.0
4. Mozambique	195.6	10.6
5. Egypt	158.2	8.6
6. Ethiopia	132.3	7.2
7. Somalia	99.3	5.4
8. Namibia	96.7	5.3
9. Sudan	91.8	5.0
10.Zimbabwe	85.8	4.7

Source: OECD.

Choice of Exchange Rate Regime: Has The Zambian Economy Performed Better Under a Floating Exchange Rate Regime?

Hobby M. Simuchile

Abstract

This paper takes a theoretical look at the subject of optimal exchange rate regime and compares Zambia's economic performance under the floating exchange rate regime to the period before October 1992 during which the exchange rate was generally fixed. From the large body of literature that exists on the topic of exchange rate regime, there is no unambiguous right answer as to the choice of exchange rate regime. However, recent analysis has focussed on the relatively narrow criterion of macroeconomic stability - defined in terms of the variance of real output, the price level or real consumption in the face of random shocks. In this regard, empirical studies have found evidence that economic performance in most countries has been better under the floating exchange rate regime compared to the fixed exchange rate regime. This seems to be the case for Zambia as evidenced by the recent economic trends.

1. Introduction

As a contribution to the body of literature on Zambia's economic performance, this paper takes a theoretical look at the subject of optimal exchange rate regime choice and compares Zambia's economic performance under the floating exchange rate regime to the period before, during which the exchange rate was generally fixed. Empirical studies show that most countries' economic performance has been better under the floating exchange rate regime compared to the fixed exchange rate regime. The same can be said for Zambia, looking at the economic trends since 1991, especially in the last five years.

The paper is organised into five further parts; the second part defines the various exchange rate regimes, the third part discusses the choice of exchange rate regime; the fourth part discusses some country experiences under the floating exchange rate regime whilst the fifth part focuses on Zambia's economic performance under the various exchange rate regimes; the fifth part concludes.

2. Exchange Rate Classification

There are two polar or extreme definitions of exchange rate regime: permanently fixed or pegged, and freely floating or purely flexible exchange rates. The fixed exchange rate regime is one where the authorities peg the value of the domestic currency to a unit of another country's currency, normally a major trading partner. Alternatively, the authorities peg to the special drawing rights[9] (SDR) or a basket of selected currencies based on some criteria.

[9]In what it is

With the fixed exchange rate, monetary autonomy is lost and the central bank must routinely intervene in the foreign exchange market to defend the parity at which the exchange rate has been set. In contrast to the fixed exchange rate regime, the authorities may opt for the floating exchange rate regime in which case the exchange rate is not pegged to any currency or basket but allowed to fluctuate freely and be determined by market forces through demand and supply for foreign exchange. This is also called a clean float as opposed to a dirty float described below.

In addition to these two polar definitions, there are hybrid exchange rate regimes. The first two are the adjustable and crawling pegs. Under the adjustable peg, the value of the domestic currency is fixed against a foreign currency and infrequently adjusted by some set rule (reconsider reconstruction of sentence). In respect of the crawling peg, the exchange rate is adjusted at regular intervals, either by discretion or some set rule, in order to take account among others changes in the inflation differentials and current account imbalances. The second hybrid regime is the managed or dirty float where the exchange rate is floated but the authorities routinely intervene in the foreign exchange market to influence the direction of the exchange rate. In this regard, the exchange rate does not float freely.

The third hybrid regime is the target zone or band regime. This involves pre-announcing a central rate, which must fluctuate within an asymmetric or symmetric band. This is also sometimes called the "Snake in the Tunnel." Under this arrangement, the central bank commits to intervene actively at the margins of the band to prevent the exchange rate from overshooting the band. An example is the European Exchange Rate Mechanism, which operated until 1999 before it was transformed into a single currency (source).

Lastly, there are dual or multiple exchange rate regimes in which official transactions take place at fixed rates and other transactions take place at a floating rate.

Others have classified either as *de jour* or *de facto* exchange rate regimes based on the publicly stated commitment of the central bank or based on observed behaviour of the exchange rate respectively (Ghosh et al, 1997). For example, due to continuous interventions in the foreign exchange market by the central bank, Zambia's exchange rate regime was reclassified as a managed float in**.**

With increasing global financial integration and international trade, the role and performance of exchange rate regimes in developing countries has become a widely debated issue in macroeconomics. Some scholars have put emphasis on the policy objectives being pursued by the authorities in an economy, others on the structural characteristics of the economy, whilst others focus on the political costs of exchange rate adjustments under either regime.

3. Choice of Exchange Rate Regime

The exchange rate plays a dual role in a small open economy. On one hand, its movements can achieve and maintain international competitiveness, i.e. nominal depreciations may improve the trade balance and balance of payments whilst cushioning the economy against external shocks, hence the case for floating **(source).** On the other hand, a stable exchange rate can anchor prices and thus stabilise output, which makes a case for fixing the exchange rate. But frequent depreciation of the nominal exchange rate is often associated with increases in domestic prices, which may turn inflationary, while fixing the exchange rate for

price stabilisation purposes is often not viable in the light of foreign exchange and external borrowing constraints **(source).** In view of this, policy makers in developing countries typically face a dilemma as to what exchange rate regime is optimal for their economies.

Selecting a fixed exchange rate regime amounts to accepting a constraint on domestic economic policies. Of all combinations of domestic economic policy choices and mixes that a country can undertake, the fixed exchange rate regime effectively limits the range of such possibilities to those policy combinations consistent with maintaining the fixed exchange rate parity. This makes domestic policy endogenous and subject to exchange rate commitment. In contrast, a flexible exchange rate regime removes this constraint in the pursuit of any particular domestic economic policy combination. Whatever the effects of any policy undertaken, exchange rate fluctuations will keep such effects within the domestic domain. Correspondingly, whatever the consequences for the national economic policies elsewhere, exchange rate adjustments will keep them outside the domestic domain. Floating the exchange rate is tantamount to freeing domestic economic policy from international constraints (Guitian 1994**).**

Studies by McKinnon (1961 or 1962?), Black (1976) and Brandon, Katsili-papaefstratiou (1981) (Not listed), Williamson (1982), Wickham (1985) and Quirk (1994), argue that where as the potential benefits of floating the exchange rate are not necessarily limited to industrialised countries, certain characteristics found in many developing countries rule out floating as a feasible or realistic option. In their view, there are two conditions for feasibility of floating exchange rate regime in developing countries: first that domestic financial markets of some minimum depth exist; second that domestic and foreign currency assets are substitutes in the private portfolios of wealth holders. It was thus widely agreed that independent floating was either infeasible or undesirable for most developing countries due to factors such as limited capital markets, restrictions on capital flows, thin foreign exchange markets and a prevalence of real shocks that should be financed from reserves. A study by Dreyer (1978) which focussed on the role of structural characteristics of developing economies concluded the same and rendered empirical support to the view that floating exchange rates are infeasible in developing countries due to under developed financial markets.

However, the two oil shocks of the 1970's and the debt crises of the 1980's, coupled with worsening terms of trade for developing countries resulted into new thinking that developing countries could successfully operate floating exchange rate regimes to assist their economies adjust to external shocks. For example, Collins (1996) notes that the view that developing countries could not successfully operate floating exchange rate regimes appears to have disappeared since mid 1980s. This is supported by the IMF's 1987 review of early experiences with flexible exchange rate regimes. The review concludes that flexible exchange rate regimes can be operated satisfactorily even by developing countries with a wide range of structures. Thus amongst other structural adjustment programmes, many developing countries have been encouraged to abandon fixed exchange rate regimes for flexible exchange rate regimes.

With this shift in thinking, theoretical literature has concentrated on the optimal exchange rate regime that stabilises macroeconomic performance in the presence of different shocks to the economy. The conclusion of some studies is that the optimal exchange rate regime depends on the nature and size of shocks to an economy as well as the structure of that

economy. For example, studies by Flood (1979), Frenkel and Aizenman (1982), Turnovsky (1983), and Aghevli *et al* (1991) suggest that countries which experience large foreign price and domestic demand shocks should choose flexible exchange rate regimes. They further argue that those economies that face domestic monetary shocks which should be financed out of reserves with no need for exchange rate adjustment should choose fixed exchange rate regimes. Aghevli *et al* (1991) state that whether domestic shocks favour exchange rate fixity or flexibility depends on the nature of the shocks, monetary (i.e. originating in the money market) or real (i.e. originating in the goods market). When the shocks are monetary, the conventional view is to maintain a fixed exchange rate regime, which would be more effective in stabilising output. In contrast, when the shocks are real, the exchange rate should be adjusted to stabilise output by generating or withdrawing external demand.

Empirical studies by Melvin (1985), Cuddington (1990) and Otoo (1991) focussed on the influence of the size of domestic and foreign shocks on a country's choice of exchange rate regime. Their findings are supported by Aghevli *et al* and suggest that the optimal choice of exchange rate regime depends on the policy makers' economic objectives, the source and size of the shocks to the economy and the structural characteristics of the economy in question. The economic objectives include price stabilisation, output and aggregate consumption.

The models used in these studies have been criticised by others like Agenor and Montiel (1996) and Collins (1996) for not capturing important real world features of the exchange rate regime choice of developing countries for at least three reasons. The first is the assumption that the critical difference between fixed and flexible exchange rate regimes is that nominal exchange rates cannot be adjusted under fixed exchange rates. However, countries that have adopted this regime typically do maintain the option of nominal adjustments. For example, the 1980s saw major adjustments in nominal exchange rates by developing countries that maintained fixed regimes. The second criticism is the failure by traditional models to incorporate the political economy of exchange rate adjustment. It may be more politically costly to adjust a fixed exchange rate than to allow similar adjustments to a flexible exchange rate because the latter is easier to disguise.

This view is supported by Aghevli et al (1991) who state that given the stigma attached to devaluation under fixed regime, an increasing number of countries have found it expedient to adopt more flexible arrangements for adjusting the exchange rate thus avoiding the political repercussions of an announced devaluation. The third is that developing countries will adopt an exchange rate regime based on the role of the exchange rate as a nominal anchor and on the credibility effect that the exchange rate regime may attach to a disinflation programme. They conclude that less open economies with external surpluses are more likely to adopt fixed exchange rate regimes, implying that the policy objective would be price stabilisation. Countries with moderate to high inflation are less likely to adopt fixed exchange rates.

From the large body of literature there is no unambiguous right answer as to the choice of exchange rate regime. However, modern analysis has focussed on the relatively narrow criterion of macroeconomic stability - defined in terms of the variance of real output, the price level or real consumption - in the face of random shocks (Aghevli *et al,* 1991). Output stability has been singled out as the most commonly adopted criterion by much of the modern literature. The question that arises is how best to manage the exchange rate so as to

minimise the variance of real output around its full capacity level in the face of diverse random shocks that arises from within the country and abroad.

4. Some Experiences under the Floating Exchange Rate Regimes

It has been found that most countries' macroeconomic performance has been better under the floating exchange rate regime than under a fixed regime. In a comprehensive survey by Ghosh *et al* (1997) for 136 countries, it was found that for the period 1960 to 1990, per capita GDP growth averaged 1.61 percent per annum. For countries with fixed exchange rate regime, per capita GDP grew by an average 1.4 percent while it grew by 2.1 percent for countries with intermediate regimes and 1.7 percent for countries with floating exchange rates. Investment to GDP ratio was about 1 percent higher in countries with fixed exchange rates while trade grew by 4.6 percent less per annum compared to countries with flexible exchange rates. The combination of slightly lower overall growth and slightly higher investment for fixed exchange rate regime countries suggests lower productivity growth, probably due to lower growth of international trade.

Collins (1996) also provided further evidence on 26 Latin American and Caribbean countries and supports the evidence on growth provided by Ghosh *et al*. In the empirical study, it was found that during 1987 to 1991, mean real GDP growth for LAC countries with fixed exchange rate regimes was just 1.09 percent compared with mean real GDP growth rate of 3.2 percent for countries with more flexible exchange rate regimes.

The IMF (1987) review of experiences with floating exchange rates supports the results of these studies. The review surveyed 12 developing countries and found that there was somewhat better balance of payments performance under floating exchange rate arrangements and similar inflation and output. Out of the 12 countries surveyed, inflation declined in 6 countries following the floating of their currencies (Bolivia, Brazil, Gambia, Peru, Philippines and Venezuela) and accelerated in 1 (Nigeria). Inflation was broadly unchanged in Paraguay following an initial upturn. The adoption of floating exchange rates has also been associated with positive output performance of the 11 countries out of the 12 surveyed. Six experienced faster GDP growth after floating (Bolivia, Nigeria, Peru, Philippines, Uruguay and Venezuela). In Brazil and Paraguay, growth performance deteriorated (Quirk 1994).

Although output, investment and balance of payments performance under the flexible exchange rate regime was better than under the fixed exchange regime, a study by Ghosh (1997) showed that for countries with fixed exchange rates, inflation averaged 8.4 percent per year, followed by 11.6 percent for countries with either crawling pegs or managed floats and 15.2 percent for countries with pure floats. The annual inflation average for the whole sample was 10.7%.

The study explains that differences in inflation rates across regimes arose from different growth rates in money supply, interest rates, real GDP or the residual velocity. Money supply grew at a lower rate in countries with fixed regimes compared to flexible regimes. Money growth averaged 15 percent in fixed regimes, 19 percent in intermediate regimes and 27 percent in flexible regimes. The empirical evidence provided by this study strongly suggests that fixing the nominal exchange rate is associated with lower inflation because of reduced rate of money growth and because of lower residual velocity growth controlling for interest rate and income effect.

5. Zambia's Experience with the Floating Exchange Rate Regime

Zambia, at independence in 1964, had a strong and vibrant economy which was supported by a booming mining industry. The country's external position was in surplus averaging US $49.6 million between 1964 and 1974; inflation rates were low, averaging 7.7 percent; and experienced economic growth averaging 2.7 percent over the same period. (see Table 1) In addition, population growth rates averaged 2.5 (lower than the economic growth rate, thus, leading to high per capita GDP of US $950) over this period and unemployment levels that were less than 20 per cent.[10]

TABLE 1: ZAMBIA: SELECTED MACROECONOMIC INDICATORS, 1964 1974

	1964-1974
Real GDP growth (%)	2.7
Current account surplus (deficit) (US $ millions)	49.6
Current account surplus (deficit) (% GDP)	3.8
External debt outstanding (US $ billions)	1.0
External debt (% GDP)	37.3
Inflation (%)	7.7
Budget surplus (deficit) (% GDP)	(4.5)
Investment (% GDP)	27.0

Source: Constructed from IMFs *International Financial Statistics*, various issues

However, from 1973 onwards, the country suffered a number of economic setbacks, including the two oil price shocks and a sharp decline in copper prices, which led to a sharp deterioration in the country's terms of trade. The situation was further compounded by the failed policy of import substitution industrialisation; independence struggle in Southern Africa, particularly Southern Rhodesia; and economic sanctions against the apartheid regime in South Africa. The result of these economic shocks was macroeconomic instability, which manifested itself in declining real GDP growth, widening fiscal and balance of payment deficits, rising inflation rates and unemployment levels, and capital flight.

Rather than restructure the economy to address the declining economic environment, the authorities took on large external debts and imposed an array of controls, including on the current and capital accounts. Additionally, the authorities pursued several exchange rate regimes, which included fixed (1964 - 1976, 1987 - 1989), managed float (1976 - 1983), and crawling peg (1983 - 1987). (See Table 2) These were accompanied by stringent capital and current account controls, administratively set, interest rate ceilings and price controls.

[10]IMF, International Financial Statistics, 1977

TABLE 2: EXCHANGE RATE REGIMES, 1964-2003 PERIOD

1964 - 1971qtr3	Rates fixed to the Pound Sterling
1971qtr4 - 1976qtr2	Rates fixed to the Dollar
1976qtr3 - 1983qtr3	Managed float against the SDR
1983qtr3 - 1985qtr3	SDR link substituted for Crawling peg on the basis of a basket of six currencies from Zambia's major trading partners
1985qtr4 - 1987qtr2	Foreign exchange auction system; Dutch auction; two-tier auction
1987qtr3 - 1989qtr4	Fixed rate, initially to the Dollar and since November 1988 to the SDR with occasional devaluation
1990qtr1 - 1991qtr3	Dual exchange rate system
1991qtr3 - 1992qtr1	Two windows unified; crawling peg
1992qtr1 - 1992qtr4	February, rate fixed to Dollar
1992qtr4 - 1992qtr4	October, Bureau de change, two windows
1992qr4 - 1993qtr4	December, two windows unified; flexible exchange rate system
1992qr4 - 1993qtr4	free market exchange rate; exchange control act suspended
2001	Exchange rate regime reclassified to managed float

Source: Bank of Zambia

During the 1980s, it was realised that the country needed to restructure and diversify the economy away from copper mining to other sectors. However, attempts to reform the economy to support diversification and the failed import-substitution industrialisation were subject to frequent reversals largely due to lack of political will. Additionally, mounting losses in the state-owned enterprise sector coupled with a restrictive external sector regime further contributed to negative real GDP growth and a sharp acceleration in inflation.

By 1990, per capita GDP had fallen to US $450, about half its level 20 years earlier. The inflation resulting from fiscal and monetary indiscipline had led to an overvalued currency and hence the economy becoming uncompetitive. This gave rise to serious balance of payments problems, which were characterized by a thriving foreign exchange parallel market, narrow export base dominated by an uncompetitive and declining copper mining industry and a huge import bill. The economy was also burdened with a huge external debt, including arrears, which had accumulated as a result of failure to service debt. Moreover, price controls and the absence of competition, under the protective umbrella of import substitution industrialization, restricted both agriculture and industrial growth leading to increasing inefficiency and escalating cost structures. This adversely affected the productive sectors' performance and profitability leading to the economy registering negative growth for the decade leading to 1992.

It was against this background that in 1991 the authorities, under a new Government, embarked on a series of radical policy reforms to liberalise and restructure the economy. Specific measures undertaken include:

- The privatization of state owned enterprises;
- Liberalization of the financial sector;
- Decontrol of prices;
- Freeing interest rates;
- Floating the exchange rate; and
- Removing restrictions on the current and capital accounts.

The measures undertaken were meant to bring about macroeconomic stability and reverse the negative trends in the real GDP; reduce inflation, increase exports and encourage both domestic and foreign investment. Floating of the exchange rate was considered vital for redressing the balance of payments problems through adjustment of relative prices.

Prior to floating, annualized monthly inflation rate averaged 81 percent during the five years leading up to 1992. Immediately after floating, the inflation rate rose to as high as 237.8 percent in July 1993. This was seen as an adjustment of the price level to its equilibrium rate, given that prices had been repressed through price controls. However, between January 1994 and December 1997, the average rate of inflation declined to 41.2 percent and further to 24.2 percent during 1998 to 2002. At the end of December 2004, Zambia recorded an annual inflation rate of 17.2 percent, the lowest in two decades. (see Figure 1)

FIGURE 1: PLOT OF ANNUAL MONTHLY INFLATION AND ANNUAL MONTHLY EXCHANGE RATE DEPRECIATION

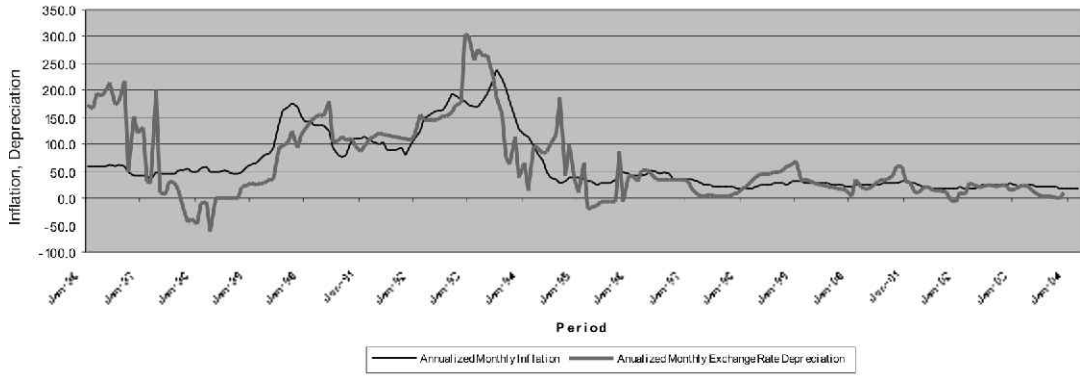
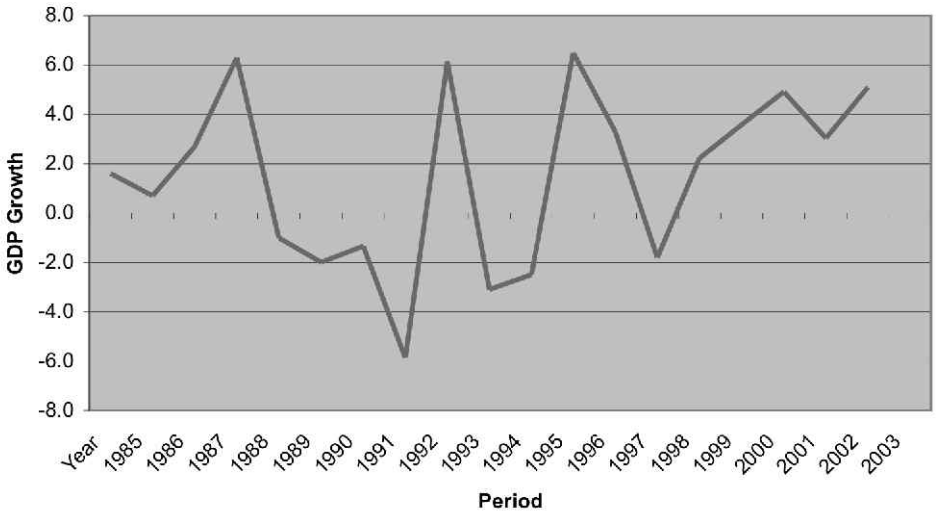


Figure 2 plots real GDP growth for the period 1985 to 2003. The chart shows that between 1985 and 1998, real GDP growth continued exhibited an erratic trend even after the advent of exchange rate floating. There are many factors that contributed to this erratic behaviour of output, which include adverse weather conditions, declining mining output due to run-down mining infrastructure and closure of some mines (RAMCOZ for example). In addition, price controls and the absence of competition had restricted both agriculture and industrial growth giving rise to increasing inefficiency and escalating cost structures which adversely affected the efficiency and profitability of the productive sector. Consequently, most formerly state owned industries that were privatized could not compete with cheap imports after the lifting of both current and capital account controls. This contributed to the negative and erratic GDP growth.

FIGURE 2: PLOT OF REAL GDP GROWTH 1985 - 2003



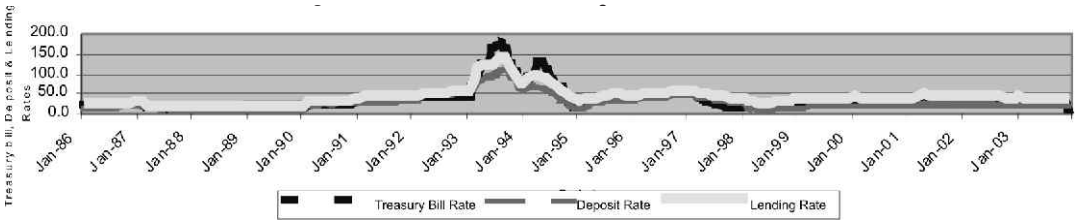
There has however been a marked improvement in real GDP growth after 1999 to date. For example, real GDP growth has averaged 4.3 percent in the last five years (1999 2003) compared to an average of 2.2 percent between 1995 and 1998; 2.1 percent between 1991 1995; and negative 0.9 percent between 1987 and 1991. The improvement in GDP growth between 1999 and 2003 is attributed to an improvement in mining, agricultural, and manufacturing output as well as an increase in tourism. This follows increased investment in these sectors, especially foreign direct investment. The improvement in GDP growth is despite adverse weather conditions in 2000 and 2001, as well as the pull out of Anglo America from Konkola mine (the largest copper mine in the country) which threatened the mine's operations.

In terms of exports, Zambia has traditionally been an exporter of metals. These accounted for 98 percent of Zambia's foreign exchange earnings prior to privatization. This picture has changed, metal exports now account for about 60 percent of foreign exchange earnings from merchandise trade, largely due to a gradual increase in non-traditional export earnings since floating of the exchange rate and liberalization of the foreign exchange market. For example, the non-traditional exports have been growing at an average of 13 percent per annum since 1993. Total non-traditional exports amounted to US $34.6 million in 1993, US $192.7 million in 1995, US $258.6 million in 1998, US $324.5 million in 2002 and US $410.1 million in 2003.

Figure 3 depicts treasury bill, deposit and lending interest rates for the period 1986 to October 2002. Prior to October 1992, the treasury bill, deposit and lending interest rates were administratively set and averaged 25.7 percent, 21.6 percent and 30 percent respectively, between 1986 and 1992. After liberalization of the interest rates and floating of the exchange rate, the interest rates skyrocketed to reach three digit levels. The treasury bill rates reached as high as 177.7 percent in August 1993, whilst the deposit and lending rates reached 111 percent and 138.8 percent respectively. In July 1994, the interest rates declined with the treasury bill rates averaging 40.8 percent between 1995 and 1997. The deposit and lending rates averaged 35.3 and 48.6 percent respectively.

Between 1998 and 2002, the treasury bill rate declined to average 34.1 percent. The deposit

and lending rates also declined to average 20.1 percent and 40.4 percent respectively. The high interest rates obtaining in the Zambian economy reflected Governments avaricious appetite to borrow in order to finance its fiscal deficits. From End-October 2003, Government decided to adhere to tight fiscal policy and substantially reduced its borrowing from the banking and non-bank private sector. Consequently, by end-March 2004, the treasury bill rate had declined to 9.4 percent whilst the deposit and lending rates declined to 9.9 percent and 31.8 percent respectively.



The above indicators show that Zambia's economic performance has been better under the floating exchange rate regime compared to the period before that when the exchange rate was largely fixed. The decontrol of prices, and nominal depreciations in the exchange rate have caused adjustments in relative prices thereby making industries more efficient and profitable, leading to increased factor productivity and capacity utilization whilst at the same time making the country's exports more competitive on the world market. However, although they have come down, the rate of inflation and lending interest rates still remain high.

6. Conclusion

The subject of choice of exchange rate regime goes well beyond technical aspects of exchange rate management. In effect, it entails a preference for internationally or domestically based systems and reflects the relative importance given to national and international considerations and objectives. Focus is on the choice of exchange rate regime that either emphasizes maintenance of price stability or a regime that maintains a country's external balance and competitiveness.

Evidence seems to suggest that countries with flexible exchange rates tend to experience higher growth rates compared to countries with fixed exchange rates, while the latter experience lower inflation rates and slightly higher investment to GDP ratio. However, the conclusion is that the criteria for choosing the appropriate exchange rate regime should depend on the pursued policy objectives. For a developing country that is not experiencing severe inflation and is broadly in external equilibrium, but is subjected to transitory shocks, it may be appropriate to focus on output stability and thus adopt a fixed exchange rate. But when the policy objective is to cushion the economy from external shocks as well as retaining external competitiveness, a flexible exchange rate regime will be appropriate.

For Zambia, macroeconomic performance has been generally better under the floating exchange rate regime compared to before. Inflation, although still high, declined to an average of 24.2 percent after floating compared to an average of 81 percent prior to floating. GDP growth has averaged 2.4 percent in the last past five years compared to 0.9 percent in the five years leading up to the float. Non-traditional exports have also increased

substantially to about 40 percent of total exports compared to less than 2 percent prior to floating of the exchange rate. The non-traditional exports have been growing at an average of 13 percent per annum since floating in 1992. However, interest rates rose immediately after floating and have remained high compared to the ten years prior to floating.

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CHAPTER 7

Asymmetric Effects of Monetary Policy in Zambia: A Structural VAR Analysis

Isaac Muhanga[11]

Abstract

The potential asymmetric effects on the economy of monetary policy in Zambia are discussed in this paper. The structural vector auto-regression (S-VAR) econometric methodology is used to disentangle these effects and analyzing whether monetary policy's effectiveness is state-contingently asymmetric. Conditioning the potential asymmetry on whether the initial level of inflation is high or low, the paper establishes that the state of the economy does matter in the effectiveness of monetary policy. In particular, shocks to monetary policy are found to have stronger effects and weaker interest rate effects when inflation is initially high. Stronger effects on the interest rate and the exchange rate are found when inflation is initially low. Further, there is some evidence in the paper that monetary policy does not frequently respond to economic shocks in a consistent manner.

1. Introduction

This paper tries to measure the extent of state-contingent asymmetry in the manner that monetary policy shocks affect the economy. Questions that arise in monetary policy border on whether policy changes can be more effective in one state of economic conditions than another. Exploring such information has interesting implications for macroeconomic management because knowledge about the extent to which objective variables are affected by monetary policy actions may tell us something about policy effectiveness. In particular, exploring short-run empirical relationships between monetary policy and other variables is relevant as these relationships provide information about the way private agents typically react to the changing state of the economy. In addition, they may also tell us how monetary policy is conducted in order to respond to economic shocks.

The motivation for such a inquiry arises from the fact that very little empirical work has been done on the transmission of monetary policy, and work that has been done in this area has dwelt on the demand for money (Mutoti, 1995, Adams, 1999, among others).

While such studies in their own way add greatly to the efficacy of monetary policy models in Zambia, several questions relating to what extent and how precisely the macro-economy responds to changes in monetary policy have had a shortage of answers. Specifically, is monetary policy's effectiveness dependent on the initial state of the economy, or is the effectiveness invariant to such a state? If monetary policy should be such state-contingent, how should authorities time their policy changes?

[11] The author is an economist in the Financial Markets department of the Bank of Zambia. Assertions and conclusions drawn in this paper are solely the author's and should not in anyway be associated with the Bank of Zambia.

In other words, are monetary policy effects asymmetric to the economy such that policy changes are more or less effective when the economy is characterised by certain conditions? These questions are the main concern of this paper.

The paper is organised as follows. In section 2, a blend of theoretical models that may be relevant in pinpointing potential sources of monetary policy asymmetry is provided. Section 3 provides the main findings of some empirical literature on monetary policy asymmetry while a brief discussion of the econometric methodology and the relevant model specification are provided in section 4. The empirical results and the analysis of the impulse response functions are presented and discussed in section 5. Section 6 concludes the paper.

2. Sources of Monetary Policy Asymmetry

One of the major sources of policy asymmetry relates to economic confidence factors (see Agénor (2001)). The argument is essentially that in an economic environment where credibility of macroeconomic management is in the low ebbs, economic agents are bound to be more pessimistic during 'bad' economic times than they may be optimistic during 'good' times. This loss of confidence arising from credibility doubts can make contractionary monetary policy less effective during bad times than they can make expansionary policy more effective in good times. In other words, agents in a distressed economy may discount at a higher rate the effectiveness of a policy-induced interest rate fall than in a booming economy.

Another potential source of asymmetry may arise from credit constraints. Following the adverse selection models of the credit markets as espoused by the Stiglitz-Weiss works (1981), research work has exploded in this area establishing the existence of credit constraints which are particularly binding in a recession. In this regard, tightening of monetary policy can result in credit constraints because banks may be less willing to lend when interest rates are high. The reason is that with higher interest rates, borrowers may have difficulties with repaying their loans so that the risk of bank asset deterioration increases. To avoid this deterioration, banks may respond by rationing credit.

What this strand of research has shown is that a tight monetary policy aimed at reducing, say, inflation may actually lead to credit rationing, thereby adding to the policy-induced reductions on borrowing and spending. However, if the economy is already in distress, relaxing constraints by pursing an expansionary monetary policy may not necessarily increase the demand for loans, particularly if the objective of a contractionary monetary policy has not been achieved in the first place (Agénor, 2001).

3. Empirical Literature

Empirically, a number of studies have shown that monetary policy does exhibit some ratchet or asymmetric effects on many macroeconomic variables[12]. In studying monetary policy asymmetry for Korea, Malaysia, the Philippines, and Turkey Agénor's (2001) estimation results, indicated that monetary policy shocks (measured as innovations in, alternatively, the money market rate, the discount rate, and the monetary base) have significant asymmetric effects which vary across instruments and countries.

[12]See for example Agénor [2001], Ball and Mankiw [1994], Macklem [1995], Cover [1992], Ravn and Sola [1996], among others.

In a pioneering paper, Cover (1992) developed a two-stage approach involving the estimation of a money supply process and an output equation. In his model, positive and negative residuals from the money growth equation were incorporated separately in the output equation and their significance tested. He found that for the United States negative money supply shocks significantly reduced output, whereas positive shocks were not significant. Garcia and Schaller (1995) find economically and statistically significant evidence of asymmetry in state-contingent setting. As suggested by models with sticky prices or finance constraints, they found that interest rate changes have larger effects during recessions than during booms. They further established that interest rates also have substantial effects on the probability of a state switch. Building on the state-contingent analysis, Karame and Olmendo (2002) also investigated the potential asymmetric effects of monetary policy shocks on U.S. economic activity by focusing on the business cycle phase in which the shock occurs. Their findings reveal that a contractionary money supply shock yields asymmetric responses of output, prices and money.

4. Methodology and Model Specification

In the same spirit with most studies analyzing responses of the economy to monetary policy shocks, this study also makes use of the structural Vector Autoregression (VAR) toolkit[13]. The rationale for using this method stems from its power to isolate policy shocks from non-policy shocks. Although certain monetary aggregates and short-term interest rates have been routinely used as indicators of monetary policy, it is quite clear from existing empirical studies that the time pattern of these and other indicators cannot be unambiguously attributed to monetary policy shocks alone. This is because of the fact that the variables are along the way affected by a myriad of other non-policy effects. It is therefore essential from an empirical point of view to isolate monetary policy effects. Without such isolation, it is impossible to come up with estimates of macroeconomic effects originated by a purely exogenous monetary policy shock. To make this possible, the structural VAR approach is well placed for the task. The advantage of this approach compared with the equally widely-used unrestricted VAR is that it imposes a minimal set of meaningful restrictions that are based on well-founded economic theory.

5. The Structural VAR Scheme

Consider an economy with the following structure

$$A_0 Y_t = B(L) Y_{t-1} + \varepsilon_t \qquad (1)$$

where Y_t is an vector of endogenous variables, A_o is contemporaneous coefficient matrix, $B(L)$ is a p-th degree matrix polynomial in the lag operator L, and ε_t is an vector of white-noise orthogonal structural shocks. In other words, their properties are such that they exhibit a covariance-variance matrix of $E[\varepsilon_t \varepsilon_t'] = \Omega$ with all off-diagonal elements equal to zero.

[13] See for instance Bernanke and Blinder (1992), Bernanke and Mihov (1997, 1998), Christiano and Eichenbaum (1992), De Arcangelis and Di Giorgio (1999), Sims (1992), among others.

Equation 1 in its structural form cannot be estimated directly (due to the feedback inherent in the system[14]). We therefore re-parameterise it in its reduced form

$$Y_t = C(L)Y_{t-1} + u_t \qquad (2)$$

where $C(L) = A_0^{-1}B(L)$ and $u_t = A_0^{-1}\varepsilon_t$ so that the covariance matrix

$E(u_t u_t^{'}) = A_0^{-1}\Omega(A_0^{-1})^{'} = \Sigma$

The transformation of equation 1 into equation 2 shos that the error terms (u_t) are a linear combination of the orthogonal structural shocks (ε_t) Although the u_ts are also serially uncorrelated with zero mean and a constant variance, they are however correlated with each other such that, unlike the matrix Ω , the covariance-variance matrix Σ s non-diagonal.

Much as equation 2 can be estimated, its structure presents a problem because it is not possible to recover the underlying structural shocks unless the equation is transformed back into a structural form that exhibits uncorrelated shocks. In its form, the reduced-form system is said to be under-identified because it has less parameters to be estimated than equation 1. With under-identification, there is therefore no way of obtaining unique parameters unless we preserve the orthogonality of the structural system.

Noting that the reduced-form residuals are simply a linear combination of the structural form innovations, (i.e $u_t = A_0^{-1}\varepsilon_t$), we can fortunately preserve this structure by introducing some exclusion restrictions on the contemporaneous matrix in such a way that the sum of n^2+n free parameters in A_0 and Ω are reduced to no more than $(n^2+n)/2$ distinct elements in Σ .

To begin with, we can account for the parameters in the system as follows. First, the structural covariance-variance matrix Ω has n unknown parameters, since all off-diagonal elements are zero. Second, the matrix A_0 has n^2 elements. Without loss of information, the diagonal elements of the contemporaneous matrix A_0 are normalized to unity so that we have n^2-n unknown elements. The n elements from Ω plus the (n^2-n) elements from A_0 give us a total of n^2 unknown structural values. From the reduced-form system, we know that Σ is symmetric, and as such it contains only $(n^2+n)/2$ distinct elements. Therefore, in order to identify the n^2 unknowns from $(n^2+n)/2$, we need to impose additional n^2- $(n^2+n)/2$ = $(n^2$-$n)/2$ restrictions on the contemporaneous matrix A_0.

There are several ways of imposing these restrictions. By far, most researchers use the Choleski decomposition, which involves recursively ordering variables in such a way that structural shocks contemporaneously affect only succeeding variables. That is, variables pre-dating others are assumed to have contemporaneous effects on those coming after them but not vice versa. This essentially means that the contemporaneous matrix A_0 is of lower-triangular form.

[14] The feedback is due the fact that each endogenous variable in the structural VAR is correlated with the contemporaneous error terms of other endogenous variables. Standard estimation techniques require that regressors should not be correlated with error terms

6. Model Specification

The model developed incorporates 4 variables: the annual rate of change in the K/USD exchange rate (*e*), annual inflation rate (*p*), the 91-day Treasury bill yield rate (*r*), and a monetary policy instrument variable (*m*). The policy instrument is taken to be the primary auction size of Government securities expressed as a proportion of the maturing stock of securities. Defining the monetary policy instrument in this manner rests on the fact that Government securities in Zambia are issued to cover maturing principals such that any excess issuances are *largely* for monetary policy purposes. In this case, net issuances of Government securities usually represent the authorities' market-based instrument with which to change liquidity conditions at very short notices. Although central bank open-market credit auctions are another market-based instrument, its effectiveness is in principle weak for this exercise given its relative shallowness in terms of liquidity. The 91-day Treasury bill is the oldest and most popular security and its yield rate is widely used as a benchmark interest rate.

In order to identify monetary policy shocks, the following restrictions on the contemporaneous structural matrix A_0 are introduced:

i. The exchange rate does not contemporaneously depend on any of the variables in the model;

ii. Only the exchange rate has contemporaneous effects on inflation;

iii. The interest rate is affected contemporaneously only by shocks to the exchange rate, and inflation; and

iv. Monetary authorities respond contemporaneously to developments in the exchange rate, inflation rate, and interest rates. In other words, monetary policy makers do change parameters of their reaction function based on the current information about the state of the economy.

These assumptions can be summarised by the following matrix combination:

$$\begin{bmatrix} u^e \\ u^p \\ u^t \\ u^m \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ \alpha_1 & 1 & 0 & 0 \\ \alpha_2 & \alpha_3 & 1 & 0 \\ \alpha_4 & \alpha_5 & \alpha_6 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon^e \\ \varepsilon^p \\ \varepsilon^t \\ \varepsilon^m \end{bmatrix} \qquad (3)$$

where the u vector represents reduced-form innovations while the ε vector represents structural shocks.

Although not fully in line with the ordering schemes commonly found in the literature on monetary policy using VARs, the exchange rate appears in the first row largely because of the way the Zambian financial markets are observed to work in the short run. In particular, it is well observable that there is a weak integration of the domestic money and the foreign exchange markets such that the exchange rate does not respond very quickly to continuous indirect monetary policy innovations, such as changes in net issuances of government securities (Muhanga, 1996). The second row is derived from the fact that the pass-through effects of exchange rate shocks to domestic prices are fairly quick and significant. In the third row, the interest rate is contemporaneously linked to exchange rate and inflation following the establishment that determination of commercial interest rates is off these variables (2003). The last row represents the BOZ's monetary policy reaction function. The

central bank is assumed to worry about the general state of economy.

To account for the state-contingent asymmetric effects of monetary policy, a partitioned VAR model is run according to the initial state of the economy. I do this by following a scheme similar to Agénor (2001) by examining economic responses in times when the initial level of inflation is high or low. Inflation will be defined as high (low) when it is higher (lower) than its sample averages. Specifically, I introduce a dummy variable D that takes the value of 1 when the inflation rate is initially high and 0 otherwise. In either case, the dummy is directly incorporated in the VAR to allow for a shift in both the intercepts and the contemporaneous slope parameters.

7. Estimation Results

The structural VAR (equation.3) is estimated using monthly data. In the first instance, impulse responses for the symmetric case are estimated where the net issuance of Treasury bills is incorporated as the monetary policy instrument. In the second instance, the asymmetric case model is estimated using the same monetary policy instrument but for two state-contingent samples, that is, samples are partitioned according to whether inflation is high or low. The results are shown for three exercises. First, the symmetric case is analysed and secondly, two asymmetric cases taking into account the state of the economy are looked at.

Impulse Response Analysis: Symmetric Case

The symmetric case impulse response functions for 10 months are shown in Figure 1 where each function is associated with a Cholesky one-standard deviation shock to the innovation to each variable in the model[15]. The upper row shows the responses of each variable to monetary policy shocks while the lower row shows the response of monetary authorities to economic shocks.

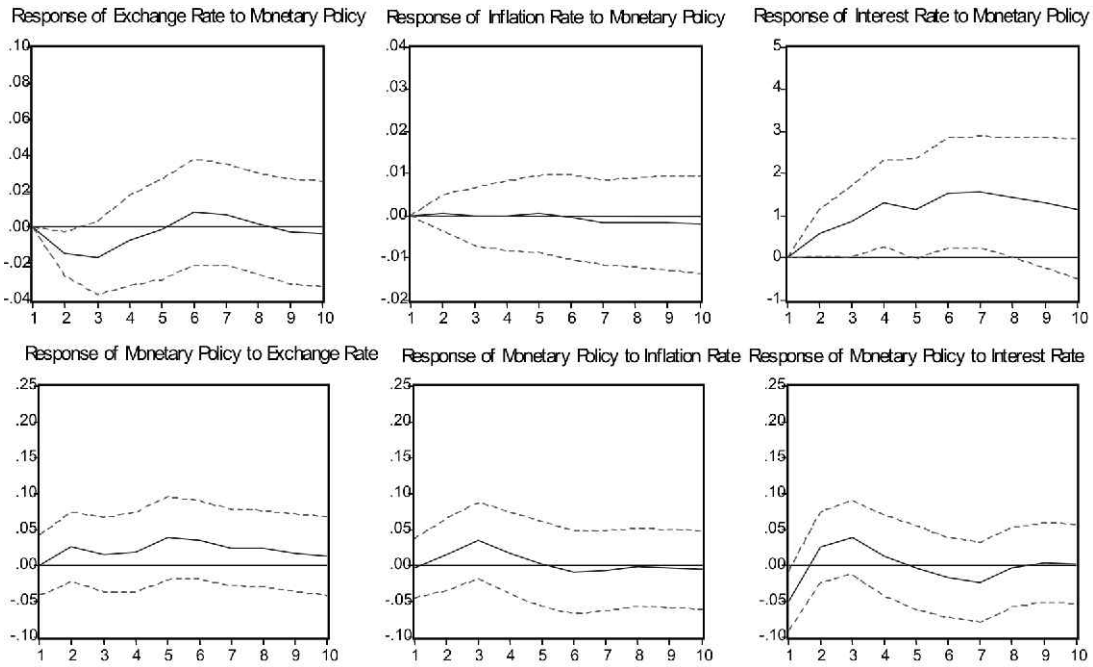
Consider a positive shock to the monetary policy instrument as depicted in top row of Figure 1. Initially, this shock does not seem to have a much significant effect on the exchange rate; the exchange rate in the next four periods tends towards an appreciation. The effect of the shock on inflation is quite mute. This result is broadly in line with the fixed-price theories that goods market prices tend to be sluggish in adjusting to economic shock. The response of interest rate is robust virtually for the whole period as it shows strong tendency to rise with a contractionary monetary policy.

Now consider the responses of monetary policy to economic events as shown in the bottom row. A positive shock to the exchange rate (that is, depreciation) is more or less met with an increase in the authorities' persistent propensity to issue more securities. A similar response is noticed towards inflation developments, but on a non-persistent scale. The response of monetary policy to positive interest rate shocks is initially defensive as authorities slow down on the propensity to issue more securities. However, this response is sharply reversed by the second period.

[15] The solid lines in the figures represent the path of the impulse response functions themselves while the dotted lines represent the associated ±2 standard error bands. The impulse responses are computed using initial values derived from the standard normal distribution.

Consider a positive shock to the monetary policy instrument as depicted in top row of Figure 1[16]. Initially, this shock does not seem to have a much significant effect on the exchange rate; the exchange rate in the next four periods tends towards an appreciation. The effect of the shock on inflation is quite mute. This result is broadly in line with the fixed-price theories that goods market prices tend to be sluggish in adjusting to economic shock. The response of interest rate is robust virtually for the whole period as it shows strong tendency to rise with a contractionary monetary policy.

FIGURE 1: RESPONSE TO CHOLESKYONE S.D. INNOVATION ±2S.E.



Now consider the responses of monetary policy to economic events as shown in the bottom row. A positive shock to the exchange rate (that is, depreciation) is more or less met with an increase in the authorities' persistent propensity to issue more securities. A similar response is noticed towards inflation developments, but on a non-persistent scale. The response of monetary policy to positive interest rate shocks is initially defensive as authorities slow down on the propensity to issue more securities. However, this response is sharply reversed by the second period.

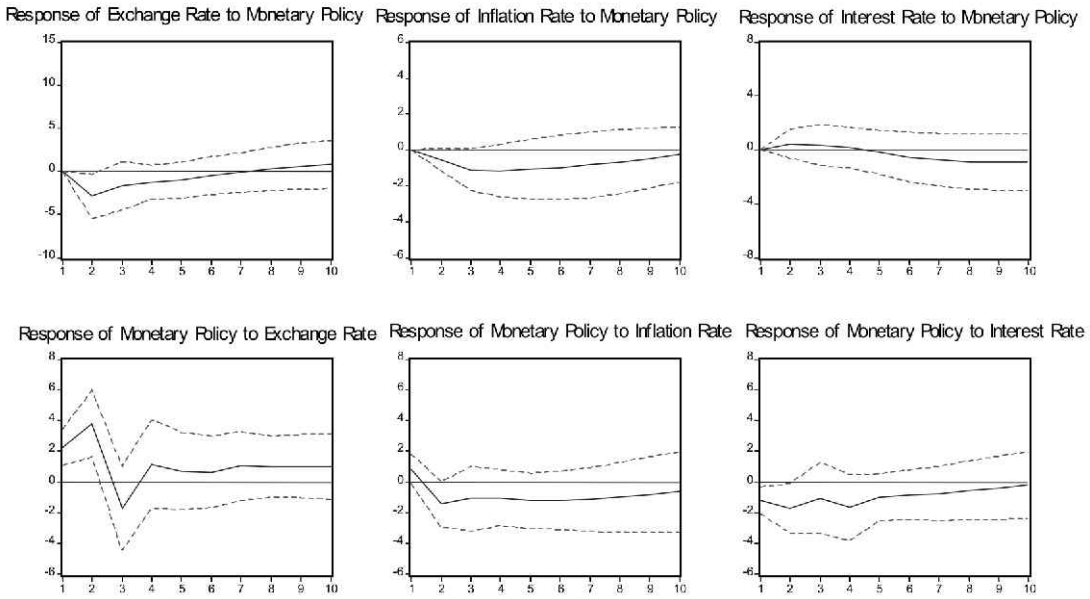
Asymmetric Impulse Response Analysis: High Inflation Case

Taking into account state-contingent effects, we first consider monetary policy effects under high inflation periods. Consider the results of a positive shock to the monetary policy as depicted in Figure 2. On impact, all the variables are virtually unresponsive to policy change. However, in the following periods, the monetary policy shock leads to exchange rate appreciation pressures, which persist for about five periods.

[16] Note that a positive shock here should be interpreted to mean that there has been an increase in the excess auction size, which implies a contractionary monetary policy.

The response of inflation is quite in line with theoretical expectations as it persistently declines throughout the dynamic period. The response of the interest rate is however timid with very little noticeable responsive trend.

Figure 2: Asymmetric Response to Cholesky One S.D. Innovations ± 2 S.E. Under High Inflation



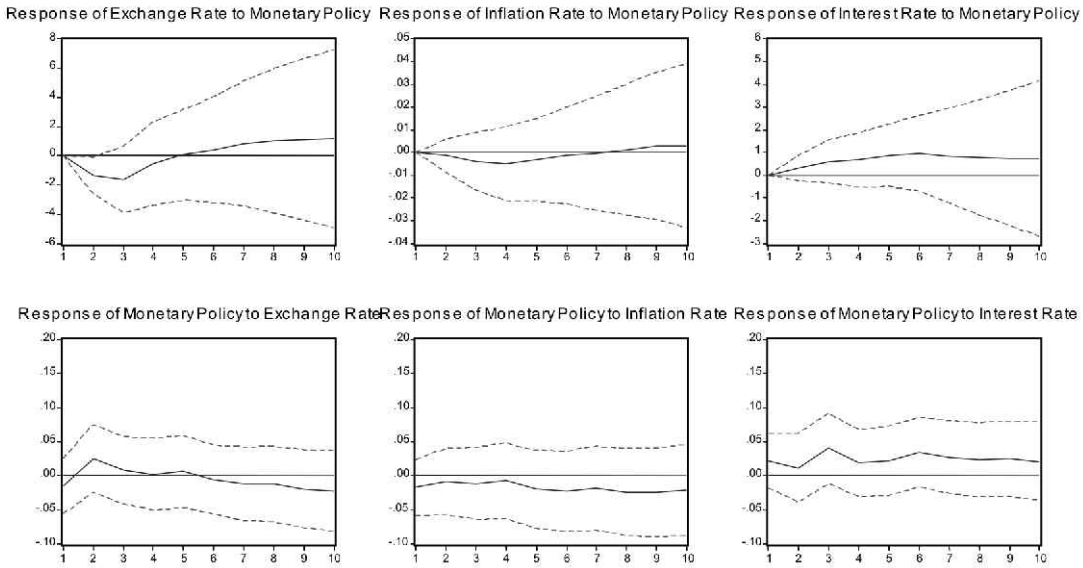
Under a high inflation rate environment, monetary policy responses to exchange rate and interest rate shocks are both vividly seen to be strong on impact, and in general persisting throughout the dynamic period. Authorities respond by raising the auction size in order to control exchange rate depreciation while they will tend to respond by lowering the auction size in order to moderate increasing interest rate. However, policy response to inflation seems to be puzzling with authorities lowering auction sizes as inflation rises.

Asymmetric Impulse Response Analysis: Low Inflation Case

Under a low inflation environment, a positive shock to monetary policy also leads to an appreciating currency, but not for a longer time than otherwise shown under high inflation case as depicted in Figure 3. The response of inflation is found to be weaker when inflation is already relatively low while the interest rate's response is comparatively stronger and more persistent than under high inflation.

When inflation is considered low, monetary policy response to positive exchange rate shocks is at most timid and relatively weaker while the response to inflation rate is persistently characterized by low propensity to increase auction sizes. The response to interest rate shocks is also not in line with expectations as authorities tend to increase the supply of government securities.

Figure 3: Asymmetric Response to Cholesky One S.D. Innovations ± 2 S.E. Under Low Inflation



8. Conclusion and Policy Implications

The results presented indicate that monetary policy is more consistent and less frustrating when conducted taking into account the initial conditions of the economy. It seems imperative that bringing down inflation should be an over-riding objective of the monetary policy in Zambia. Conditioning the potential asymmetry on whether the initial level of inflation is high or low, the paper establishes that the state of the economy does matter in the effectiveness of monetary policy. In particular, shocks to monetary policy are found to have stronger effects on inflation and weaker interest rate effects when inflation itself is initially high. In such circumstances, it seems instructive to directly target inflation itself. Stronger effects on the interest rate and the exchange rate are found when inflation is initially low. With inflation initially low, one would advise that monetary policy should be conducted through the exchange rate and interest rate channels. Further, there is some evidence in the paper that monetary policy does not frequently respond to economic shocks in a consistent manner.

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CHAPTER 8

Effect of Stabilisation Policies on Macroeconomic Performance in Zambia

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Abstract

The paper analyses the effect of stabilisation policies in Zambia. The results of econometric tests show that the use of the monetary approach to correct for balance of payments disequilibria is inappropriate in Zambia. However, monetary policy is effective in controlling inflation and stabilising the exchange rate but has no effect on real GDP. The results also show that the real exchange rate has an insignificant effect on the balance of payments. The relative price effects (the real exchange rate effects) work through imports and not exports so that the overall effect is insignificant. Since investment has a high import content, a policy of devaluation adopted in order to correct for balance of payments disequilibria has adverse effects on investment and hence future growth.

1. Introduction

Since the negative copper price shock of 1974, Zambia has experienced twin problems of high inflation and a deficit in the balance of payments. To reduce these pressures, an International Monetary Fund (IMF) supported stabilisation programme has been adopted. The IMF plays an important role in the adjustment efforts of its member countries by assisting in the design of programmes aimed at achieving viability of the balance of payments, accompanied by price stability and a sustainable high rate of growth. They also provide financing to support these programmes[1]. Broadly defined, stabilisation (or financial programme) is, a package of policies designed to eliminate disequilibria between aggregate demand and aggregate supply in the economy; which typically manifests itself in balance of payments deficits and rising prices. While no single theoretical model underlies all financial programmes, a broad framework within which most of them are formulated has evolved in the IMF over the years. Within this framework, there is a fairly well defined relationship between money supply, the balance of payments and domestic prices in which the supply of and demand for money play central linking role.

The effects of these policies on the real sector are treated less explicitly. When feed- backs from the real sector are taken into consideration, the analysis is made on a more informal case-by-case basis rather than in the context of an explicit formal methodology. It is therefore difficult to say a priori whether a given financial programme will have undesirable effects on growth and employment, something that has worried policy makers and academic economists alike.

[1]Santaella (1996) details the macroeconomic characteristics of countries prior to their adopting a Fund supported program. Typically, the countries are suffering from a worsening current account balance, a loss of international reserves and an increase in inflation.

Robicheck (1967) observed that in implementing a financial programme, one has to be aware of the need to frame programmes that are compatible with the aspirations for rapid growth.

IMF programmes are controversial. Governments that enter into agreements with the IMF claim that it is for the better, yet incidences of strikes, riots and ransacking of super- markets manifest that IMF programmes mobilise some resistance. In Zambia, the riots that took place in 1986 forced the authorities to abandon the IMF programme in 1987. Since 1989 todate the Zambian have remained on the IMF supported economic programme. Scholarly opinion is also divided: statistical findings range over a spectrum of possible conclusions. Khan and Haque (1998) concluded that IMF-supported programs are generally successful in stabilising the economies. On the other hand, Przeworski and Vreeland (2000)Cha claim to have found evidence that programme participation lowers growth rates.

In fact, Khan and Haque (1998) argued that there is no theoretical guarantee that Fund adjustment packages will achieve their desired outcomes. They describe Fund programs as complex packages of policy measures, which combine aggregate demand policies with supply enhancing, relative price policies. The theory underlying the dynamic link between the policy package and a set of multiple macroeconomic variables is not well established. They also argue that Fund supported programs are only one of the macroeconomic "shocks" to a country with a programme. External shocks such as changes in the terms of trade and the cost of servicing debt will also affect the country's ability to achieve the objectives of the programme.

This paper is aimed at establishing the appropriateness of the analytical approach used in the design of the financial programme. It begins by describing the general macroeconomic framework, which is consistent with both the World Bank and the IMF analytical approaches in section 2. Sections 3 describes the analytical approach of the IMF. Sections 4 and 5 provide an empirical investigation of the link between the money supply, the balance of payments, the exchange rate, real GDP and inflation. Section 6 concludes.

2.0 The General Macroeconomic Framework

The general macroeconomic framework presented in this section is consistent with both IMF and the World Bank analytical approaches. It assumes that the economy is divided into four sectors, the private sector, the public sector, the external sector and the domestic banking system, which is assumed for simplicity to consist solely of the central bank.

2.1 The Private Sector

The private sector budget constraint is given by

$$Y - T - C_P - \Delta K = \Delta M + \Delta F_P - \Delta D_P \qquad (1)$$

The private sector uses the sale of its output goods (Y) to pay for taxes (T), for consumption (Cp) and investment ΔK and accumulate financial assets. The private sector's accumulation of financial assets consists of money (ΔM) and foreign assets (ΔFp), minus borrowing from the banking system ΔD_P).

2.2 The Public Sector

The public sector receives taxes and uses the proceeds for consumption (Cg). It does not engage in any investment and any surplus is devoted to the accumulation of foreign financial assets (ΔF g) net of borrowing from the banking system (ΔDg). This gives the following public sector budget constraint:

$$T - Cg = \Delta Fg - \Delta Dg \qquad (2)$$

2.3 The External Sector

The foreign sector receives revenues in the form of imports purchased by the domestic economy (Z) and it spends on domestic exports (X). The external sector budget constraint

$$X - Z = \Delta F + \Delta R \qquad (3)$$

ΔF is the change in foreign assets for both the private and public sectors and ΔR is the change in reserves.

2.4 The Financial Sector

Finally, the central bank is a financial intermediary, which acquires assets in the form of international reserves and claims on the domestic private and public sectors (ΔD) and supplies its own liabilities in the form of money to the private sector. These transactions must satisfy the following balance sheet constraint:

$$\Delta M = \Delta R + \Delta D \qquad (4)$$

Summing (2.1) to (2.4) yields;

$$Y - Cp - Cg - K - X + Z = 0 \qquad (5)$$

Equation (5) is the national income identity. In the following section, we utilize these balance sheet constraints in the IMF financial programming model.

3.0 The IMF Financial Programming Model

The Fund's task is to provide advice to countries on macroeconomic policy and to finance temporary balance of payments disequilibria. When the balance of payments deficits are not inherently temporary, they must be rendered so by corrective policy measures, which typically involve a reduction in domestic credit expansion and devaluation. The Fund approach to balance of payments adjustment is based on the models by Polak (1957) and Robicheck (1967). The fundamental ingredients of this approach are:

- Real GDP is assumed to be exogenously determined

$$Y = Py \tag{6}$$

where Y denotes nominal GDP, P denotes the domestic price level and y is real GDP, which is regarded as exogenous. The change in nominal GDP can be approximated as:

$$\Delta Y = \Delta Py' + P'\Delta y \tag{7}$$

In this equation, both last period's real GDP, y' and last year's price level P' are predetermined. The change in real GDP is exogenous while the change in the domestic price level is the endogenous variable.

- velocity of money is assumed to be constant:

$$\Delta M^{D} = v\Delta Y \tag{8}$$

The v is a constant, which represents the inverse of the income velocity of money and is the demand for nominal balances. The money market is assumed to be in flow equilibrium. Therefore;

$$\Delta M^{S} = \Delta M^{D} = \Delta M \tag{9}$$

where M^{D} is the supply of money. These three equations together with identity (4) permit the change in foreign exchange reserves to be expressed in terms of exogenous variables and policy variables as follows:

$$\Delta R = v\Delta Py' + vP'\Delta y - \Delta D \tag{10}$$

Δ D, which consists of domestic credit to the private and public sectors is a policy variable controlled by the monetary authorities. Equation (10) is the fundamental equation of the monetary approach to the balance of payments, which was pioneered by the Fund. The balance of payments is expressed as the difference between the private flow demand for money and the flow of domestic credit. The model is based on the assumption of a constant velocity of money and the exchange rate.

In this simple model, increases in domestic credit will be offset by decreases in foreign reserves on a one for one basis. Based on a targeted change in foreign exchange reserves, and a projected change in real GDP and hence money demand, the solution to equation (10) provides the desired path for domestic credit. Since policy makers' loss functions in countries facing balance of payments problems presumably attach little weight to positive deviations of R from its desired value, the targeted expansion in domestic credit is set as a ceiling. Thus equation (10) provides the rationale for the use of credit ceilings performance criteria in Fund programmes. By monitoring the expansion of domestic credit, it is possible

to determine if the program is on track in achieving the targeted increase in reserves. From the above description, it is obvious that the demand for money plays a critical role.

For domestic credit to have a predictable effect on the balance of payments, the demand for money must bear a stable relationship with a limited set of independent variables. What is needed in this framework is that the demand for money, or velocity, responds in a predictable fashion to changes in variables such as real income and prices.

Equation (10) however, contains two endogenous variables - ΔR and Δp- so that it is possible to find a unique solution for both conditional on a chosen expansion of credit. The solution is depicted in Figure 1.

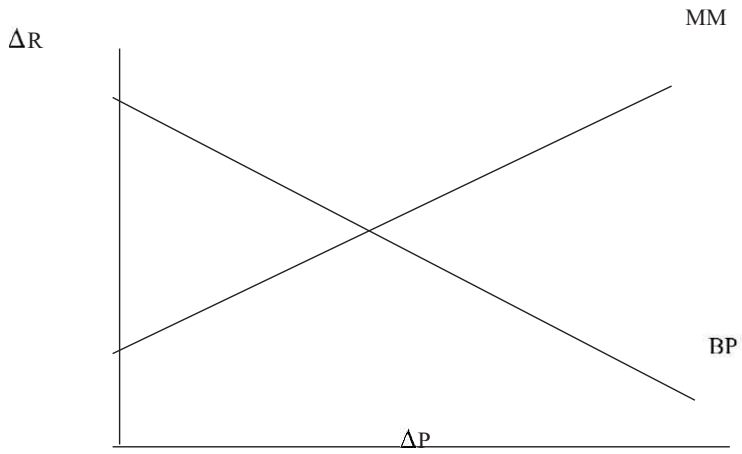

Figure 1: The Polak Model

Equation (10) is a straight line in the ΔR - ΔP space, denoted MM, with intercept vPΔ y - D and a positive slope of vy'. The intuition behind is that an increase in the price level reduces real money balances and thus leads to excess demand for money. To achieve equilibrium in the money market, the nominal money supply must be increased through an increase in reserves. A reduction in the rate of expansion of domestic credit will shift the line upwards, so an improvement in the balance of payments will be associated with any rate of inflation Δ P. But altering the rate of credit expansion can only alter the position of the line. It cannot determine where the economy will be found along this line at any moment of time so that the domestic price level will be indeterminate in this model. This indeterminacy is removed by taking into account the balance of payments identity (3) and an import demand function. Letting imports depend on nominal GDP, the latter can be written in the form:

$$Z = aY \tag{11}$$

$$Z = a(Y' + P'\Delta y + y'\Delta P) \tag{12}$$

When we substitute (12) into the balance of payments identity (3), we have;

$$\Delta R = X - \Delta F - a(Y' + P'\Delta y) - ay'\Delta P \qquad (13)$$

This defines the second relationship between the change in reserves and the change in prices. Equation (13) is the well known Polak model which is a straight line BP with intercept X - ΔF a(Y' + P'Δy) and a negative slope equal to ay'. The intuition behind is that an increase in prices raises nominal income at a constant real income level, increasing imports through the marginal propensity to import parameter a. Its intersection with the positively sloped line M M yields the equilibrium levels of the balance of payments (ΔR and inflation ΔP).

In order to permit shifts in the BP line, we modify the Polak model by including the influence of the nominal exchange rate on prices, imports and exports. The price level is now defined as:

$$\Delta P = (1 - \Theta)\Delta P_D + \Theta\Delta e \qquad (14)$$

ΔP_D is an index of domestic prices, Θ is the share of importables in the overall price index and e is the nominal exchange rate defined as the domestic currency price of a unit of foreign currency. This introduces an additional policy variable in form of the exchange. We also allow imports to depend on the relative price of importable goods in terms of domestic goods as follows:

$$Z = Z' + (Z' - b)\Delta e + b\Delta P_D + a\Delta y \qquad (15)$$

where b is a positive parameter that measures the responsiveness of the volume of imports to the relative price of importables. According to equation (2.15), increases in domestic real G D P and in domestic prices raise spending on imports, while devaluation ill reduce imports if the volume of imports is sufficiently responsive to relative prices11.

Finally, the volume of exports is assumed to depend on the relative price of foreign goods in terms of domestic goods, while net foreign capital inflows are taken as exogenous in foreign currency terms.

$$X = X' + (X' + c)\Delta e - c\Delta P_D \qquad (16)$$

$$\Delta F = \Delta f\,(1 + \Delta e) \qquad (17)$$

Δ F are net foreign capital inflows in foreign currency terms. Substituting the price identity (14) into the version of (10), derived from (4), as well as (15), (16), and the balance of payments identity (3) allows the expanded model (the Monetary and Polack Model) to be written as[2];

$$\Delta R = vy'(1-\Theta)\Delta P_D + vy'\Theta\Delta e + v\Delta y - \Delta D \qquad (18)$$

$$\Delta R = (X'-Z'-\Delta f)(1+\Delta e)+(b+c)[\Delta e - \Delta P_D] - a\Delta y \quad (19)$$

In the expanded model, the variable in the horizontal axis becomes ΔP_D, the change in domestic prices. More importantly, control over the nominal exchange rate, e allows the authorities to shift the locus traced out by equation (13) so that a better balance of payments outcome can be attained for a given rate of inflation. With two instruments at their disposal, the authorities can now attain the targeted values for both the balance of payments and the rate of inflation.

The model presented thus far is a classical form of the Polak model in which we have income on the horizontal axis. With real income fixed, the model can be presented with the change in prices only on the horizontal axis. The Keynesian closure model is one solved for the change in real GDP taking the price level as given. The Keynesian model predicts a deterioration in the balance of payments and an increase in real income as a result of an increase in domestic credit. The classical closure on the other hand predicts a deterioration in the balance of payments and rising inflation.

The above analysis has shown how credit ceilings can be derived from the basic monetary model. In practice, the ceiling on the expansion of total domestic credit is frequently accompanied by a ceiling on the expansion of credit to the non-financial public sector. This sub-ceiling plays a dual role. On one hand it assists in the monitoring of the overall domestic ceiling since in the Fund's experience, violations of the overall credit ceilings tend to originate from excessive expansion of credit to the public sector. More importantly, the public sub-ceiling ensures that the availability of credit to the private sector is not sector is not curtailed by the overall credit ceiling. Formally, the expansion of credit to the private sector functions as a secondary target in Fund stabilisation programmes. Such a target, say Dp, can be achieved by the expansion of credit to the public sector as an instrument, according to:

$$\Delta D_G = \Delta D - \Delta D_p \qquad (20)$$

The target value of private credit expansion is typically related to the projection of nominal GDP. For example, it may be postulated that the expansion of credit to the private sector keep pace with the increase in GDP. Thus, the targeted expansion of private credit could be derived from a demand for credit relationship such as;

[2]It is possible for expenditure on imports to rise after a devaluation purely as a result of valuation effects. This occurs if the volume of imports is not responsive enough to the relative prices the initial prices are equal to unity. $P = PDF = ePf = 1$

$$\frac{M_t}{p_t} = a_o - a_{1t}\dot{i}_t \quad (21)$$

From the non-financial public sector's budget constraint, equation (21) fixes the sector budget constraint from below the line (from the financing side). The public sector must adjust to this programmed deficit by increasing revenue and/or reducing expenditure.

The Flood and Garber Model

A similar model to the one presented above was used by Flood and Garber (1984) in analyzing the collapse of fixed exchange regimes. They built a perfect foresight model around five equations:

$$\Delta D_p = \left(\frac{D_p}{Y}\right)\Delta Y \quad (22)$$

$$M_T = R_t + D_t \quad (23)$$

$$\dot{D} = \mu \quad (24)$$

$$i = i^* + S_T/S \quad (26)$$

Equation (22) is the money demand equation in which the real money demand is specified as a function of the interest rate. Equation (23) specifies the components of nominal money supply Mt as reserves (R) and domestic credit (D). The growth rate in domestic credit is given by equation (24). Equation (25) provides the basic purchasing power parity (P P P) condition while equation (26) is the uncovered interest parity (U I P). Using equations (25) and (26) in (22), we obtain

$$M_t = \beta S_T - \alpha \dot{S}_t \quad (27)$$

where â = (a_oP* -a_1P*i*) and á = a_1P*

If the exchange rate is fixed, reserves adjust to maintain money market equilibrium. The quantity of reserves at any time is given by:

$$R_t = \beta S_t - D_T \quad (28)$$

The rate of change of reserves i.e, the balance of payments is

$$R = -D = \mu \quad (29)$$

Under a fixed exchange rate regime, S= 0 so that Mt = S_tP. This is equivalent to saying that the money supply should equal the foreign money supply and demand multiplied by the foreign price level and the exchange rate. Reserves will therefore equal

The equations above are an illustration of how the growth in domestic credit leads to the depletion of reserves and eventually to the collapse of a fixed exchange rate regime. The probability of an attack on the reserves of the central bank depends on the amount of initial reserves and the growth rate in domestic credit. The time when reserves run out is given by the following relation:

$$T = \frac{(\beta S - D)}{\mu} \qquad (30)$$

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The attack on the fixed peg takes place before the time that reserves run out. The above equation means that an increase in reserves delays the attack while an increase in the domestic credit hastens the attack on the central bank reserves.

The IMF analytical framework presented above has the following implications; a reduction in domestic credit improves the balance of payments position and reduces domestic inflation; a devaluation improves the balance of payments position but at a cost of increased inflation; a combined policy, involving a reduction in domestic credit and a devaluation will lead to enhanced balance of payments improvement with an ambiguous effect on inflation which depends on the relative magnitudes of the two effects. These implications are investigated empirically in the next two sections. Section 4 focuses on the Monetary model and section 5 analyses the Polak model.

4.0 Empirical Analysis: Monetary Model

In order to determine the effectiveness of IMF stabilisation programmes in Zambia, we analyse the effect of monetary policy on inflation and the balance of payments. Our analysis is also extended to include the effect on the exchange rate and real income. Three different approaches are used. In the first approach, we analyse the effect of domestic credit on reserves and the exchange rate using Granger causality tests and variance decompositions. In the second, we use a co integrated VAR model, starting with an analysis of the demand for money in Zambia followed by variance decomposition analysis using an equilibrium correction framework. In the third, we focus on the effect of the money supply only as measured by M1 . We start by describing the statistical properties of the series.

4.1 Data and Statistical Properties of the Series

The sample used in this analysis covers annual data for the period 1965 to 1999. This is the period over which data is available for all the variables of interest. For some variables, data goes as far back as 1964 and for some it goes beyond 1999. All the data used in this analysis was obtained from the International Financial Statistics (IFS) of the IMF.

We start by first determining the statistical properties of the series used in the analysis. Unit root tests are conducted to determine whether the series are stationary processes. The

procedure used here is the standard Dickey Fuller and augmented Dickey Fuller tests. The null hypothesis is that of a unit root. A significant test statistic would reject the null and accept stationarity

TABLE 1: DESCRIPTION OF VARIABLES

Variable	Description
TB	Trade Balance
R	Commercial Bank Weighted Lending Rate
ER	Exchange Rate
P	Consumer Price Index
MI	Money Supply
DC	Net Domestic Assets (Credit) of the Bank of Zambia
P^c	Copper price
Y	GDP
RES	Gross International Reserves

Table 1 provides descriptions of the variables included in the model. From the results presented in Table 2 below we notice that the log of the Consumer Price Index (P), the supply of money measured by M1 and the Net Domestic Assets at Bank of Zambia DC are I (2) variables. This implies that inflation is a non-stationary variable. However, the rate of change of the inflation rate is stationary. The real supply of money and the real Net Assets, both deflated by the consumer price index are I(1) .The trade balance and the interest rate are stationary while the rest of the variables are I (1).

TABLE 2: UNIT ROOT TESTS

Variable	Order of Integration
Trade Balance	0
Interest Rate	0
Exchange Rate	1
Consumer Price Index	2
Real GDP	1
Money Supply (MI)	2
Domestic Credit	2
Copper Price	1
Reserves	1

4.2 Empirical Analysis based on changes in Domestic Credit

The macroeconomic effects of changes in domestic credit depend on the exchange rate regime. Under a fixed exchange rate regime, some (or all) of the changes in domestic credit will be offset by changes in reserves through the balance of payments, reducing (or eliminating) the effects on domestic variables. With a flexible exchange rate, the value of the currency will adjust. This may increase the domestic effect of changes in the money supply (as suggested by rigid price models), or neutralise any real effects (as suggested by the monetarist models). Small country monetarist models predict that under a fixed exchange rate, changes in the money supply will be completely offset by variations in foreign reserves

restoring the original money supply. This result is derived from the monetary equilibrium condition with the assumption of exogenous income (at potential output), prices (due to purchasing power parity) and interest rates (assuming perfect capital mobility). Models with less restrictive assumptions (e.g. resources are not fully employed, capital is not very mobile and reserve flows are sterilized) imply a balance of payments offset that may be smaller than the minus one value predicted in the monetarist model.

Granger causality tests are carried out using bivariate VARs using block non-causality. We use bivariate VARs because the effect of one variable on another cannot be isolated in a multivariate model. However, a five variable VAR is estimated, (domestic credit, foreign reserves, the exchange rate, prices and income) and variance decompositions to determine the degree to which the domestic credit shocks explain changes in the exchange rate. In addition, the effects of domestic credit shocks on income are evaluated. The VARs are also used to evaluate the sources of inflation, comparing the extent to which shocks to domestic credit and the exchange rate explain inflation.

Inferences drawn from VARs can be sensitive to the lag length chosen. We use the Akaike Information Criteria (AIC) and the Shwarz Bayesian Criteria (SBC) to specify the lag structure of the equations in the VARs. As usual, the SBC chooses a shorter lag length than the AIC. Based on the AIC, we choose a lag length of one. We then perform block exogeneity tests for each of the variables in the model.

In determining the effect of domestic credit on reserves and other variables, we use the “block Granger non-causality test". It provides a statistical measure of the extent which lagged values of a set of variables are important in explaining another set of variables, while lagged values of the latter variables are included in the model. Our interest is in determining the effect of domestic credit on reserves, the exchange rate, inflation and income. We therefore use bivariate VAR models for each of them separately. In the first model, we include domestic credit and reserves, in the second model we include domestic credit and the exchange rate and the same for inflation and real income.

The variables used in the VARs are the second differences of domestic credit and prices measured by the consumer price index and first differences for rest of the variables. The results presented in Table 3 show that domestic credit Granger causes the exchange rate and inflation rate but not real GDP and reserves. There is no Granger causality in either direction between real income and domestic credit and between domestic credit and reserves. The log likelihood ratio statistic for testing the null hypothesis that the coefficients of a sub- set of jointly determined variables in the VAR are equal to zero is not rejected in the case of changes in reserves and real GDP but rejected in the case of changes in the exchange rate and inflation. However, the causality from reserves to domestic credit is relatively stronger than the reverse (with p-values of 0.48 and 0.84 respectively). This phenomenon could be a result of monetary authorities responding to exogenous changes in reserves in order to meet IMF programme benchmarks. For example, the Government typically finances short- falls in balance of payments support by borrowing from the central bank. Reserve money, however, does not change as a result of this if there are adequate reserves which are run down.

TABLE 3: GRANGER NON-CAUSALITY TESTS

	Independent Variables				
Dependent Variable	DC	Y	P	ER	RES
DC		0.7(0.70)	0.99(0.61)	2.3(0.32)	1.5(0.48)
Y	1.6(0.45)				
P	15(0.0)			7.7(0.02)	
ER	12(0.003)		1.3(0.50)		2.7(0.3)
RES	0.36(0.84)			1.8(0.41)	

We observe strong Granger causality from domestic credit to the exchange rate but no Granger causality between the exchange rate and reserves. The latter result suggests that external shocks that affect reserves such as Aid flows have little effect on domestic variables. This could be a result of deliberate responses by the monetary authorities. Our conclusion from Granger causality tests is that domestic monetary policy (defined here as change in domestic credit) is not effective in correcting balance of payments disequilibria (measured by changes in reserves) but effective in stabilising the exchange rate and inflation. The results also show that the exchange rate Granger causes inflation and that monetary policy does not affect real income.

Further evidence is provided by variance decompositions. Table 4 provides the percentage of the forecast errors of each variable that is due to shocks to itself and due to other variables in the model after fifty years. In order to assign variance shares to the different variables, the errors in the model must be orthogonalised. It has become standard to use the Choleski decomposition. The variance decomposition can be sensitive to the ordering chosen. In our model, the variables are ordered as follows: DC ,Y, P, ER, RES. The ordering was chosen under the assumption that domestic credit is likely to be the most exogenous of the variables since it is under the control of the monetary authorities. In order to check the robustness of the results, we estimated the model under a different ordering with reserves coming before domestic credit. The contemporaneous correlation between domestic credit and reserves makes it difficult to distinguish the balance of payments offset from sterilization of reserve flows. If sterilization occurs immediately while the balance of payments adjusts with some lag to changes in domestic credit, then reserves should be placed before domestic credit.

TABLE 4 VARIANCE DECOMPOSITIONS

SOURCE OF VARIATION

Dependent Variable	DC	Y	P	ER	RES
DC	0.87	0.05	0.01	0.04	0.03
Y	0.09	0.70	0.11	0.09	0.01
P	0.10	0.04	0.76	0.10	0.01
ER	0.30	0.08	0.33	0.27	0.03
RES	0.20	0.02	0.02	0.24	0.52
Variance Decomposition based on Different Ordering of the Variables					
Dependent Variable	RES	DC	Y	P	ER
RES	0.91	0.03	0.01	0.02	0.03

The results from variance decompositions (Table 4) show that the exchange rate has a higher effect on reserves than domestic credit (24 and 20 percent respectively). This result is

consistent with the Granger non-causality tests where the p-value for the effect of domestic credit on reserves is 0.84 compared with 0.41 for the effect of the exchange rate. However, both variables do not Granger cause the change in reserves. Income and prices, put together, account for an insignificant 4 percent of the variation in reserves.

The results of the variance decomposition based on a different ordering of the variables in the model are also shown in Table 04. With reserves coming before domestic credit, the results show an even smaller effect of domestic credit on reserves. Domestic credit accounts for only 3 percent of the variation in reserves with 91 percent of the variation coming from its own shocks.

We also estimate the model with the exchange rate coming before the prices in Table 5. We find in this case that the exchange rate accounts for 55 percent of the variation in inflation while domestic credit accounts for 10 percent just as in the original model. In comparison with the original ordering, domestic credit and the exchange rate now account for 65 percent of the variation in prices instead of 20 percent.

TABLE 5: VARIANCE DECOMPOSITION WITH THE EXCHANGE RATE BEFORE PRICES

Dependent Variable	DC	Y	P	ER	RES
RES	0.21	0.02	0.12	0.15	0.52
ER	0.30	0.07	0.59	0.01	0.03
P	0.10	0.04	0.55	0.30	0.01

In summary all the results show that domestic credit in Zambia has a stronger effect on the exchange rate than on the balance of payments. This result seems to be at odds with the theory given the control regime in operation in Zambia, shortly after independence. The nominal exchange rate in Zambia was fixed until 1973. During this period, however, the economy was enjoying a foreign exchange windfall caused by favourable copper prices. The effect of an increase in domestic credit on reserves in this period is likely to be offset by the inflow of reserves from exports earnings. After the negative copper price shock of 1974, reserves have for a long time been quite low. The economy cannot afford to fix the exchange rate using reserves. Any attempt to do so would last for only a short period. It is not surprising therefore that domestic credit has a significant effect on the exchange rate rather than on reserves.

Despite some episodes of fixed exchange rates regimes, the government in most cases resorted to frequent devaluations in response to unfavorable developments in the external environment. The results also show that inflation in Zambia is driven by the exchange rate and domestic credit and that domestic credit has an insignificant effect on real GDP.

From Granger causality results and variance decompositions, it seems fair to say that the IMF stabilisation policy of targeting the growth rate in domestic credit is successful in controlling inflation and stabilising the exchange rate but ineffective in eliminating balance of payments deficits as measured by a change in reserves.

4.3 Empirical Analysis using a Vector Equilibrium Correction Model

In this section, we analyse the effect of monetary policy on the balance of payments and the exchange rate based on the monetary disequilibrium model of Khan and Knight (1981).

There are two monetary approaches to the balance of payments, one developed in the Fund and one under the leadership of Harry Johnson in Chicago. The IMF approach is an evolutionary development of the Khan/Keynes multiplier model in an open economy. Johnson's approach is anti-Keynesian. It posits the essentially monetary character of the of the balance of payments. Johnson argues that the balance of payments is essentially a monetary phenomenon. Johnson's criticism of the Keynesian model was specifically directed at the basic assumption on which this system of balance of payments rests. The Keynesian system assumes that the monetary consequences of balance of payments surpluses or deficits can be and are sterilized by the monetary authorities so that the surplus or deficit can be treated as a flow equilibrium. The monetary approach assumes and in some cases asserts that these monetary inflows or outflows are not sterilized or cannot be within the period relevant for policy analysis but instead influence the domestic money Supply. They introduced a new causal approach to the balance of payments where they argue that it is the expenditure of unwanted cash balances that leads to the import surplus and the subsequent outflow of reserves. The balance of payments position is considered to be a reflection of decisions on the part of residents to accumulate or run down their stock of money balances. The Johnsonian approach assumes that the demand for money does not change once equilibrium has been attained. Any injection of money is considered excessive and the official settlements account is the place where the excessive money must be disposed of. Hence, credit creation must cause a balance of payments deficit of equal size. The monetary approach does not say through which account "above the line" this will happen.

Polak (2001) has argued that economic agents can get rid of excess holdings of money in two ways, by buying foreign goods or much more easily by repaying domestic credit to the banking system. Whether and to what extent credit creation leads to one or the other will, to begin with, depend on how it takes place. When credit creation takes place in the form of open market operations in a fully equilibrated credit market, the Johnsonian assumption that the operation has no effect on the demand for money may approximate reality. In those circumstances, however, they are most likely to react to the imbalance in their position by the repayment of loans from the domestic banks and only a small part of the credit creation will lead to a loss of reserves- unless the linkage of the country to the international capital markets is so perfect that most of the newly created money will at once flow abroad. In many developing countries, however, credit is rationed and credit creation is associated with the creation of additional incomes. The Fund's monetary approach takes credit creation as a proxy for an autonomous increase in demand. While the IMF approach also finds that the full amount of credit creation will over time leak out through the balance of payments, their model does not support Johnson's dictum that the loss of reserves reflects the excess of money in the economy. Polak has argued that the increase in the rate of credit creation or the higher level of exports caused, for example by an increase in the price of an economy's main export staple will raise the money supply only gradually as the new economic situation persists. But this impulse will, more or less at once, raise the annual level of incomes of those who benefit from it and thereafter, income in the country will continue to rise as a result of successive spending rounds. As the demand for holding money increases correspondingly, the economy will experience a shortage of money, to be met only gradually by an increase in its supply. Yet inspite of this shortage of money, money will be spent to pay for additional imports as expenditure is partially adjusted to the higher income level. In the

step by step approach of the Polak model, the stock of money remains below its income equivalent until the end of its income period. If one accepts the basic model that the demand for money is a function of the level of income, and that the supply of money builds up only gradually over time, the conclusion must be that any cause that raises income while creating additional money will be accompanied by a shortage of money. In an equilibrated money market, the shortage of money would be reflected by the rate of interest.

Khan and Knight (1981) use the following specification in determining the impact of money balances and relative prices on the balance of payments.

$$\Delta \log R_t = \lambda_1 \left[\log M_t^d - \log M_{t-1} \right] - \lambda_2 \left[\log P_{T-1} - \left[\log \left(e_{t-1} p_{t-1}^* \right) - \log \beta_0 \right] \right] \quad (31)$$

M_t^d refers to the demand for money, at time t, M_{t-1} refers to the supply of money at time t -1 and P refers to the price level. The overall balance of payments, represented by a change in the stock of international reserves, R (in terms of domestic currency), is specified as a positive function of the excess demand for nominal balances and a negative function of the deviation of the domestic price level from its purchasing power parity equilibrium. β Denotes the equilibrium real exchange rate. This specification is a dynamic version of the monetary model of the exchange rate presented earlier. Models in the tradition of the monetary approach to the balance of payments do not distinguish between the current account and the capital account. They make no prediction as to whether domestic residents rid themselves of excess money balances by increasing expenditure (domestic absorption) relative to output or by purchasing financial assets abroad. Most empirical applications of the monetary approach to the balance of payments assume that the change in a country's international reserves is exactly equal to the difference between flow supply of money and flow demand. This standard assumption does not seem realistic in the context of developing countries, where the degree of international mobility goods and assets may not be sufficient to allow an excess supply of money to be offset fully and instantaneously by the balance of payments leakages. The equation specified is consistent with the monetary approach to the balance of payments, but includes a degree of dynamic adjustment as measured by the parameter λ_1. Thus it allows for inertia in the response of flows to monetary disequilibria in the short run while still retaining the feature that the effect of an expansion of domestic credit on the money stock is completely offset in the long run. Khan and Knight (1981) specified the demand for money functions as follows:

$$\log M_t^d = \beta_1 + \lambda_3 \log Y_t - \lambda_4 r + \lambda_5 \log P \quad (32)$$

Where Y refers to real income and r to the nominal interest rate. Substituting the above equation into the balance of payments equation (31) yields the following equation:

$$\Delta \log R_t = \lambda_1 \left[\beta_1 + \lambda_3 \log Y_t - \lambda_4 r + \lambda_5 \log P - \log M_{t-1} \right] - \lambda_2 \left[\log P_{T-1} - \left[\log \left(e_{t-1} p_{t-1}^* \right) - \log \beta_0 \right] \right] \quad (33)$$

The approach adopted in this section is to use co integrating errors as a measure of excess real balances. We start by analyzing money demand in Zambia. The conventional money demand equation includes income and the interest rate as determinants of money demand. We use a formulation which is typically used for developing countries in which interest rate on other financial assets is excluded from model. This follows directly from the paucity of financial alternatives to money in developing countries. The relevant substitution in such countries is therefore between money and goods, or real assets, with the opportunity cost being the expected rate of inflation. The variables included in the money demand equation are the real money supply, measured by the M1 deflated by the consumer price index, real GDP deflated by the GDP deflator, and the inflation rate. All these variables are I (1). The following dummies are included in the model, D3 for 1977, D4 for the period 1986 to 1988, and D5 for 1989. All the dummies are statistically significant in the model. After 1977, Zambia was on the second standby financial arrangement with the IMF. This was necessitated by the negative price shock of 1974. The emphasis was on the reduction of Government spending. The period 1986-1988 relates to the time when Zambia adopted its New Economic Recovery Programme with emphasis on growth from own resources. In 1989, the country concluded a new policy framework paper with the IMF, with emphasis on the liberalisation of markets and devaluation.

Econometric Procedure

Our objective is to analyse the effect of monetary disequilibrium on reserves using a cointegrated vector equilibrium model. The general vector equilibrium correction model is specified as follows:

$$\Delta X_t = a_0 + a_1 t - \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + U_t \qquad (34)$$

Ï is the long run multiplier matrix while $\tilde{A}_i$ are the short run coefficient matrices capturing the short run dynamic effects. The variables specified as I(1) variables in the model are the log of real money (M1), the log of real GDP and the log of inflation. The intercept enters unrestricted while the trend is restricted to lie in the cointegrating space. The results of the cointegration analysis based on the maximal eigenvalue of the stochastic matrix are summarized in the Table 6.

TABLE 6: COINTEGRATION RESULTS: VARIABLES IN THE COINTEGRATING VECTOR ARE M1, Y AND∆P

Null	Alternative	Statistic	95% Critical Value
r=0	r=1	29	25
r<=1	r=2	9	19
R<=2	R=3	3	12

The results based on the trace of the stochastic matrix suggest that the null of no cointegration is rejected. When we use the model selection criteria, the AIC suggests a rank of two while SBC and HQC suggest a rank of one. It is therefore fair to conclude that there is one cointegrating vector. Using the cointegrating vectors from the Johansen procedure, we

obtain the results of the equilibrium correction model for the log of M1. The results are presented in Table 7.

TABLE 7: ERROR CORRECTION MODEL FOR M1: DEPENDENT VARIABLE IS ΔM1

Regressor	T-Ratio
Intercept	-4.86 (0.00)
$\Delta M1_{-1}$	-2.10 (0.047)
ΔY_{-1}	1.87 (0.074)
$\Delta\Delta P_{-1}$	-3.1 (0.005)
ECM_{-1}	-4.8 (0.00)
D3	-2.3 (0.03)
D4	-4.5 (0.00)
D5	-2.2 (0.04)

TABLE 8: COINTEGRATED VECTORS IN JOHANSEN ESTIMATION (NORMALIZED IN BRACKETS)

M1	Y	ΔP	Trend
0.55885 (1.0000)	-0.98812(-1.7681)	0.95292(1.7051)	0.035149 (0.062896)

The results show that demand for money in Zambia is positively related to real GDP and negatively to the rate of inflation. The signs support our assumption regarding the money demand function for developing countries. The equilibrium correction model shows a significant negative coefficient for inflation in the M1 equation.

In analysing the effect of monetary disequilibria on the balance of payments, measured in this case by a change in reserves, we include reserves among the I(1) variables in the model with everything else remaining the same. The cointegration results based on the maximal eigenvalue statistic are presented in Table 9.

TABLE 9: COINTEGRATION RESULTS. VARIABLES IN THE COINTEGRATING VECTOR ARE ML, Y, ΔP AND RES

Null	Alternative	Statistic	95% Critical Value
R=0	r=1	38	31
R<=1	r=2	21	25
R<=2	R=3	10	19

The results from trace statistic also show that there is one cointegrating vector. The results based on the model selection criteria (AIC, SBC,HQC), however suggest two cointegrating vectors. The results of the equilibrium correction model for reserves is presented in Table 10.

TABLE 10: ERROR CORRECTION MODEL FOR RES AND ER: DEPENDENT VARIABLES ARE Δ RES AND ΔLER

Regressor	T-Ratio (Prob) for ΔRES	T-Ratio (Prob) for ΔlER
Intercept	0.04 (0.97)	-0.057(0.96)
$\Delta M1_{-1}$	-0.17 (0.86)	-1.56(0.13)
ΔY_{-1}	0.56 (0.58)	-1.14(0.27)
$\Delta\Delta P_{-1}$	0.33 (0.74)	-1.13(0.27)
Δ RES/ ΔLER	-0.16(0.87)	1.64(0.12)
ECM_{-1}	-0.03 (0.97)	-0.14(0.89)
D3	-0.47 (0.64)	-0.34(0.74)
D4	-0.45 (0.66)	0.0034(0.97)
D5	-0.33 (0.75)	1.8(0.07)

The results show that the ECM has an insignificant effect on reserves. In order to determine the relative effects of the monetary disequilibria on the balance of payments and the exchange rate, we use orthogonalised forecast error variance decomposition of the cointegrated VAR at a 50 year forecast horizon. Structural shocks are identified using the Choleski decomposition with M1 as the most exogenous variable. The results of the VAR variance decompositions are presented in Table 11.

TABLE 11: ORTHOGONALISED FORECAST ERROR VARIANCE DECOMPOSITION: RESERVES (RES) AND THE EXCHANGE RATE (ER)
SOURCE OF VARIATION

Dependent Variable	M1	Y	ΔP	Own Shock
RES	0.008	0.002	0.01	0.98
ER	0.01	0.14	0.35	0.50

The variance decomposition analysis above shows that variables in the money demand equation have a greater effect on the exchange rate than reserves. They account for only 2 percent of the variation in reserves while accounting for 50 percent of the variation in the exchange rate.

4. 4 Empirical Analysis based on Money Supply (Ml)

In this section, we analyse the effect of monetary policy, measured by changes in M1 on the balance of payments, the exchange rate, inflation and real income.

Inflation and the Exchange Rate

A quantitative macroeconomic framework used in various forms by a number of authors to gauge the effect of stabilisation policies in developing countries is the monetary equilibrium model developed by Khan (1981), which is based on the monetary approach to the balance of payments. The domestic rate of inflation relative to the foreign rate is assumed to be positively related to the excess supply of real money balances and a negative function of the deviation of the domestic prices from their purchasing power parity equilibrium level. Formally, Khan's specification is written as follows:

$$\Delta \log P = \lambda_1 \left[LogM_{T-1} - \log M^{d}_{t-1} \right] - \lambda_2 \left[\log P_{T-1} - \left[\log \left(E_{t-1} PF_{t-1} \right) - \log \beta_0 \right] \right] + \lambda \quad (33)$$

P is the domestic price level, E is the exchange rate in units of domestic currency per unit of foreign currency and P^f is the foreign price level. M is the stock of real money balances deflated by the domestic price level. λ . is a constant, reflecting the steady state properties of the system.

The monetary disequilibrium model has been analysed in the previous sections. We focus here on the effect of the supply of money alone (measured by M1). We use a three variable cointegrated VAR model including the growth rate in money supply (ΔLM1, the exchange rate (LER) and the inflation rate (ΔLP). The variables LM1 and P are I(2) and are therefore differenced for inclusion in the cointegration analysis. The co integration results show the existence of two co integrating vectors. The results of variance decompositions from the cointegrated VAR model at a fifty year horizon are presented in Table 12.

TABLE 12: ORTHOGONALIZED FORECAST ERROR VARIANCE DECOMPOSITION FOR VARIABLE ER AND Δ1P COINTEGRATION WITH UNRESTRICTED INTERCEPTS AND RESTRICTED TRENDS IN THE V AR

SOURCE OF VARIATION

Dependent Variable	ΔLM1	LER	ΔLP
LER	0.52	0.42	0.06
ΔLP	0.66	0.07	0.26

The results show that money supply growth accounts for 52 percent of the variation in the exchange rate and 66 percent of the variation in inflation. These results reinforce our earlier conclusion that the IMF prescription of targeting the growth rate of money supply is an appropriate instrument for controlling inflation and stabilising the exchange rate in Zambia.

Balance of Payments and Real GDP

In the previous section, we established that money supply growth has a significant effect on inflation and the nominal exchange rate. In this section, we explore its effect on the balance of payments and real income. We estimate two separate bivariate VARs including real Ml and reserves in one and real Ml and real GDP in the other. All the variables used are in real terms. The results of cointegration tests show that we cannot reject the null of no cointegration between reserves and M1. We therefore proceed by estimating an unrestricted VAR model. We use the Choleski decomposition to identify the structural shocks. The results of the cointegration analysis and of the variance decomposition are summarised in Tables 13 and 14.

TABLE 13: COINTEGRATION WITH UNRESTRICTED INTERCEPTS AND RESTRICTED TRENDS IN THE VAR

Null	Alternative	Statistic	95% Critical Value
R=0	r=1	17	19
R<=1	r=2	5	12

The results based on the maximal eigenvalue statistic suggest that we do not reject the null hypothesis of no cointegration. The trace statistic for the null of no cointegration is 22 with a critical value of 26. The AIC suggests a rank of 0 while both, the SBC and the HQC suggest a rank of zero. It is therefore reasonable to accept the null of no cointegration. Instead of using a cointegrated VAR model, we use an ordinary VAR model. The results of the variance decompositions from the VAR model are presented in Table 14.

TABLE 14: ORTHOGONALISED FORECAST ERROR VARIANCE DECOMPOSITION FOR VARIABLE RES AND ΔLM1 BASED ON 31 OBSERVATIONS FROM 1968 TO 1998.

Dependent Variable	ΔLM1	ΔRES
ΔRES	0.03	0.97
ΔLm1	0.88	0.12

The results clearly show no close link between reserves and real money supply. Table 15 shows the results of cointegration tests between the money supply and real GDP. We also do not reject the null of no cointegration.

TABLE 15

Null	Alternative	Statistic	95% Critical Value
R=0	r=1	9	19
R<=1	r=2	4	12

The results from this section reinforce our earlier conclusion on the ineffectiveness of monetary policy as a means of eliminating balance of payments deficits. We also observe that monetary policy has no effect on real GDP, implying that it is also ineffective in stimulating economic activity in Zambia.

4.5 Empirical Analysis: Polak Model

The Polak model is based on the national income identity in which the balance of payments is determined by exports, imports and net foreign capital flows. The model is expanded to include the effect of relative prices (which we interpret as the real exchange rate) on both exports and imports. The model also includes the effect of nominal income on imports through the marginal propensity to import. The Polak form of the financial programming model can be given a classical closure in which it can be solved for the price level while taking output to be exogenous. It can also be given a Keynesian closure in which it is solved for real output taking the price level as given.

The model summarised by Figure 1 implies that for a given level of inflation, the overall balance of payments can be improved by a nominal exchange rate devaluation, a reduction in domestic credit or a combination of both policies. A nominal devaluation with no change

in domestic credit will lead to an increase in domestic prices but the real exchange rate depreciates, overall, as reflected by an improvement in the balance of payments. A combined policy of devaluation and a reduction in domestic credit should lead to a greater improvement in the balance of payments position at a lower cost in terms of increased inflation. The combined policy should lead to a higher real exchange rate depreciation.

In modeling the balance of payments using the Polak model, we focus on the trade balance. A problem with the monetary model is that it does not distinguish through which accounts above the line the balance of payments adjustment occurs. It is therefore more appropriate to analyse the effect of policy variables such as domestic credit and the exchange rate on the current account (or the trade balance due to incomplete current account data). The trade balance is modeled as a function of the copper price, given the economy's heavy dependence on copper for its export earnings; nominal income, which affects imports; the exchange rate and the domestic price level are intended to capture the effect of relative prices. The model we estimate is:

$$TB = \beta_0 + \beta_1 \Delta Y + \beta_2 \Delta P^C + \beta_3 \Delta ER + \beta_4 \Delta \pi \qquad (36)$$

where TB refers to the trade balance, Y to nominal GDP, P^c to the copper price, ER to the exchange rate and π to the inflation rate. We use the static long run parameters (dynamic multipliers) in determining the effect of the variables on the trade balance. In a simple model

$$Y_T = \beta_0 Z_t + \beta_1 Z_{T-1} + \alpha_2 Y_{t-1} + U_t \qquad (37)$$

A static equilibrium is defined by: E $[Z_i] = Z^*$ for all t. In which case E [Yi] = Y^* will be a constant if á < 1, and Yi will converge to:

$$Y^* = KZ^* \qquad (38)$$

where $K = (\beta_0 + \beta_1) / (1 - \alpha_1)$. K and the associated standard errors are the static long run parameters. K gives the total effect of a change in Z on Y.

The static long run equation obtained after an OLS regression of the trade balance on GDP, the copper price, the real exchange rate and inflation is:

$$\underset{SE}{TB} = \underset{40.08}{251} - \underset{362.4}{432.9}\Delta Y + \underset{5.607}{14.28}\Delta P^C + \underset{341.6}{126.9}\Delta ER + \underset{541}{511.9}\Delta \pi \qquad (39)$$

The results of the model show that the trade balance is driven mainly by the exogenous variable - the changes in the price of copper P^C. We also observe a negative, but insignificant, effect of nominal GDP (Y) on the trade balance. This effect is a result of the effect on imports. The effect of the nominal exchange rate and prices are also statistically insignificant. The

nominal exchange rate has a positive effect. This is also a result of its effect on imports.

Since the export sector is highly concentrated, we do not expect changes in the relative prices to have a significant effect on exports. In fact, in the original version of the model, the exports are considered to be exogenous. It is therefore, more appropriate to analyse the effect of income and relative prices on the balance of payments by considering the effect of these variables on imports. The static long run equation for imports is:

$$\underset{SE}{IM} = \underset{0.03}{-0.0047} + \underset{0.28}{0.5}\,\Delta Y + \underset{0.0045}{0.0045}\,\Delta P^{C} - \underset{0.26}{0.47}\,\Delta ER - \underset{0.48}{0.07}\,\Delta\pi \qquad (40)$$

The results show that imports respond positively to nominal income and negatively to the nominal exchange rate. The copper price also has a positive effect on imports. The effect of the change in the copper price is a result of the resource expansion effect. The results support the predictions of the theory implied by the Polak model on the effect of the exchange rate on imports. The consumer price index has a negative coefficient. We would expect the consumer price index to have a positive coefficient instead of a negative one. This result could be due to multicollinearity between the variables, especially between the copper price and the exchange rate and between the exchange rate and the consumer price index. The R^2 is 0.68 but there are hardly any significant parameters in the model at 95 percent level.

In modeling exports, we take account of the fact that Zambia is heavily dependent on copper so that the value of exports depends largely on the copper price. The static long run equation for exports is:

$$\underset{t-value}{EX} = \underset{-0.6}{-0.016} + \underset{0.005}{0.012}\,\Delta P^{C} - \underset{-0.05}{0.003}\,\Delta ER + \underset{-0.15}{0.04}\,\Delta\pi \qquad (41)$$

The static equation shows that exports are largely determined by the change in the copper price. The consumer price index and the nominal exchange rate do not have a significant impact on exports. This is due to the highly undiversified structure of the export sector in Zambia.

5.1 Interpretation of Results and Policy Implication

The results from econometric tests suggest that the monetary disequilibrium model is inappropriate in explaining balance of payments developments in Zambia. However, the results show a strong relationship between money supply on one hand, and inflation and the exchange rate on the other. The results, however seem to support the predictions of the Polak model in which the balance of payments is determined by the real exchange rate and nominal income. The relative price effect works through imports rather than exports. This is so because of the economy's highly undiversified export structure. Our conclusion therefore is that the policy prescriptions of the IMF which emphasise tight monetary policies are incapable of eliminating balance of payments disequilibria but are successful in reducing inflation and stabilising the exchange rate. An effective policy for improving the balance of payments is devaluation. This works by depressing imports with the adverse consequences

for investment. Devaluation increases the cost of imported capital goods needed for investment. In addition to its negative effect on domestic investment, devaluation, in a country with balance of payments shortfalls, hurts the budget. In the face of persistent balance of payments shortfalls, an exchange rate depreciation increases the overall budget deficit in foreign currency terms. The domestic currency deficit (ΔC_g) is given by;

$$\Delta Cg = \beta_d + ER(ds - bop) \qquad (42)$$

where ER is the nominal exchange rate, d_s is external debt service and bop is balance of payments support. If we assume that $\hat{a}_d$ the balance on the domestic budget is broadly exchange rate neutral, and if ds > bop then trivially, an exchange rate depreciation increases the overall budget deficit and makes it difficult to meet the reserve money benchmarks. The government may thus be predisposed to avoid an exchange rate depreciation even when it may be beneficial to the exportable sector and the level of domestic interest rates.

6. Conclusion

From the results of econometric tests carried out in this paper, we can conclude that the monetary approach to the balance of payments used by the IMF is inappropriate. Using Granger causality tests, variance decomposition analysis and co integration, we find that monetary policy is effective in controlling inflation and stabilising the exchange rate but the balance of payments position is exogenously determined mainly by the copper price. Relative prices (the real exchange rate) have an insignificant impact on the balance of payments. While they have a significant effect on imports, their effect on the undiversified export sector is insignificant.

The Polak model is only applicable to imports. However, in a country heavily dependent on imported capital goods for its capital formation, a policy of devaluation reduces investment. This hampers growth, reducing the country's ability to return to a sustainable balance of payments position. We also show that a policy of devaluation worsens the fiscal budget in the presence of aid shortfalls. The government will therefore be predisposed to avoid a depreciation of the nominal exchange rate even though this may be beneficial for the balance of payments.

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