Issues On The Zambian Economy

Bank *of* Zambia

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CONTENTS

Foreword

Over the years, the Bank of Zambia has been facilitating the publication of the Bank of Zambia (BoZ) Reader – Issues on the Zambian Economy. The aim of this publication is to provide the 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 BoZ 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 publication is the eighth issue and has articles on contemporary issues of current debate in the economy including: Managing Short Term Capital Flows in Zambia; The Changing Behaviour of the Kwacha/US Dollar Exchange Change Rate: Is it a Random Walk?; Economic Life of Zambia's University Students: The Case of University of Zambia; Re-Examination of the SADC Macroeconomic Convergence Criteria; Foreign Exchange Swaps as Instruments of Monetary Policy in Zambia; and Inflation and Economic Growth in Zambia: A Threshold Autoregressive (TAR) Econometric Approach.

With gratitude, we wish to thank the contributors of these articles to the BoZ Reader and it is our sincere hope that this will encourage other economists and social scientists to share their ideas and empirical findings, and thereby contribute to the pool of ideas and literature on the Zambian economy through this publication. Additionally, we wish 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.

Michael Gondwe.

Governor

Bank of Zambia

CHAPTER ONE

Managing Short Term Capital Flows in Zambia

By

Anthony M. Simpasa and Francis Z. Mbao

Abstract

While private capital inflows are considered beneficial, they have some pitfalls particularly for short term capital flows that tend to be speculative in nature, they have the potential to destabilise the economy. Large portfolio inflows, deemed to be unsustainable in the long-run have been perceived as the main cause of financial crises in emerging economies. For this purpose this paper investigated the effects of capital flows in Zambia and other countries with a view to building up credible policy options for Zambia so as to deal with adverse effects of such flows based on other countries' experiences. In view of this, we recommend that firstly, the Zambian authorities should look at measures to direct foreign capital inflows towards financial issues with long term maturity. Secondly, the authorities should scale up reserve accumulation in the event of the surge in capital inflows other than allow for currency appreciation. Thirdly, a framework to categorise non-residents' funds in the banking system according to maturity and type of deposit, for both Kwacha and foreign currency accounts, and an appropriate surveillance mechanism be put in place to monitor non-residents' flow of funds into the banking system.

I. Introduction

Economic theory suggests that opening up the economy to international trade and capital flows is one way to enhance economic growth. This is because foreign capital inflows are generally considered desirable in that they augment domestic resources by financing investment and increasing consumer welfare through smoothening of inter-temporal consumption. In developing countries where the capacity to save is constrained, foreign capital inflows give an opportunity for firms to tap into international markets to finance domestic investment. Foreign capital inflows, particularly private portfolio flows in debt and equity are also beneficial in so far as financial market development is concerned. Increased capital inflows therefore enhance market development through increased liquidity and stimulating competition in financial markets by broadening the investor base. Benefits of capital inflows on macroeconomic policy discipline have been found to be strong particularly when there is legal certainty (Grilli and Milesi-Ferretti, 1995).

While private capital inflows are considered beneficial, they also have some pitfalls. Three forms of risk induced by capital flows can be identified (Kawai and Lamberte, 2010). The first one relates to macroeconomic risks in which case capital inflows are associated with the expansion in domestic credit that may lead to the economy overheating and cause inflationary pressures. The second is the risk of financial instability especially if they create a problem of maturity and currency mismatches on the balance sheet of private firm borrowers. The third risk is one that relates to capital flow reversals especially when they stop suddenly

and begins to flow outward. This may lead to currency depreciation and/or foreign reserves depletion.

Particularly for short term capital flows that tend to be speculative in nature, they have the potential to destabilise the economy. Large portfolio inflows, deemed to be unsustainable in the long-run have been perceived as the main cause of financial crises in emerging economies. Scholars have attributed the East Asian and Latin American financial crisis to speculative capital flows (Rana, 1998). Further, large short-term capital flows can pose a number of problems for macroeconomic policy thereby complicating the process of implementing monetary policy. High volumes of capital flows result in the appreciation of the domestic currency with adverse consequences on the competitiveness of the external sector (Lartey, 2007).

A prolonged appreciation of the real exchange rate that accompanies large capital inflows could adversely affect the tradable sector by shifting resources from the exportable to the non-tradable sector, causing a contraction in non-traditional exports (NTEs). In Zambia, for instance, it is argued that the appreciation in the exchange rate at the height of rapid inflows between 2006 and mid 2008 was the main cause of low performance of the NTEs. However, Adam and Simpasa (2009) have shown that the low supply response of NTEs sector is largely due to binding structural constraints, including an unreliable transportation system and the general poor state of infrastructure.

The purpose of this paper is to investigate the effects of capital flows in Zambia with a view to building up credible policy options to deal with adverse effects of such flows. The rest of the paper is structured as follows: Section two presents information on the composition of global capital flows while section three contains information on the composition and trends of capital inflows in Zambia. Section four suggest policy measures to deal with capital flows and their effectiveness while section five gives the conclusion and recommendations.

II. Composition of Global Capital Flows

Global capital flows largely comprise Foreign Direct Investment (FDI), Foreign Portfolio Investments (FPI), private creditors' and cross-border depositors' flows, official flows and financial derivatives. Foreign capital is termed to be FDI if it accounts for more than 10% stake in a local business while any foreign stake of less than 10% is FPI.

FDI largely accounts for the largest component of capital inflows but it is fundamentally self-sterilising. This type of capital inflow does not create liquidity pressures and its associated adverse effects in the domestic financial market, as it largely comes in form of imported machinery. In 2010, net FDI inflows in the emerging market economies were estimated to have increased to US $350 billion from the US $322 billion recorded in the previous year (Suttle et al, 2011) compared to net FPI's of US $199 billion and US $153 billion, respectively.

With regard to the FPI, this can further be divided into two forms being equity portfolio and debt portfolio. The debt portfolio comprises of investment in both government securities and corporate bonds. The FPIs, like foreign bank funding, are more susceptible to sudden reversals. Wei (2006) argues that sudden reversals of capital flows are more likely to occur among countries that rely relatively more on portfolio debt flows than FDI.

On the private creditors' capital flows, this comprises commercial bank lending and non-bank lending. Suttle et al (2011) shows that the estimated private creditors' funds to emerging markets increased in 2010 to a net of US $358 billion from the net of US $127 billion recorded in

2009. Accounting for this rise was the net flows attributed to the non-banks' lending amounting to US $194 billion (figure for 2009 was US $142 billion) compared with the US $164 billion of the net bank lending (figure for 2009 was negative US $15 billion).

Capital flows were larger in emerging Europe than in other emerging economies (Rummel, 2011). In addition to volume, the composition of capital inflows to emerging Europe also differed from that of other regions. The difference was largely attributable to cross-border loans and deposits from western European parent banks to their affiliates in emerging Europe.

In terms of the official flows, two types can be identified as being those from international financial institutions and bilateral creditors. Between the two, net flows from international institutions have been relatively higher although they showed some levels of decline in 2010 while the latter had increased. Net flows from international financial institutions to emerging markets declined to US $29 billion from the US $46 billion recorded in 2009 while net flows from the bilateral creditors rose to US $26 billion from US $21 billion in 2009.

Concerning the derivatives and their role in facilitating or abating capital flows, one needs to understand how these operates. A derivative is a financial contract whose value/price is derived from the value of some underlying asset, commodity or event. Derivative products include forward contracts, futures contracts, options and swaps. Derivatives have the potential to encourage international capital flows in that they are able to improve pricing efficiency and provide means for investors to better manage their risks so as to encourage greater amounts of investment.

Derivatives help with price discovery, which leads to efficient pricing of assets and this in turn helps with or allows for the decomposition of the risks embodied in an asset or transaction that has been broken down and priced separately. From the investment perspective, the efficient pricing of assets and the associated risk component of these assets creates an incentive for foreign investors to be interested in foreign assets were the derivative market is in existence in some form. This is largely due to the fact that they would be paying efficient prices and receiving market efficient rates of return on their investments. So price discovery and risk distribution in this regard helps attract more foreign investment because investors who do not want all the various types of risks associated with owning a foreign asset can now make the investment with the reasonable expectation of being able to hedge away unwanted risk-components such as exchange rate risk or credit risk.

Notwithstanding the above, derivatives can also undermine the virtues associated with capital flows in an effort to hedge against risks associated with local asset price. The primary concern of investors is to hedge against any loss in the value of the assets of interest. This hedging can only take place if there is one party willing to take a long position (buying) and another party willing to take a short position (selling) of the hedging instrument. If there are more short hedgers than their long counterparts in the derivatives markets the only way for all the short sellers to find long buyers is for speculators or arbitragers to take positions in the market. It should be noted that market makers usually maintain a flat or nearly flat book positions. They do this by not selling short unless they can offset that position by buying long. In the event that there is no one to sell short to, then the dealer is reluctant to buy long. To get round this problem, a synthetic short local currency position has to be created and thereby overcome the risk of taking the long position in the derivatives market.

A synthetic short position is generated by obtaining a local currency loan whose funds are in turn used to buy foreign exchange in the spot foreign exchange market. The dollars so

obtained are then invested in dollar denominated assets. This process ultimately leaves an investor owing in local currency, thereby creating a short position in the market. The purchasing of the dollar denominated assets arising from the synthetic position so created causes an outflow of capital from the economy.

For most developing countries, the derivatives markets use synthetic short positions in order to complete the market. In this regard, most of the sponsors of capital inflow, whether FDI, FPI or bank loans, tries to hedge the local currency risk using synthetic short positions. Consequently, the act of hedging capital inflows will result in at most equivalent amounts of capital outflows.

Local banks in developing countries play some role in the derivatives market and this is mainly done through the over the counter (OTC) market, (Kregel, 1998). Particularly in emerging markets, banks' dealings in foreign exchange derivatives accounted for nearly 90% of total turnover in the OTC market (Moreno, 2011).

The banks' role in these transactions is that of intermediation by not only matching local borrowers and foreign lenders, but also acting as market innovators to create investment vehicles that attract lenders and borrowers by facilitating the use of derivatives. According to Kregel (1998), these activities often require facilitating banks in the intermediation process to accept some of the risks associated with the derivatives created. This is in order to produce packages with the characteristics desired by final borrowers and lenders, which may or may not be hedged by the bank, subject to its own investment strategy. But if hedged, this may be done through the purchase of derivative contracts. The primary objective of banks in this process is consequently not necessarily the maximisation of profits by seeking the lowest cost of funds and channelling them to the highest risk-adjusted return, but rather in maximising the amount of funds intermediated in order to maximise fees and commissions.

Following the sudden stop in capital inflows in 2008 after the Lehman Brothers bankruptcy and the eventual reverse in the global capital flows, a number of countries particularly the Asian nations instituted measures meant to minimise the impact of the capital flows on their economies. A wide range of policy tools were used by different countries in their Capital Flow Management (CFM). Pradhan et al (2011) and Nallari (2011) have documented various country responses to the problem of a sudden stop in capital flows. What is common to all the countries in terms of response to capital flows after the global financial crisis is the decision to increase their amount of international reserves rather than allow for currency appreciation.

Different policy measures were put in place and each was aimed at addressing country specific problems related to the foreign capital flows. However, five objectives were focused on by the macro prudential initiatives instituted and include: (i) to mitigate complications for central bank market operations that stemmed from inflows to short-term instruments, the case of Indonesia; (ii) to limit inflows to local bond markets, the case of Korea and Thailand; (iii) to reduce risks in both the banking system and the real economy, the case of Taiwan and Turkey; (iv) to limit vulnerabilities stemming from private sector external borrowing, the case of India, Turkey and Brazil, and (v) to curb speculative activity in foreign exchange markets that was seen to be contributing to exchange rate volatility, the case of South Africa and the rest of the cases covered (For more information see the appendix).

III. Composition and trends of capital inflows in Zambia

Since the liberalisation of the Zambian economy in the early 1990s and subsequent abolition of capital controls in 1994, Zambia has become one of the relatively more open economies in the world. Total trade (exports plus imports) as a measure of openness was estimated at 39.5% of gross domestic product (GDP) in 2007. Latest statistics for 2010 put this at 74.5%, underpinning the increase in trade volume as well as strength of growth in GDP. The economic reforms, under the auspices of the International Monetary Fund (IMF) and World Bank, also included liberalisation of interest and exchange rates.

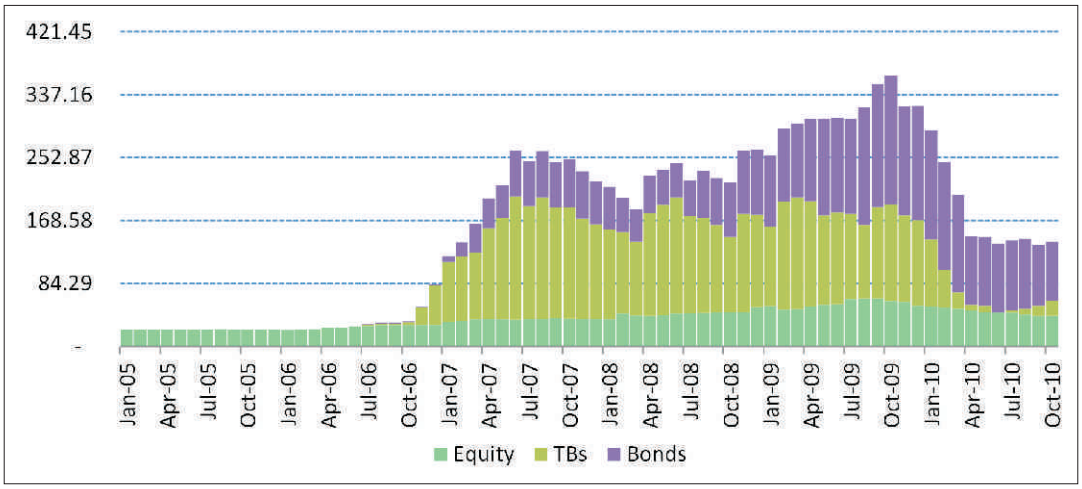
After a sustained commitment to policy reform and broad macroeconomic stability, Zambia reached the Highly Indebted Poor Countries (HIPC) Initiative completion point in April 2005, resulting in substantial debt forgiveness. From more than US$7.0 billion of external debt prior to the HIPC Initiative, total external debt was reduced to under US$1.0 billion. The HIPC Initiative completion point coincided with the onset of the commodity boom, which saw strengthening of copper prices by about 30 % in constant US dollar terms to nearly US$9,000 per tonne in mid-2008. These developments bolstered the availability of foreign exchange in the market and created investor confidence. Thus, whereas previously Zambia was grouped together with other politically and economically risky countries, these concerns were significantly diluted with the aid of policy endorsement by international financial institutions.

A combination of the above factors created incentives for foreign private capital inflows. For instance, macroeconomic stability increased foreign portfolio investors' confidence in the Zambian financial markets even as domestic real interest rates were low relative to its peers. The trend of total foreign private capital flows showed a peak from virtually nothing in 1997 to US$348.0 million by June 2008 before it petered off in the wake of the global financial crisis. The composition of foreign capital inflows included investment in government securities, foreign acquisition of equity at the Lusaka Stock Exchange and foreign borrowing by the domestic financial institutions and the non-financial corporate sector. Data on foreign borrowing is scant and difficult to collate, therefore, the analysis below is largely restricted to investment in domestic government paper and equity investment on a detailed basis.

With regard to foreign private sector debt from international financial institutions , the 2010 quarterly private sector external debt survey by the Bank of Zambia shows a net inflow of US $190.4 million, down from the US $211.6 million net inflow estimated in 2009. This figure excludes foreign banks' lending to local banks.

Of these inflows, the largest increase was realised in the Government debt market, which also recorded a significant amount of outflows as the crisis deepened (see Chart 1). In particular, short-dated Treasury bills suffered the highest reduction in foreign investment holdings, falling from a high of US$182.0 million in March 2008 to below US$0.5 million in mid-2009. In contrast, foreign investment in Government bonds contracted by less than half, with outstanding amount recorded at US$85.0 million in mid-2009 compared with US$102.0 million in March 2008. This is largely due to the nature of their tenure which ranges from 2 to 15 years.

Chart 1: Foreign Portfolio Capital Flows Cumulative Net Purchases (US$ Millions)



Source: Bank of Zambia and Lusaka Stock Exchange

As at end October 2010, net foreign portfolio investment in Government securities market stood at US$39.8 million out of which US$8.5million was in Treasury bills . However, by end-March, 2011, investment in Treasury bills by non-residents had increased by nearly two thirds to US$171.7 million against an increase of 19% for Government bonds to US$31.9 million. Foreign equity participation stood at US$32.2 million by end of October 2010, almost equivalent to the non-resident holdings of Government bonds.

Whilst portfolio investment in bonds and equity has been relatively stable, foreign holdings of Treasury bills suffered the greatest outflows during the crisis, which may be indicative of the speculative nature of short-term capital flows. Further, the rate of recovery of foreign investor participation in the debt market has been slow, reflecting their lingering risk aversion to emerging markets sovereign debt, underpinned by the crisis in Europe.

Given the liquidity and development of the Government securities market relative to the equity market, foreign portfolio investment in public debt poses potential vulnerability concerns and policy challenges in terms of managing private capital flows. Taking the global financial crisis as a test case, the pace of liquidation of foreign portfolio investment in Government securities indicates the degree of vulnerability inherent in this segment of foreign portfolio investment. It therefore provides justification for policy makers to pay particular attention to the composition of portfolio investment when drafting policy responses.

By virtue of their short-term nature, Treasury bills are easy to redeem and could potentially cause damage to the macroeconomy, in particular the exchange rate pressure and strain on the Government budget due to early redemptions. For instance, due to the reversal of foreign portfolio flows in mid-2008, the exchange rate depreciated sharply, precipitating inflationary pressures as seen by the rise in inflation to 16.6% in 2008 from 8.9% in 2007. This occurred mainly due to a rapid increase in demand for foreign exchange as non-resident investors unwound their Government securities holdings, resulting in a net outflow of US$226.0 million (Mutoti, et al, 2010).

The volatility of the exchange rate was also greater during the crisis period following rapid reductions in foreign investors' holdings of Treasury bills. This period also represented the Bank of Zambia's marked presence in the foreign exchange market, attempting to tamper exchange rate volatility through an increase in sales of foreign exchange (Charts 2 and 3). At

the height of the crisis, the exchange rate exhibited high rate of volatility, with the 5-day moving standard deviation recorded at an average of 42.3 between 2008 and 2009 compared to 24.0 prior to the crisis in 2007. Volatility was high during periods of large Bank of Zambia interventions between July 2008 and June 2009. Over this period, the Bank of Zambia sold US$416.5 million to support the market against purchases of US$12.0 million, resulting in net intervention of US$404.5 million. Despite this market support, the exchange rate exhibited relatively high levels of volatility, with the five-day standard deviation averaging 61.4 compared with the trend average of 37.0 over the same period. Subsequently, the Bank reduced the size of its intervention, and correspondingly, as a matter of interest, it was observed that volatility in the exchange rate eased. However, this period also coincides with a relative improvement in global economic conditions.

Chart 2: BoZ Intervention and Exchange Volatility

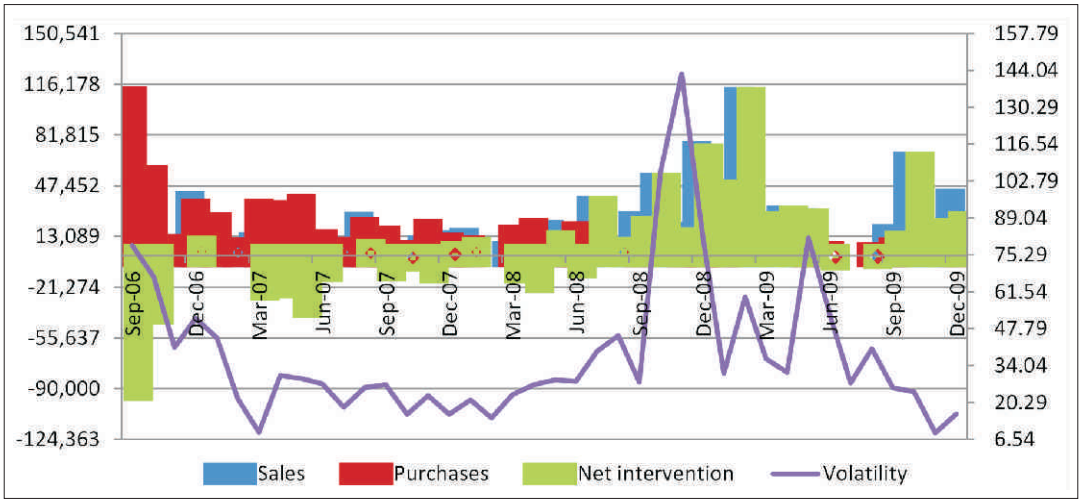
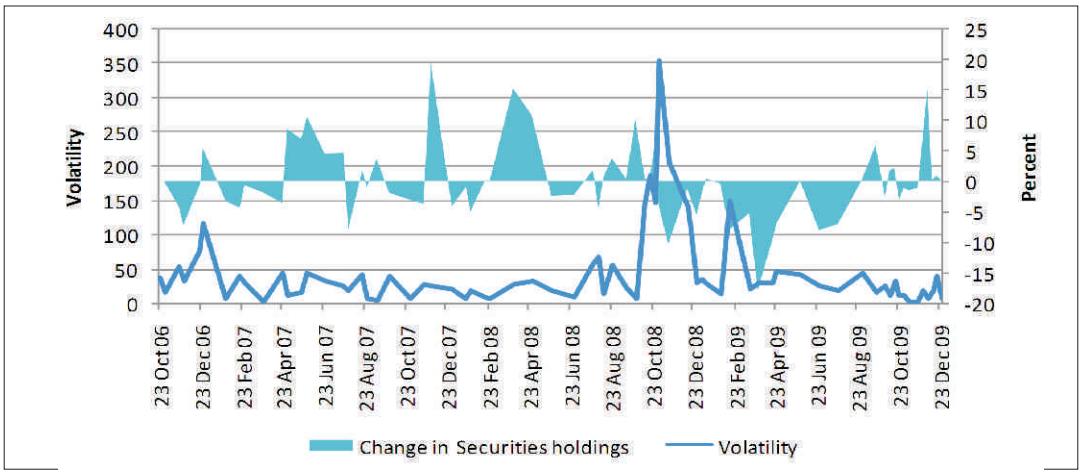


Chart 3 shows net portfolio outflows vis-à-vis exchange rate volatility. Foreign investment in Government securities recorded net outflows of about 76% on average, the bulk of which was recorded from October 2008 through to July 2009. This is also the period in which the exchange rate exhibited high volatility.

Chart 3: Change in capital flows and exchange rate volatility



Since 2010, there has been some recovery in short-term capital inflows, but the risks remain. To the extent that foreign participation in securities market is undertaken through the domestic banking system, this poses another challenge – potential deterioration in bank balance sheets in an event of unexpected capital outflows. In the context of Calvo, et al (1993) credit expansion funded by foreign capital can put pressure on bank balance sheets in the event of exchange rate turmoil, exacerbating the fragility of the financial system. However, in Zambia, Government restrictions on domestic currency borrowing by foreigners for speculative purposes have helped reduce exposure by domestic banks to foreigners. This has further limited the expansion in foreign participation in the debt market and curtailed rapid expansion of the domestic banks' loan book exposure to foreigners.

IV. Policy Measures to Deal with Capital Flows and their Effectiveness

Given the general destabilising nature of stort-term capital flows, two broad types of policy measures have been suggested. These are indirect and direct measures. Indirect measures consist of policy responses to capital flows which are designed to influence their effect on the macroeconomy whereas direct measures target the flows themselves in attempting to affect their volume or composition. The application of each of these set of measures is based on the strength and threat of the risk to the economy. Thus, when applying these measures, policy makers should weigh the trade-off between potential risks and benefits of foreign capital flows.

i. Indirect Policy measures

Indirect measures take the nature of price incentives and attack capital flows by assessing the impact on the macroeconomy. A popular form of managing capital inflows is sterilised intervention. Sterilised intervention involves buying foreign exchange from the market so as to prevent nominal exchange rate appreciation due to excessive inflows of capital. During periods of significant capital inflows, potential for the exchange rate to appreciate is high, and this tends to harm export competitiveness. Thus, the monetary authorities intervene in the foreign exchange market by purchasing foreign exchange, and simultaneously conduct open market operations to drain domestic reserves in order to offset the inflationary effect of intervention.

Although sterilisation intervention is the universal policy response to capital inflows, empirical evidence has shown that it is the least efficient because it exacerbates the capital inflows problem by widening the interest differential, thereby attracting more short-term capital. This policy response appears to be counter-productive in discouraging capital inflows and may be unsustainable in the long-term owing to the losses incurred by the central bank (Le Fort and Budnevich, 1996). Yet it remains the most preferred form of capital control.

The Bank of Zambia commits to intervene in the foreign exchange market when there are threats to exchange rate stability, although the source of this instability is not explained in the framework but it is linked to monetary policy objectives (Chipili and Zgambo, 2006). Intervention may also be driven by the need to accumulate foreign exchange reserves, and could be undertaken when the actual level of reserves deviates from the target, as set in the reserves management policy. Implicit in this intervention framework is that a surge in foreign inflows or rapid decumulation of foreign exchange holdings that pose a risk to the exchange rate or reserves position may be the basis for intervening in the market. The intervention could be announced or may be discreet, to surprise the market. The potency of this

intervention action is assessed by looking at its effect on narrowing the confidence interval-upper versus lower bound.

ii. Direct policy measures

Direct restrictions on capital inflows can target either outflows or inflows. Empirical evidence on the effect of direct capital controls is also mixed. There have been considerable differences in the impact of controls on inflows and controls on outflows. Some studies suggest that direct controls significantly reduce short–term flows (Inoguchi, 2009), yet others suggest that the effectiveness of capital controls is asymmetric and depends, in large measure, on the general macroeconomic policy stance and strength and depth of the financial system and tend to vary with specific country characteristics (Kawai and Takagi, 2003; and Ostry et al, 2010).

a. Controls on capital outflows

One approach to controlling excessive capital flows involves the placement of restrictions on capital outflows (see, for instance, Kawai and Tagaki, 2003 for Malaysia). This method is achieved through 'voluntary' actions by creditors or through the imposition of controls over the outflow of capital in general. However, this approach is considered inefficient as it may not encourage domestic restructuring but instead serve as a facade for the implementation of populist policies often leading to a deepening of the financial crisis such as the case in Latin America following the debt crises of the 1980s. Further, investors may interpret these controls as indicative of a lack of confidence in the domestic economy, which in turn could exacerbate the problem of potential capital flight.

The other approach is to liberalise capital outflows so as to encourage a move away from domestic assets to foreign assets thereby decreasing net inflows. This policy is based on two tenacious assumptions.

Firstly, it assumes that the announcement of liberalised outflows has a negative impact on inflows. Secondly, the policy also assumes that domestic investors will increase their purchase of foreign assets. However, it is noted that the effectiveness of this approach may be undermined by higher domestic interest rates which may attract heavier inflows by sending a positive signal to markets, increasing investor confidence and thereby fuelling even larger inflows (Bartolini and Drazen, 1997). Nonetheless, this argument has empirical backing across several countries (Reinhart and Reinhart, 1998).

b. Controls on capital inflows

Controls on capital inflows are widespread and have proven to be more efficient in influencing capital movements than measures that are designed to influence capital outflows. Controls on inflows succeed in shifting the composition of capital away from short-term to longer maturities, instead of altering the total volumes of flows. Such restrictions take one of the two forms: quantitative restrictions that prohibit inflows of funds and tax-based restrictions which make capital transfers more costly.

The latter approach was implemented in Chile and Colombia. Such measures took the form of unremunerated reserve requirements (URR) at the central bank on foreign currency liabilities associated with direct borrowing by firms (Clarke, et al, 2000; Cardarelli et al, 2009). Chile's URR entailed that funds equal to a percentage of the sum invested in the country be deposited

in a non- interest yielding account at the central bank by the foreign investor. Like any other URR, the foregone interest was equivalent to an implicit tax.

The Indian style of capital controls implemented in the 1990s, took various forms ranging from restrictions on foreign direct investment, foreign portfolio investment through to investment in immovable assets by non-resident Indians. These controls, while implemented through a gradual approach, are operated by a substantial bureaucratic apparatus (Shah and Patnaik, 2007). Specifically for portfolio investment, only foreign institutional investors (FIIs) approved by the Reserve Bank of India are permitted to invest in India's stock and bond exchanges. The FIIs can, in turn, conduct transactions on behalf of individual foreign investors, firms and investment funds. The cap for foreign equity stakes is set at 10% of a firm's total market capitalisation while trading in derivatives is strictly regulated. Foreign investment in government bonds was restricted to US$1.76 billion and total corporate bond ownership by foreign investors was capped at US$500.0 million (Shah and Patnaik, 2007).

Within the existing control regime, the authorities opted to apply more targeted controls aimed at changing the size, composition and maturity of India's capital inflows beginning in 2007. These policies were enacted with a view to head-off risk of potential financial system instability. In this regard, short-term commercial borrowing was limited to US$20.0 million. Foreign institutional investors were not permitted to use participatory notes to invest in the stock exchange while mutual funds were completely banned from using the same instruments on derivatives and derivative-linked trades. The Securities and Exchange Board of India also tightened the criterion to become an FII.

In an attempt to reduce the speculative induced volatility and appreciation of the Indian rupee, Indian residents and firms cannot convert the local currency into foreign currency for purposes of acquiring assets or lending funds overseas without prior approval of the Reserve Bank of India. Furthermore, bank lending and borrowing is also subject to controls. Indian banks are allowed to post a foreign exposure of 20% of their lending portfolio and 15% of their liabilities, although these limits are treated on a case-by-case basis.

Based on the analysis of the various policy measures, scholars argue that effectiveness of capital controls is not symmetric. For tax-based policy on capital inflows, Chile and Colombia appear to have been successful in insulating their economies against external shocks. In the case of Chile, the URR, complemented by a gamut of other administrative controls, succeeded in shifting the composition of capital inflows towards long-term maturities, and retaining monetary control. The effectiveness of the URR was particularly enhanced by the high enforcement capacity of the central bank of Chile and strength of institutions manifested by compliance with the law and a relatively low degree of corruption. However, estimates have shown that welfare costs in terms of quasi-fiscal losses, and lower investment and growth attributed to these controls were equally significant (Gallego et al, 2002 and Ulan, 2000). In Indonesia, a ceiling on private offshore borrowing was imposed but this policy measure was met with difficulty due to the relatively free foreign exchange system and the lack of accurate and timely information necessary to control the flows.

Capital controls are only justifiable where financial markets are thin, the private sector's risk management policies are underdeveloped and where the regulators capacity to supervise the financial sector is limited resulting in severe market distortions (Clarke et al, 2000). However, the effect of these controls is only transitory. These measures tend to increase the cost of capital and may therefore be growth inhibiting. Controls should not be used as a substitute for a sound macroeconomic policy and strong institutional fundamentals. A strong domestic financial sector with a sound banking system is essential for developing countries to reap the

benefits and withstand the risks associated with large and potentially volatile capital flows.

In addition to monetary policy measures, fiscal restraint has been advanced as a long-term measure to address the negative effects of large volumes of capital flows (Kasekende et al, 1996). Tight fiscal policy in addition to promoting macroeconomic stability is considered an effective measure to guard against the inflationary impact of possible eventual reversal of capital flows (Colbo and Hernadez, 1994). Further, it is suggested that lower government borrowing can serve as a means of offsetting the effects of sterilisation by reducing interest rates.

Balin (2008) evaluated the effectiveness of India's capital controls and observed that controls were not able to reverse appreciation of the Indian rupee. Although the controls did not stem the expansion in capital inflows, they succeeded in shifting the maturity from the short-term to long-term, more like the outcome of the Chilean URR. Furthermore, available information does not show strong evidence of the circumvention of controls on portfolio flows. Nonetheless, some sources suggest that non-FIIs made equity investments on the Indian market through 'asset bartering'. In principle, investors made few de facto changes to inflows, while in de jure terms, constraints were more effective.

iii Policy Framework for Dealing With Speculative Capital Flows in Zambia

Unlike many countries that have implemented capital controls, Zambia's problem is not one of encouraging capital inflows, but rather, the major concern is to stem pernicious outflows in order to prevent financial instability. Thus, the menu of policies proposed should take into account the unique situation in which Zambia finds itself.

Given Zambia's experience with foreign capital inflows and the reversals recorded from 2008 during the peak of the global financial crisis, there is need to design a policy framework aimed at counteracting the adverse effects of capital flows on the macroeconomy. However, such a framework must be consistent with overall macroeconomic fundamentals and should reflect the investment needs of the economy. The policy measures must also reflect available technical capacity to implement them without incurring significant costs and design a framework that aims at attracting capital inflows without compromising financial stability and monetary policy implementation.

The Bank of Zambia uses sterilised intervention as the main policy instrument to minimise volatility in the exchange rate arising from large volumes of capital inflows and outflows. Further, in light of the liberalised foreign exchange market, this measure is complemented by the accumulation of reserves in order to build a safeguard against adverse effects on the currency arising from a potential reversal in the capital flows.

In 2009, the Bank of Zambia also instituted measures to protect the domestic financial system from speculative behaviour by restricting lending to non-residents in domestic currency without any underlying economic activity. In principle, this requirement implies that Kwacha lending by commercial banks to foreigners should be directed to tangible projects with long-term maturity and positive risk-adjusted returns. This measure has most likely minimised the cross-border currency carry trade activities. Although the effectiveness of this policy measure is yet to be evaluated, available data show a reduction in bank lending to non-residents. In 2009, the turnover of lending in Kwacha to non-residents by Zambian banks was recorded at K2,073.8 billion, the bulk of which was made prior to the policy announcement. At end of 2010, Kwacha lending turnover to non-residents was only K43.8 billion.

However, the effectiveness of these measures is inhibited by the absence of restrictions on lending to non-residents in other currencies. Therefore, whilst banks' have recorded a reduction in turnover of Kwacha lending, there has been an increase in foreign currency denominated lending turnover to non-residents. For instance, in 2009, the turnover of lending in foreign currency (predominantly US dollars) was recorded at US$1.2 billion, whilst in 2010 the figure was US$7.9 billion. This could be a recipe for locally originated intra-market currency carry trade which may induce foreign currency volatility given the interest rate differential between the Kwacha and foreign currency time deposits. The investor would simply borrow in US dollar and sell the dollars in the spot market and have the proceeds invested in the Kwacha denominated assets maturing within a short term.

V. Conclusion and Recommendations

This paper has highlighted policies designed to manage capital flows. A review of literature on countries' experiences with capital controls shows mixed outcomes. Nonetheless, among a set of available instruments, there is consensus on use of price based instruments rather than direct controls, even though price incentives also represent second best measures to manage capital flows relative to prudential regulation. Furthermore, there is general agreement that controls are more effective on capital inflows rather than outflows, because for the latter, the potential for circumvention is high.

From the evidence adduced in the literature, targeting inflows appears more effective than exerting control on outflows. Furthermore, price incentives tend to be more effective in shifting portfolio composition of capital inflows than direct measures, although their potency is lower in less developed financial systems.

Drawing from previous experience with Zambia's portfolio outflows, which mainly affected short-term non-residents' investments in Treasury bills, we propose that foreign investment in Government securities be limited to Treasury bills with maturity of not less than 273-days while there should be no limit on foreign investment in Government bonds.

Given that investors may circumvent this directive through secondary market trading, one way of gaining protection is to put in measures that ensure that investors should hold securities for at least three months before disposing them in the secondary market. This restriction has the benefit of lengthening the maturity of Treasury bills held by non-residents away from very short-dated instruments towards longer maturities, and allows the Bank of Zambia to closely monitor net foreign inflows in the securities market. Furthermore, it provides the authorities with the ability to respond in a timely manner to any unforeseen developments in portfolio capital flows. Thus, the measure is aimed more at containing volatility rather than limiting foreign investment in Government paper. Therefore, a well-functioning secondary market for Government securities is not at variance with proposed measures of containing volatility in that it deepens the market and provides the much needed liquidity.

Targeting equity investment may also provide a cushion for forestalling instability in the foreign exchange market. However, to the extent that regulating trading in stocks falls outside the central bank mandate, there is need to create a surveillance institutional framework bringing together the Securities and Exchange Commission of Zambia and other regulatory authorities in controlling inflows in the capital market. The first point of call is to strengthen already existing structures and collaboration among these institutions. Furthermore, lessons learned during the crisis and how existing collaborative efforts dealt with the problem could

provide a framework for preventing and/or minimising adverse effects of future crises.

Although foreign exchange intervention appears to be volatility inducing, this evidence must be evaluated against the background of the global financial crisis, when other factors were potentially responsible for the observed volatility in the exchange rate. Thus, we argue that in the absence of a crisis, the Bank of Zambia could retain use of the existing framework of sterilised intervention to minimise the adverse effects of speculative capital flows on the exchange rate. Reserve accumulation acts as a fall back to stabilising the markets when they get distressed. This is the strategy most of the emerging market economies are using rather than allow for currency appreciation when there is a surge in the foreign capital flows.

In dealing with banking sector problems, the Central bank should improve banking regulation and encourage effective enforcement and regulation of the banking and financial system to ensure a sound and resilient banking system. This should be coupled with the development of a deeper and liquid domestic financial market. Improving transparency and disclosure of financial activities and market discipline should also be emphasised. The most critical issue in this regard relates to banks intermediation role in short term capital flows. To minimise this, the Bank of Zambia should apply a higher reserve ratio for all forms of short term deposits by non-residents (both Kwacha and foreign currency). Evidence shows that such a policy measure yielded some benefits for the Chilean and Colombian economy, especially in shifting inflows towards longer dated maturities. Although the Chilean application of URR may be appealing, it presents substantial implementation challenges. Going this route would require strong institutional and technical capacity to design an appropriate framework for identifying inflows eligible for reserve requirements.

For Turkey, there is even a disaggregation to setting the reserve ratio on the type and maturity period of the foreign inflows into the banking system on the local currency accounts. However, this policy too requires an adequate data on banks' borrowings from non-residents in order to calculate the appropriate reserve ratio. The policy measure also requires a strong analytical and technical capacity and therefore presents implementation challenges. It should be noted that commercial banks' monthly prudential returns to the Bank of Zambia shows a breakdown of non-resident deposits and requires some minor improvement to suite the surveillance objectives.

Whilst the above policy measures have some degree of potency in containing the adverse effects of capitals flows, they cannot substitute for prudent macroeconomic and effective institutional framework. In this regard, the Bank of Zambia should continue pursuing policies that engender macroeconomic stability. In particular, the central bank should continue with judicious monetary policy whilst urging prudent fiscal policies to avoid raising interest rates to levels that encourage speculative capital inflows.

In summary, we recommend that firstly, the Bank should look at measures to direct foreign capital inflows towards financial issues with long term maturity. Secondly, the Bank of Zambia should scale up reserve accumulation in the event of the surge in capital inflows other than allow for currency appreciation. Thirdly, a framework to categorise non-residents funds in the banking system according to maturity and type of deposit, for both Kwacha and foreign currency accounts, and an appropriate surveillance mechanism be put in place to monitor non-residents flow of funds into the banking system.

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APPENDIX: Country Experiences with Responses to Foreign Capital Flows

Republic of Korea: The Bank of Korea passed a directive in June 2010 aimed at limiting banks' exposure to derivatives by capping foreign exchange forward positions relative to their equity capital. In terms of corporates, the exposure limits to derivatives for foreign exchange hedging was reduced to 10% of export receipts from 11%. The primary objective of capping foreign exchange trading was to limit exchange rate volatility. Besides, the government of Korea re-imposed withholding taxes on foreign investors' holdings of government securities to limit inflows into local bond markets.

In January 2011, the Republic of Korea reintroduced a 14% withholding tax on foreigners' holdings of government bonds and central bank securities aimed primarily at slowing down the foreign capital inflows into government bond markets.

India: After the Lehman Brothers bankruptcy at the end of the third quarter and the ensuing credit crunch, the Reserve Bank of India (RBI) in October 2008 liberalised external commercial borrowings (ECBs) to ease access to foreign capital by local borrowers. The ECBs include bank loans, buyers as well as suppliers' credit, debt instruments and securitised instruments. In October 2010, the RBI reinstated limits on external commercial borrowing by capping interest rates for borrowed funds so as to limit speculative capital inflow. The main aim was to limit access to foreign credit to best corporate credits and prevent high cost of borrowing. This was to cushion the economy from the adverse impact of the reversal in the capital flows in the event of the markets getting distressed.

Indonesia: As investments in government securities were restricted to at least three years after the global financial crisis, foreign inflows switched to one- and three-month central bank bills (SBIs) on an increasing proportion in 2009 and 2010. In June 2010, the Bank of Indonesia (BI) introduced two regulations. The first one related to minimum holding period of central bank bills, which was restricted to one month for both domestic and foreign investors. This measure was introduced in order to limit the volatility of the net foreign capital flows. The second one involved limiting foreign access to central bank instruments by phasing out one- and three-month SBIs in favour of nine- and 12-months SBIs, and expanded supply of non-tradable term deposits up to six months tenor, which are only available to banks operating in Indonesia. This was aimed at limiting the volatility of the short term foreign capital inflows.

The central bank also increased its foreign exchange market intervention for the purpose of increasing its foreign reserves as a tool for stabilising the markets if a net capital outflow crisis arises in future. In addition, the BI also re-imposed a limit on banks' external short-term borrowing to 30% of capital in January 2011, limiting their capacity to intermediate short-term inflows. Further, the BI in March 2011 raised reserve requirement on foreign currency accounts from 1 to 5% . A further increase to 8% is scheduled for June 2011. These measures are also aimed at limiting banks' vulnerabilities to inflow volatility, and to reduce incentives for banks to intermediate short-term inflows.

Taiwan Province of China: In an effort to stem the rapid growth of the short term foreign capital inflow, the Financial Supervisory Commission (FSC) passed a regulation in November 2009 to bar access to time deposit accounts for foreign investors. Time deposits have been identified to be one avenue for carry trades[1] currency speculation.

[1]Carry trades is a trading strategy were a trader sells a certain currency with a relatively low interest rate and uses the proceeds from that transaction to purchase a different currency yielding a relatively higher return. The aim is to capture the difference between the rates. The risk with curry trades is the exchange rate uncertainty. Often the funds involved are borrowed funds and therefore curry trades are relatively highly leveraged.

In November 2010, the FSC announced measures aimed at reducing access of nonresidents to government bonds by limiting them to 30% inbound remittances' investments in domestic securities, to include government securities of remaining maturity greater than one year. Further in January 2011, the FSC put a regulation in place with an objective of effectively barring banks from offering interest-bearing accounts to nonresidents. This was done by way of increasing the reserve requirement on local currency accounts held by non-residents to 90% on balances exceeding the outstanding balance on December 30, 2010 while balances below the end-2010 levels were subjected to 25%t reserve requirement. Required reserves for such accounts no longer get interest earnings.

Thailand: Just like the Korean Republic, Thailand re-imposed withholding tax on foreign investors' holdings of government securities in October 2010 in order to limit foreign capital inflows into the local bond markets. Further, to avoid rapid currency appreciation due to the foreign capital inflows, ceilings on residents' outward direct investment, lending abroad, and foreign currency holdings were raised in February and September 2010.

Malaysia and the Philippines: To prevent rapid local currency appreciation arising from a surge in the foreign capital inflows, Malaysia in October 2010 announced an increase in the investment limit of the Employee Provident Fund to 20% from 7%. In a seemingly related development, the Philippines announced a measure in November 2010 of increasing ceilings on residents' purchase of foreign exchange and foreign assets from authorised agent banks and permitted prepayment of private sector foreign exchange loans. These measures were aimed at encouraging capital outflow and thereby counter the destabilising effect of the inflows.

Brazil: Concerned with the rapid foreign capital inflows and its macroeconomic perturbations, Brazil instituted measures to stem rapid foreign capital inflows. In October 2009, Brazil reinstated a tax on portfolio inflows (Imposto de Operações Financeiras, or IOFs) a higher rate, of 2%, on non-resident portfolio equity and debt inflows which was originally established in 1993 and used intermittently since its introduction. The objective was to discourage carry trades. The IOF was further increased to 6% in October 2010 for all fixed income securities and the tax was also raised to 6% from 0.38% on the margin payments required on derivatives traded in the local market including foreign exchange futures. In March 2011, a 2% tax was imposed on offshore debt issuance and borrowing by corporates of less than one year maturity.

Turkey: Its main form of capital inflows were mostly credits from foreign banks to Turkish banks in the nature of short-term loans, deposits, repatriation of Turkish banks' assets onshore, and non-residents' purchases of government debt securities. In December 2010, measures were put in place to extend the maturity of foreign inflows. Specifically, withholding tax rate on bonds issued abroad by Turkish firms was reduced to 7% (1- 3 years maturity), 3% (3- 5 years maturity), and zero percent (maturities longer than 5 years). The local currency reserve ratio differentiated across maturities, ranging from 5% on deposits with maturity of at least one year to 8% for those with maturity of up to one month. Foreign exchange reserve ratio kept at pre-crisis level of 11% and remuneration of reserve requirements stopped. In January 2011 the reserve ratio for short term deposits was further increased ranging from 9% to 12%.

South Africa: The main concern has been the appreciation of the Rand as a result of foreign inflows. To counter this, the country instituted measures that meant to allow more outflows from resident investors. In October 2009, individuals' offshore investment limit was raised to R4 million from R2 million per annum. In March 2010, banks were allowed to invest abroad up

to 25% of their non-equity liabilities and further in October a 10% levy on the capital that South Africans could transfer upon emigration was abolished. In December 2010, resident institutional investors' offshore investment limit was raised by 5 percentage points and it now ranges between 25% and 35% depending on the type of institutional investor. In January 2011, all qualifying international headquarter companies were permitted to raise and deploy capital offshore without exchange control approval.

CHAPTER TWO

The Kwacha - US Dollar Exchange Rate: Is it a Random Walk?

By

Emmanuel Mulenga Pamu, Maxwell C. Musongole and Emmanuel Chokwe

Abstract

This paper investigates the fractal structure of the daily Kwacha/US dollar exchange rate for the period 2004 to 2011 using the rescaled range (R/S) analysis. The results suggest that the exchange rate during this period was an unbiased random walk. The fractal structures of the exchange rate in each year were also examined. The rate exhibited traces of trend-reinforcing characteristics in 2004 and 2005 while the rate had anti-persistent features in the period 2006 to 2011. The R/S analysis has been applied before to characterise the Kwacha/Dollar exchange and revealed that the rate was a persistent process biased towards depreciation during the period January 1995 and December 2003 (Musongole, 2003). The change in the exchange rate from biased towards depreciation in the period 1995 to 2003 to an unbiased random walk between 2004 and 2001 might be attributed to improved external sector developments.

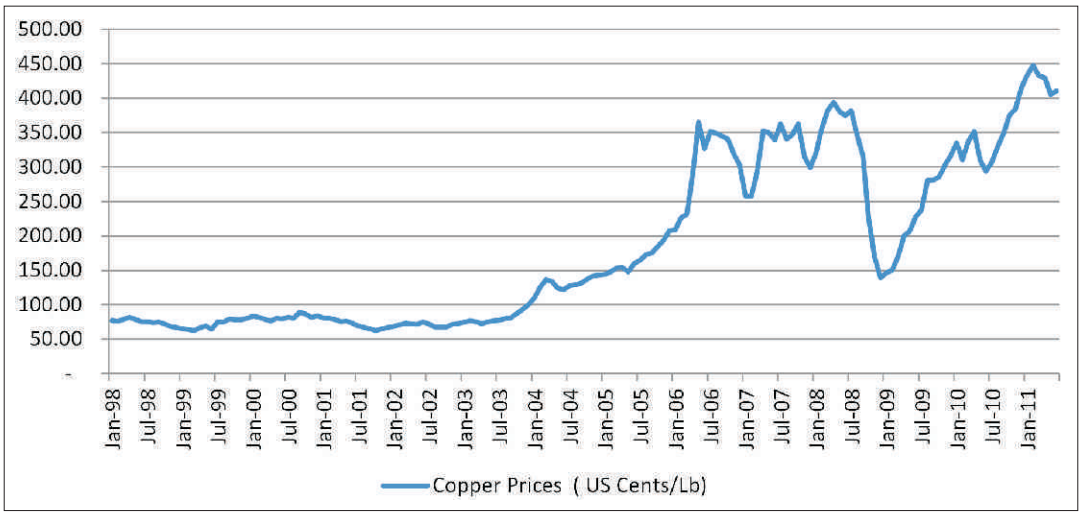
I Introduction

Movements in the Zambian Kwacha – US Dollar exchange rate have been characterised by numerous factors over time. In 1974, the international price of copper fell. The low prices of copper persisted into the 1980s and 1990s. Initially the Zambian Government perceived the fall in copper prices as a temporary phenomenon, and thus resorted to borrowing both domestically and externally. External borrowing resulted in Zambia accumulating a huge external debt that became a burden on the country's economic development. As a result, from 1974 up to the late 1990s, the accumulation of external debt and persistent current account deficits biased changes in the nominal exchange rate towards depreciation.

However, during the early 2000s, the international price of copper rose steadily until the onset of the financial crisis in 2008 (see Figure 1). In April 2005, Zambia received debt relief under the Highly Indebted Poor Countries' (HIPC) initiative and further under the Multilateral Debt Relief Initiative (MDRI). These factors improved investor confidence in the Zambian economy which increased portfolio flows into the economy. As a result, the economy experienced periods of appreciation in the exchange rate until the onset of the 2008 global financial crisis.

Musongole (2003) applied chaos theory and fractal geometry using rescaled range (R/S) analysis to investigate the underlying fractal structure of the exchange rate for the period January 1995 to December 2003. The results showed that the exchange rate was persistent (i.e. trend re-enforcing) and biased towards depreciation, with a Hurst exponent of 0.6849. This result was in line with the prevailing economic conditions affecting the exchange rate during the period.

Chart 1: Copper Prices (US Cents/Lb)



In the recent times fractal geometry has been widely applied in describing natural phenomena and physical systems. The main attraction of fractal geometry is its ability to describe the irregular or fragmented shape of natural features as well as other complex objects that traditional Euclidian geometry fails to analyse (Lopes and Betrouni, 2009). In Mandelbrot (1977), the fractal sets that make it possible to describe the degree of regularity of an organizational structure related to the physical systems behavior are described.

The application of fractal geometry in the analysis of exchange rates has been on the increase. In Evertsz (1995), fractal geometry is used to investigate self-similarity of high frequency US dollar – Deutschmark (USD-DEM) exchange rates. Multi-fractal analysis was applied to investigate the existence of a multiplicative flux of financial information in exchange rates (Schmitt et al., 1999). Fractal theory has also been applied to establish that the Iranian Rial has complex chaotic behaviour with big degrees of freedom (Torkamanni, et al, 2007).

Chaos theory describes systems which are dynamic in nature and whose evolution depends on initial conditions. Such systems may seem to be random but in fact are deterministic with their future characteristics fully dependent on their initial conditions. In Stewart (1990), chaos theory is described as the study of the stochastic behaviour of deterministic systems while Prigogine and Stengers (1985) depict chaos theory as a paradoxical combination of uncertainty and determinism. One of the approaches to the study of chaos theory has been the fractal theory, where fractals are sets that exhibit properties of self-similarity. A fractal is a multitude whose parts are similar to the whole (Mandelbrot, 1982).

In this paper, chaos theory, using the R/S analysis, is applied to investigate the characteristics of the Kwacha/US dollar exchange rate in the period 2004 to 2011. The remainder of the paper proceeds as follows: in section two, a detailed discussion of the R/S analysis technique is given. The data used in the analysis are described in section three. In section four, the fractal structure of the exchange rate is computed and the findings are presented and discussed. Concluding remarks are given in section five.

II Rescaled Range Analysis

This section outlines the steps necessary to carry out the R/S analysis in the computation of the Hurst coefficient. The Hurst coefficient is closely related to the fractal dimension. The

fractal dimension describes how an object or time series occupies its space. It is a product of all the factors that influence the system producing the object or time series. Several methods for computing fractal dimension are discussed (Chatterjee and Yilmaz, 1992 and Beliner, 1992). Mandelbrot (1982) showed that the fractal dimension of a time series is the inverse of its Hurst exponent (H).

The method to compute the fractal dimension is illustrated by considering the length of a coastline (Peters, 1991). Coastlines are considered to be jagged lines. The fractal dimension of a coastline is then calculated by measuring its jagged property. The number of circles with a certain diameter that are needed to cover the coastline are counted. The diameter is increased and again the number of circles is counted. Continuing this, the number of circles has an exponential relationship to the radius of the circle, and the number of circles scales according to the following relationship:

$N(2r)^D = 1$ ..... (1)

where N = number of circles
r = radius
D = fractal dimension

Using logarithms, the equation $N(2r)^D = 1$ can be transformed to:

$$D = \frac{\log N}{\log(1/2r)} \quad \text{.....} \quad (2)$$

The circle counting method for determining fractal dimension is not practical, especially for time series. The relationship between the circle counting method of measuring fractal dimension and the Hurst exponent is:

$$D = \frac{\log N}{\log(1/2r)} = 2 - H \quad \text{.....} \quad (3)$$

In this paper, D=2-H, will be used to compute the fractal dimensions of the Zambian Kwacha exchange rate.

A coastline with a higher fractal dimension is more jagged than that with a lower fractal dimension. In a similar way, different economic time series can be compared by noting their fractal dimensions.

Rescaled Range Analysis

The steps to compute the Hurst exponent are outlined in Peters (1989, 1991,1994) as follows:

Begin with a time series of length M. Convert this to a time series of length M=N - 1 of logarithmic ratios

$$\log\left(\frac{M_{i+1}}{M_i}\right), i = 1,2,3,...,M - 1 \quad \text{.....} \quad (4)$$

Step 2, divide this time period into A contiguous sub periods of length n such that $A_n = N$. Label each sub period I_a, with $a = 1,2,3,...,A$. Each element in I_a is labelled N_{ka} such that $k = 1,2,3,...,n$. For each I_a of length n, the average value is defined as:

$$e_a = \frac{1}{n}\sum_{k=1}^{n} N_{k,a} \quad \text{.....} \qquad (5)$$

where $e_a =$ average value of the N_i contained in sub period I_a of length n.

The time series of accumulated departures X_{ka} from the mean value of each sub period I_a is defined as:

$$X_{k,a} = \sum_{i=1}^{k} (N_{i,a} - e_a), k = 1,2,3,...,n \quad \text{....} \qquad (6)$$

The range is defined as the maximum minus the minimum value of X_{ka} within each sub period I_a :

$$R_{I_a} = \max(X_{k,a}) - \min(X_{k,a}), \text{ where } 1 \le k \le n. \qquad (7)$$

The sample standard deviation calculated for each sub period I_a :

$$S_{I_a} = \left(\frac{1}{n}\sum_{k=1}^{n} (N_{k,a} - e_a)^2 \right)^{\frac{1}{2}} \quad \text{.....} \qquad (8)$$

Each range R_{I_a} is now normalized by dividing by S_{I_a} corresponding to it. Therefore, the rescaled range for each I_a sub period is equal to $\frac{R_{I_a}}{S_{I_a}}$. From step 2 above, we had A contiguous sub periods of length n . Therefore, the average R/S value for length n is defined as

$$(R/S)_n = \frac{1}{A}\sum_{a=1}^{A} \left(R_{I_a} / S_{I_a} \right) \quad \text{.....} \qquad (9)$$

The length n is increased to the next higher value, and ***(M - 1)/n*** is an integer value. We use values that include the beginning and ending of points of the time series, and steps 1 through 6 are repeated until ***n=(M-1)/2*** We now perform an ordinary least square regression on log(n) as the independent variable and ***log(R/S)$_n$*** as the depended variable. The intercept is the estimate for log(c), the constant. The slope of the equation is the estimate of the Hurst exponent ***H***. That is

$$\log(R/S_n) = \log(c) + H^*\log(n) \quad \text{.....} \qquad (10)$$

H =0.50 would imply an independent process. $0.50 \le H \le 1.00$ implies a persistence time series, and a persistent time series is fractal and characterized by long memory effects. In such time series there is correlation between events across time scales, and the Hurst exponent describes the likelihood that two events are likely to occur. $0 \le H \le 0.50$ signifies anti-persistence. An anti-persistence process reverses itself more frequently than a random process.

Correlation

The impact of the present on the future is expressed as a correlation and given by

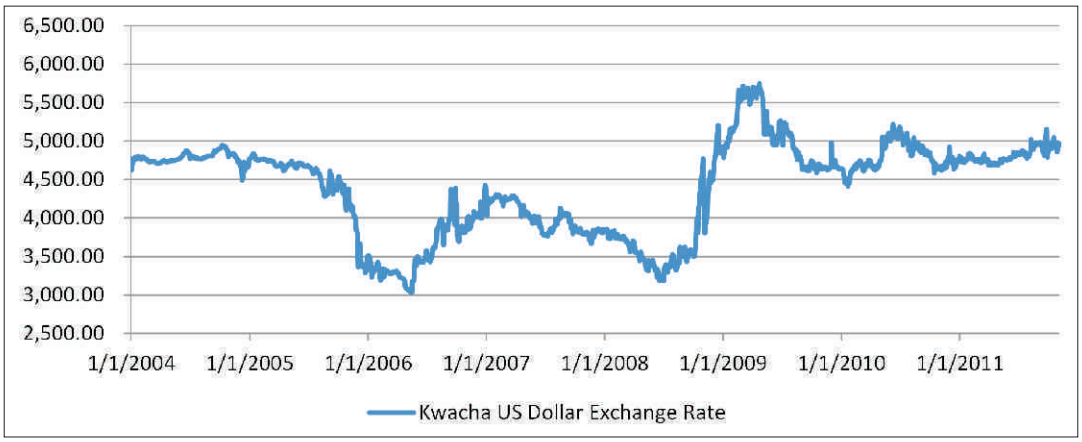
$$C = 2^{(2H-1)} - 1 \qquad 2.7$$

where C= correlation measure, H= Hurst exponent

III Data

In this section, the data used in the analysis are described. The data used are the middle values of the daily buy and sell rates of the US Dollar from 2004 to 2011. The data are plotted in Chart 2.

Chart 2: Kwacha US Dollar Exchange Rate



The chart shows the exchange rate from January 2004 to November 2011. We note that there is no discernible seasonal variation in the movement of the exchange rate during this period. Furthermore the trend of the exchange rate in this period is not clearly defined. The exchange rate is characterized by local fluctuations and not a so clear global trend.

IV The Fractal Structure of the Exchange Rate

The Hurst exponent for each year for the study period is computed. The correlation coefficients and the fractal dimensions for each year were also computed as shown in Table 1. The results show that in 2004 and in 2005 the exchange rate had trend reinforcing characteristics with H=0.55 and H=0.52, respectively. That is, in 2004 and 2005 the exchange rate was fractal. In these years the exchange rate showed less noise, was more persistent and had a clearer trend. This meant that the exchange rate during this period had less volatility. Furthermore, the exchange rate in 2004 and 2005 had positive correlation. This implied that past and current events impacted significantly on the future of the exchange rate.

Table 1: Hurst Exponent, Fractal Dimensions and Correlation Coefficients for the Exchange Rate in Different Periods

Period	Hurst Coefficient	Fractal Dimension	Correlation	Hurst Coefficient Standard Deviation	Number of Data Points
2004	0.550	1.450	0.072	0.156	262
2005	0.517	1.483	0.024	0.016	262
2006	0.477	1.523	-0.032	0.015	249
2007	0.416	1.584	-0.120	0.005	243
2008	0.274	1.726	-0.269	0.013	249
2009	0.358	1.642	-0.179	0.005	251
2010	0.407	1.539	-0.121	0.006	250
2011	0.272	1.728	-0.271	0.010	209
2004-2011	0.490	1.510	-0.014	0.0216	1964

For the period 2006 to 2011, the results show that, in each year, the exchange rate was antipersistent (ie with the $H < 0.5$). That is it fluctuated around a typical value implying, in these years the exchange rate exhibited the mean-reverting characteristics. The exchange rate also recorded negative correlation in each year, which meant that, in these years, past events did not necessarily reinforce future events.

The Hurst exponent for the entire period 2004 to 2011 was computed as $H=0.49$ and very close to $H=0.5$. This meant that the characteristics of the exchange rate in the overall period 2004 to 2011 were of random nature. The correlation coefficient was negative indicating that over the period, past events played little impact on the future events.

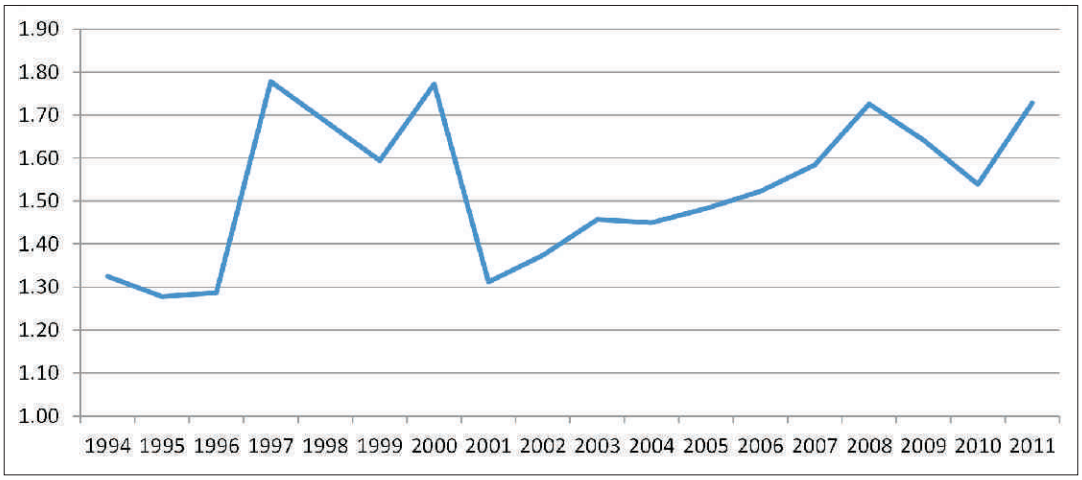
The fractal dimension which gives insight into how a process is formed was computed for the exchange rate in each year for the period 1993 to 2011. The correlations to measure the impact of current events on future occurrences were also computed for each year in the period. Table 2 below shows the results.

Table 2: Yearly Exchange Rate Fractal Dimensions and Correlations for the Period 1993 - 2011

Period	Hurst Coefficient	Fractal Dimension	Hurst Coefficient Standard Deviation	Number of Data Points	Correlation
1993	0.475	1.525	0.0352	259	-0.03406
1994	0.675	1.325	0.00707	260	0.274561
1995	0.722	1.278	0.00499	260	0.360371
1996	0.713	1.287	0.01332	262	0.343503
1997	0.222	1.778	0.00484	261	-0.31981
1998	0.314	1.686	0.00071	261	-0.22729
1999	0.406	1.594	0.0056	261	-0.12218
2000	0.228	1.772	0.00891	260	-0.31413
2001	0.688	1.312	0.00566	261	0.297739
2002	0.626	1.374	0.00597	261	0.190857
2003	0.543	1.457	0.01756	261	0.061423
2004	0.55	1.45	0.1559	262	0.071773
2005	0.517	1.483	0.01601	262	0.023847
2006	0.477	1.523	0.01523	249	-0.03138
2007	0.416	1.584	0.00534	243	-0.10992
2008	0.274	1.726	0.01303	249	-0.26897
2009	0.358	1.642	0.00491	251	-0.17869
2010	0.407	1.539	0.00604	250	-0.12096
2011	0.272	1.728	0.01044	209	-0.271

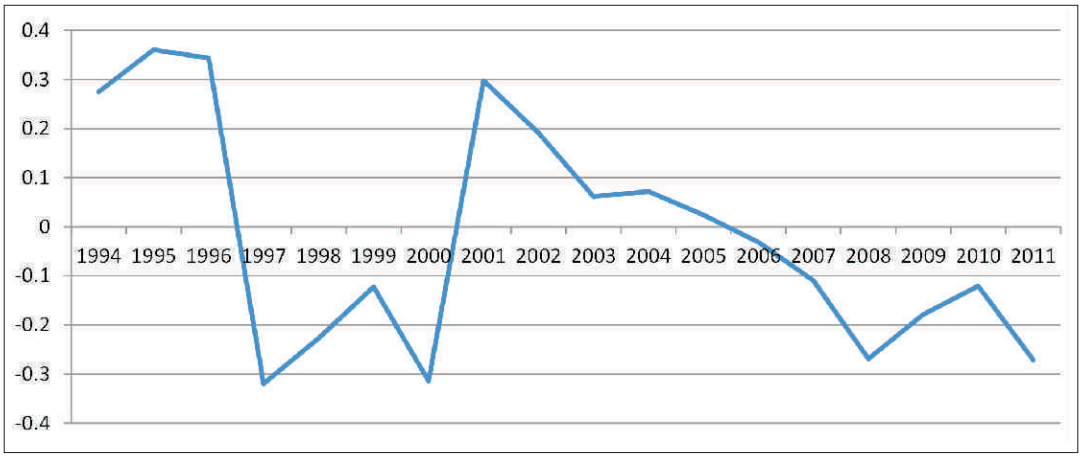
The plot of the fractal dimensions in Figure 3 shows some important features of the exchange rate behaviour in the period. There is a general marked trend in the fractal dimensions of the exchange rate over the period. The plot reveals that from 1993 to about 1996 and from 2001 to about 2005, the exchange rate was a persistent process and biased towards depreciation. In the remaining years, the exchange rate was mainly anti-persistent with mean reverting characteristics.

Chart 3: Fractal Dimensions of the Exchange Rate in each Year 1993 - 2011



The correlation coefficients for the exchange rate in each year 1993 to 2011, plotted in Figure 4 measure the extent to which past events of the exchange rate affect the future outcomes of the rate in the year. Positive correlation may signify strong relationship between current and future events. The plot shows that from 1993 to 1996 and from 2001 to 2005, past events in the exchange rate impacted on the future rate. In the rest of the other years the rate was an unbiased process with current events having minimum impact on the future exchange rate.

Chart 4: Correlations of the Exchange Rate in each Year 1993 - 2011



V Conclusion

The paper investigated the changing behaviour of the Kwacha/US dollar exchange rate using the rescaled range (R/S) analysis. Previous research revealed that the Kwacha/US dollar exchange rate had a Hurst exponent $H=0.6849$ for the period January 1995 to December 2003. This implied that the exchange rate was a persistent process and thus a biased random walk and influenced by past events (Musongole, 2003). In this paper, the fractal structure for the daily Kwacha/US dollar exchange rate for the period 2004 to 2011 was investigated. The Hurst exponent $H=0.49$ reveals that generally, the exchange rate during this period could be described as a random process or unbiased random walk. However, the fractal structure of the exchange rate in each year for the period 2004 to 2011 showed that the characteristics of the exchange rate were mixed and differed according to the years. The exchange rate exhibited traces of trend-reinforcing characteristics in 2004 and 2005 while the rate had anti-persistent features in the years 2006 to 2011. The change in the dynamics of the exchange rate from a biased random walk (1993 – 2003) to an unbiased random walk could be attributed to improved external sector developments during the period 2004 to 2011. In periods before, movements in the exchange rate were unidirectional and biased towards depreciation. The behaviour of the Kwacha/Dollar exchange rate mimicked an unbiased random walk starting 2006 onwards implies that one cannot easily predict the rate although a pattern in the movement of the rate can be established. Further research is required to determine the scaling factors of the exchange rate.

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CHAPTER THREE

Economic Life of Zambia's University Students: The Case of University of Zambia

By

Daniel Ndhlovu; Sophie Kasonde-Ng'andu, Madalitso K. Banja and Janet Serenje

Abstract

The University of Zambia has a cross section of students which includes school leavers, non-school leavers and in-service. Some of these students are on Government bursary sponsorship scheme while others, are sponsored by their employers or are self-sponsored. However, students indicated that they face economic challenges in pursuit of university education. This study found that 85% of the respondents rated the cost of living at the University of Zambia as high, even though the majority are on Government sponsorship. In order to cope with the high cost of living, 21% of the respondents engage in business activities, 15% in vacation employment while 64% do not engage in any activities to raise extra funds. The high cost of living at the University of Zambia has a negative effect on the academic performance of most students.

I Introduction

While university education continues to be considered a largely public enterprise, students and their families are making substantial contributions both to the cost of tuition and other expenses associated with studying. For instance, a study by the Department for Employment, Education, Training and Youth Affairs (1998) indicates that the share of expenditure of tertiary education covered by students and their families ranges widely from a negligible amount of the gross domestic product in Denmark, Sweden and Austria to almost 40% in the United States, and over 50% in Korea and Japan. The share of spending has been increasing in different ways in different countries, such as new imposition of fees, reduction in subsidies to goods and services bought by students.

In Zambia like other countries, private participation in university education has grown to the extent that individuals have to contribute more than in the past to the cost of tuition and living expenses. However, very little is known about how the student general populace in tertiary institutions rate the cost of living at the institutions, how various categories of students manage to meet the cost of living and the effects of cost of living on their academic performance. It was necessary therefore, to conduct a study of this nature to determine the economic life of students in tertiary institutions with a specific case of the University of Zambia and its effect on their academic performance.

Statement Problem

The University of Zambia has a cross section of students which includes school leavers, non-school leavers and in-service. Some of these students are on the Government of the Republic of Zambia (GRZ) bursary sponsorship scheme, others especially in-service students are sponsored by their specific employers while others still are self-sponsored. However, students lament that there are a lot of economic challenges and responsibilities faced in pursuit of university education. For instance, all students have to meet the urgent demands of photocopying data, cost of meals, accommodation, tuition and transport just to mention but a few. What is not clear is how the students' general populace at the University of Zambia rates the cost of living at the university, how various categories of students meet the cost of living and the effects of cost of living on their academic performance. In order to determine answers to these questions a study of this nature was necessary.

Purpose of the study

The study sought to determine the economic life of students at the University of Zambia in regards to how students rate the cost of living at the university, how they cope with the cost of living and the effects of cost of living on their academic performance.

Objective of the study

The following objectives guided the study:

1. To determine the sponsorship status of students at the University of Zambia;
2. To establish cost areas that students spend money on and levels of expenditure;
3. To establish how students rate the cost of living at the University of Zambia;
4. To determine how students cope with the cost of university education at the University of Zambia; and
5. To determine effects of cost of living on academic performance of students at the University of Zambia.

Research questions

The following research questions were used to guide the study:

1. What is the sponsorship status of students at the University of Zambia?
2. Which cost areas do students at the University of Zambia spend money on and levels of expenditure?
3. How do students rate the cost of living at the University of Zambia?
4. How do students cope with the cost of university education at the University of Zambia?
5. What are the effects of cost of living on academic performance of students at the University of Zambia?

II Literature Review

As early as 1998, the Department for Employment, Education, Training and Youth Affairs in the United States of America noted an increase in the forms of university education available to a growing number of students. To this effect, there was a growing demand for university education. The demand for university education was not simply driven by 'supply-side' decision by governments to fund places but also by demand – the choice made

by learners. The choice by young people and adults to pursue university education was influenced partly by economic considerations – notably the trade-off between earnings forgone while studying and the greater prospective future earnings that result. This situation is similar to that of the supporters of the Human Capital Theory such as Sakamota and Powers (1995) who found that an educated population was also a productive population. Robert (1991) had also developed a Human Capital Model to explain that education and human capital were the drivers of high labour productivity and levels of technology that influences the world today. Countries such as Korea, Taiwan, Singapore and Hong Kong were cited to have made large investments in education and achieved unprecedented rates of economic growth.

Similar approaches have been practiced in the United States of America. State Higher Education Executive Officers (SHEEO) (2011) reported that enrolments of students have increased and created competition over the available resources to the point of relying on families to sponsor their children. Studies in other African countries such as Nigeria (Ndagi, 1983), South Africa (Gaurly, 1995), Ghana, (Daniel, 1995) reveal that universities faced a challenge of how to generate additional resources to cope with such numerical expansion of students. The challenge caused respective governments to adopt cost sharing practices in education. The student' loan scheme has been the most popular one of the threefold approach. Barr, (2005) reported that loan scheme had been used in many countries in the region as well as internationally, and relieved students from the stress of looking for money to meet educational related costs. As a result, students concentrated on studies.

Similarly, because of the centrality of knowledge, skills and technology in shaping organisation and productivity of the economy, the Zambian Government considers education a productive investment. To this effect, the Ministry of Education (1996), stated that education is a right for each individual and a means for enhancing the well-being and quality of life for the entire society. In 1964 at independence and some years thereafter, Zambia was faced with a challenge of inadequate human resource. In order to meet the demand for human resource, the government came up with a deliberate policy of free education. This meant that learners at whatever level including university students, had their school fees and other personal requirements paid for by the government. If anything, they contributed very little towards their education. Since then, the Government of the Republic of Zambia (GRZ) has been supporting the provision of education in both public and private learning institutions. For instance, it has been providing sponsorship to many students in public learning institutions and provides legislative framework for both public and private learning institutions in Zambia.

As demand for university education grew, the Zambian government embarked on reforms to liberalise entry into the universities, which included allowing more self-sponsored students into the institutions of higher learning. The move was intended to expand and diversify student enrolment and cut down on excess demand for bursaries from government.

In 1989, the then Ministry of Higher Education announced measures that required university students to contribute towards the cost of their education (GRZ: Ministry of Higher Education, Science and Technology, 1989). This economic and financial policy framework reasserted that in order to strengthen the financial base for education, Zambia had to introduce user fees for the beneficiaries of secondary schools and higher education as cost effective measures.

In case of escalating cost of education, the Government of the Republic of Zambia enacted the 2011 Education Act in which article 120 (2) states, 'the Minister may establish a bursary and scholarship scheme to assist orphans and vulnerable learners at any public, aided or community educational institution.'

On the basis this literature, a threefold approach should be encouraged in Zambia; one approach is the government's position on cost sharing with students and their families; second one is the Public-Private Partnerships and the third approach to encourage is the GRZ Students' Loan Scheme. It is hoped that when stakeholders in education realise the value of education and embrace these three cost sharing approaches to education, nations and Zambia inclusive would achieve the assumptions of the Human Capital Theory.

To a larger extent therefore, the government's position on the cost of education, especially tertiary education has since then shifted from being primarily the responsibility of the state to that of sharing with students and their families. However, there exist knowledge gap about how students in tertiary institutions rate the cost of living and its effect on their academic performance. This study therefore, sought to fill up this knowledge gap.

III Methodology and Empirical Results

Since the researchers sought to have an in-depth understanding of the situation, a case study design was used. In addition, both qualitative and quantitative methods were used. Scheduled interviews and non-participant observations were conducted to yield qualitative data while quantitative methodology made use of questionnaires. Three hundred and forty-eight (348) students participated in the study. This number consisted of 144 females and 204 males. See table 1 for the distribution of the sample by school.

Table 1: Distribution of sample by School (N=348)

School	Male	Female	Total
Agricultural Science	19	18	37
Education	37	25	62
Engineering	28	8	36
Humanities	17	21	38
Law	27	30	57
Mines	34	12	46
Natural Science	29	16	36
Veterinary Medicine	22	14	36
Total	**204**	**144**	**348**

The disparity in the numbers of males and females in table one was due to the fact that the actual numbers in schools varied greatly. In addition, the response from female students was lower compared to their male counterparts.

In order to provide each element in the population an equal chance to be selected and included in the study sample, simple random sampling procedure was used. As a result, 348 students participated in the study. Interview schedules, non-participants observation checklist and semi-structured questionnaire were used to collect data from the respondents in the sample.

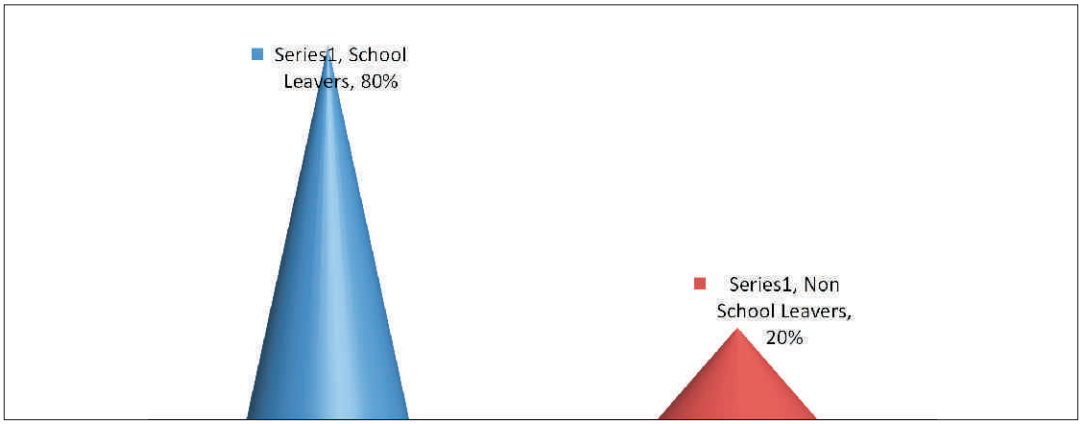
The quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) to obtain frequencies and percentages. Thematic analysis was used to analyse qualitative data.

Regarding issues of ethical nature, consideration was made to keep the names of respondents anonymous. Consent was also obtained from the respondents before allowing them to participate in the study.

IV Presentation and Discussion of Findings

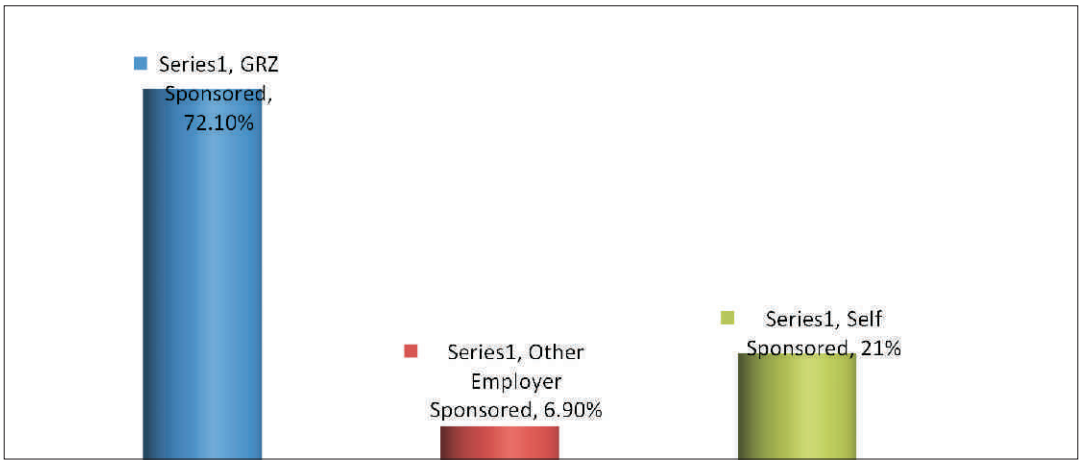
The presentation begins with the admission status of the respondents. It was found that 80% of the respondents were school leavers and the rest were non-school levers (See Chart 1).

Chart 1: Admission status of respondents at the University of Zambia (N=348)



Regarding the sponsorship status of respondents, Government is the largest sponsor at 72.1% (see chart 2).

Chart 2: Students' Sponsorship Status at the University of Zambia (N=348)



This situation where apart from students being sponsored by government, other sponsors have embraced the cost sharing approach to education is encouraging. Similarly, this is what Sakamota and Powers (1995) the proponents of Human Capital theory encouraged and when they argued that an educated population was also a productive population.

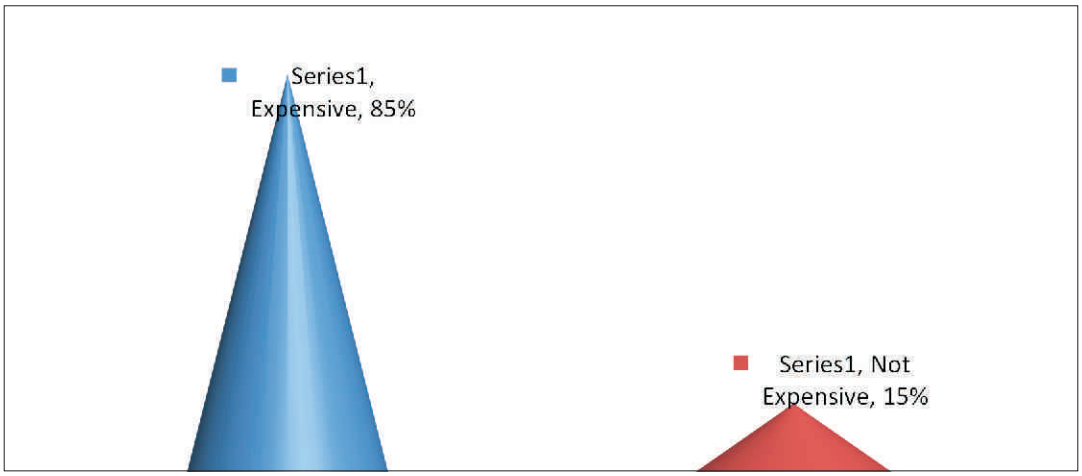
As how respondents allocated their income, it was found that they spent their money in several cost areas which include: tuition fees, savings, food, accommodation, books and magazines, clothing, church or associations, transport, personal care, mobile phones, internet services, photocopying and printing (see Table 2).

Table 2: Income Allocation per Semester

Description	N	Average levels of expenditure per semester
Tuition fees	185	3,149,614.38
Savings	80	491,687.50
Food	348	461,535.34
Accommodation	147	425,972.79
Books and Magazines	237	257,848.10
Clothing	248	255,625.00
Church/Associations	35	198,285.71
Entertainment	138	183,985.51
Transport	246	134,186.99
Personal care	277	123,032.49
Mobile phone	273	119,106.23
Photocopying and Printing	310	104,270.97
Internet Services	249	91,445.78

As how students rated cost of living at the University of Zambia, 85.1% of the respondents, indicated that it was expensive (see Chart 3).

Chart 3: Students' rating of cost of living at the University of Zambia (N=348)



Further analysis of the data regarding students' rating of cost of living at the University of Zambia by gender is shown in Table 3

Table 3: Students' rating of cost of living at the University of Zambia by gender (N=348)

Rating	Gender of respondents		Total
	Male	Female	
Expensive	169	127	296
Not expensive	35	17	52
Total	204	144	348

Interestingly, although on face value data in Table 3 show more males than females indicated cost of living at the University of Zambia to be expensive, the Chi-square test shows that there was no significant difference between male and female ratings (see Table 6).

Comparison between how school leavers and non-school leavers rated the cost of living at the University of Zambia, revealed that although on face value more school leavers than non-school leavers rate the cost of living to be high (Table 4), no significant difference was found by the Chi-square test.

Table 4: Students' rating of cost of living at the University of Zambia by admission status (N=348)

Rating	Admission Status		Total
	School Leavers	Non-School Leavers	
Expensive	236	60	296
Not expensive	43	9	52
Total	**279**	**69**	**348**

Although it is clear that the cost of living at the University of Zambia is considered to be high, no significant difference between male and female students and between school leavers and non-school leavers was found by the Chi-square test. There is need therefore, to mitigate the situation to the advantage of the students' academic welfare. One of the measures to mitigate the cost of living at the University of Zambia is to put in practice the intentions of government in the 2011 Education Act, article 120 (2) which states, 'the Minister may establish a bursary and scholarship scheme to assist orphans and vulnerable learners at any public, aided or community educational institution.'

As regards the specific category of students (government, other employer sponsored or self-sponsored) that finds life more expensive at the University of Zambia, all the categories indicated that it was expensive. (see Table 5).

Table 5: Students' rating of cost of living at the University of Zambia by Sponsorship category (N=348)

Rating	Sponsorship status			Total
	Government	Other Employer	Self	
Expensive	212	18	66	296
Not expensive	39	6	7	52
Total	251	24	73	348

Regardless of their gender, admission and sponsorship status, most students felt the cost of living at the University of Zambia was expensive. However, concerning which specific category felt that cost of living at UNZA was more expensive, no statistical significant differences were found (see Table 6).

Table 6: Chi-square Test Result on Students' rating of Cost of Living at UNZA

	Alpha	X^2	Df	P. value	Comment
Cost of Living Vs. Gender	0.05	1.902	1	.168	P> 0.05 accept H0
Cost of Living Vs. Admission Status	0.05	0.244	1	.621	P> 0.05 accept H0
Cost of Living Vs. Sponsorship Status	0.05	3.626	2	.163	P> 0.05 accept H_2

As how respondents coped with high economic demands at the University of Zambia, 21% of them were engaged in business and 15% in vacation employment. They engaged in business activities and vocational employment in order to raise extra funds to meet the high cost of living at the University. However, it was also noticed that the majority (64%) of the students did not engage themselves in any activity to raise extra funds for their school needs. Comparatively as shown in Table 7, more school leavers than non-school leavers engaged themselves in other activities to raise funds to meet the high cost of living at the University of Zambia.

Table 7: Activities Students Engaged in to Raise Extra Funds at UNZA

Activities Students participated in to raise funds			Admission Status		
			School Leaver	Non-School Leaver	Total
Vacation Employment	Gender of Respondents	Male	21	11	32
		Female	13	7	20
	Total		**34**	**18**	**52**
Business	Gender of Respondents	Male	32	11	43
		Female	23	7	30
	Total		**55**	**18**	**73**
No activities	Gender of Respondents	Male	99	11	110
		Female	91	22	113
	Total		**190**	**33**	**223**

The situation on whether students engaged in business activities to raise extra income or not raises concern with regard to its negative effect on their academic performance. As rightly alluded to by the students themselves, instead of studying, they spent time raising funds. Those who did not engage themselves in income generating activities failed to concentrate on studies because of worrying about inadequate resources at their disposal. As rightly put by one of them, 'you cannot concentrate on studies with an empty stomach. This is where the student loan scheme reported by Barr, (2005 would help to address the situation. It has worked in in many countries in the region as well as internationally, and relieved students from the stress of looking for money to meet educational related costs.

Concerning how respondents felt the effect of high cost of living at the university affected their academic performance, 49% of them felt they were negatively affected, 21% felt they were positively affected and 30% did not feel the effect. As regards to how each gender felt about the effect of high cost of living, more males (67%) compared to 33% females felt that it negatively affected their academic performance (see Table 8).

Table 8: How the Effect of Cost of Living at UNZA Affects Academic Performance of Students

Effect	Gender of respondents		Total
	Male	Female	
Positively	35 (49%)	37 (51%)	72
No Effect	54 (51%)	51 (49%)	105
Negatively	115 (67%)	56 (33%)	171
Total	**204**	**144**	**348**

An analysis of these findings on the Pearson Chi-Square test revealed that the differences between each gender were statistically significant. However, what still remains unclear is why more males than females seem to have been negatively affected.

Concerning those who felt the high cost of living at the University of Zambia negatively affected their academic performance, the following were some of the reasons given to justify their response;

> *"I worry, where to get money for photocopying and printing learning materials;*
>
> *I cannot afford most of the prescribed learning materials because they are expensive;*
>
> *I waste time looking for money instead of studying, it is difficult to study on hungry stomach, even with 75% tuition sponsorship by GRZ;*
>
> *I still struggle to pay the balance and instead of concentrating on studies, I am busy looking for money to meet the cost of living at campus."*

The students who felt the cost of living at the University of Zambia did not negatively affect their academic performance attributed it to the meal allowance given to them by GRZ that have helped them meet other financial needs. Additionally, one of them said, 'the challenge of high cost of living at the University of Zambia has motivated me to work hard and become a better person in future.'

Interestingly, other students felt that the high cost of living at the University of Zambia had no effect on their academic performance. One of them said, 'money or no money, I still study and pass.' Another student said, 'I manage to study because I want to redeem myself from poverty. I do not depend on extrinsic but intrinsic motivation, therefore, whether in financial trouble or abundance, my desire is to graduate.'

The cases here are clear aspects of extrinsic and intrinsic motivation. Students driven by extrinsic motivation rely more on outside motivators such as resources, praise or encouragement to do their work. On the other hand students driven by intrinsic motivation are self-driven. Whether the cost of living is high or not their desire is to emancipate themselves by doing well in school.

IV Conclusion

Based on the findings, the study concludes that despite 72% of the respondents being on GRZ sponsorship, 21% self-sponsorship and 7% sponsored by other employers, the cost of living at the University of Zambia was considered high. This is evidenced by 85% of the respondents rating the cost of living at the University of Zambia as high. The cost areas where they spent the money included: tuition fees, savings, food, accommodation, books and magazines, clothing, church or associations, transport, personal care, mobile phones, internet services, photocopying and printing. In order to cope with the high cost of living at the university, some respondents engage in business activities and vacation employment. However, the majority (64%) of the respondents do not engage in any activities to raise extra funds to meet the high cost of living at the university. The high cost of living at the University of Zambia has a negative effect on the academic performance of most students. It is therefore, necessary that the recommendations are considered to address the situation.

V Recommendations

Based on the findings, the following is recommended;

i. The position of the government on the cost of education, especially tertiary education which emphasises sharing with students and their families need to be supported.
ii. GRZ should increase bursary schemes but inform of loans to students to enable them meet the high cost of living at the university.
iii. Public-Private Partnerships must be encouraged in meeting the cost of education.
iv. Students should be encouraged to participate in vacation employment in order to supplement efforts of government and or other sponsors.

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CHAPTER FOUR

Re-Examination of the SADC Macroeconomic Convergence Criteria

By

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Abstract

The objective of this paper was to re-examine the suitability of the SADC macroeconomic convergence criteria (MEC). The paper applied both the descriptive analysis and the econometric methods. The econometric approach focused on estimating the SADC member countries' long run steady state of all the primary MEC indicators and the current account balance as a percentage of GDP, which is a secondary indicator. Both descriptive and econometric analysis show that the overall performance in the two-year period (i.e. 2009 and 2010) the 2009-2012 MEC targets have been observed to be satisfactory, although the inflation target seems to be a challenge for most member countries. The implication of the empirical results on inflation is that the 3.0% set for the period beyond 2012 will not be achieved by most member countries and it is recommended that the target be revised to a single digit to accommodate economic growth for the countries that have not developed within the region in the absence of knowledge on threshold inflation for each member country.

I Introduction

1.1 Background

The merits of macroeconomic convergence and the methodology of setting its targets are a subject of debate. Maleleka (2007) argues that it is acknowledged that there is no decisive scientific justification on the benefits or otherwise in setting macroeconomic convergence performance indicators, especially on the small economies. His arguments are based on MacCarthy and du Plessis (2001) who have stated that the strategy of macroeconomic convergence is not essentially a best policy in their reference to the convergence programme for SADC. However, Kutan and Yigit (2007) found out that economic integration has leveraged many countries for long run catch up.

After the endorsement of the 31 July 2001 Memorandum of Understanding by the Southern African Development Community (SADC) Ministers of Finance and Investments, which covered the principles and process of achieving economic convergence in SADC, primary and secondary macroeconomic convergence (MEC) indicators were identified and are regularly monitored. Macroeconomic convergence is one of the essential conditions to fostering regional integration, which is the desired outcome of SADC.

SADC monitors a total of nine MEC indicators of which three are primary indicators. The primary criteria were laid out in the Memorandum of Understanding on Macroeconomic Convergence, signed by Member States in 2002. These were later transformed into an annex in the Protocol on Finance and Investment. The primary indicators include inflation, the budget deficit and public debt. With the exception of inflation, the indicators are expressed

as a ratio of nominal Gross Domestic Product (GDP). A surplus in respect of the budget balance indicator is naturally regarded as an outcome that befits meeting the indicator's requirement given a minimum negative (deficit) threshold.

Secondary indicators are made up of the current account deficit (measured as a percentage of GDP); economic growth (measured as real GDP growth); gross international reserves (measured in terms of months of import cover); central bank credit to government as a percentage of revenue; domestic savings as a percentage of GDP (with domestic savings comprising of savings by both the government and non-government sectors); and investment as a percentage of GDP, which comprises of gross fixed capital formation by the government and government-related agencies as well as fixed investment by the non-government sector). A surplus in respect of the current account indicator is considered a favourable outcome given a minimum negative (deficit) threshold.

1.2 The Problem

A number of reviews on the SADC MEC indicators have been made (Jefferies, 2009, ECA-AU, 2008, etc.). Nonetheless, the focus has been on the 2008 targets and no review has been done so far under the 2012 targets to the best of author's knowledge. The paper by Jefferies offers a detailed review and critique of the relevance of the SADC convergence criteria and numerical targets. However, it is inclined towards a non-inferential statistical approach. This paper therefore aims at using both the descriptive analysis and econometric methods in its empirical approach to re-examine the MEC targets.

1.3 The Objective

The primary objective of this paper is to re-examine the current SADC MEC indicators and their targets and recommend whether they are attainable. Specifically, the study aims at achieving three things:

To estimate each SADC member country's long run steady state in respect of each MEC indicator and then compare the estimated results with their respective MEC indicator targets. This is to enable us establish which MEC target is likely to be achieved and by which country;

i. To compute each country's MEC indicator's speed of convergence towards its own steady state. This is to help us ascertain which countries are likely to move faster towards or away from the SADC convergence targets;

ii. To draw conclusions on which type of the MEC indicators/targets are suitable for the region.

iii. The rest of the paper is structured as follows: section two presents information on the MEC indicators and targets for SADC and the peers while section three presents information on empirical issues under a descriptive analysis of the performance of SADC countries' MEC indicators against their targets on one hand and estimation procedures and results of the MEC indictors on the other. The conclusion and policy recommendations come up in section four.

II MEC Indicators and Targets

2.1 SADC MEC Indicators and Targets

Under the SADC MEC programme, member states were and are expected to meet these set of macroeconomic convergence criteria at three points in time over the period of ten years from 2008 to 2018 (see Table 1).

Table 1: Primary MEC Targets

Description	2008	2012	2018
Annual Inflation rate (average)	<10%	<5%	<3%
Fiscal Deficit as a percentage of GDP	<5%	<3%	<3%
Public Debt as a percentage of GDP	<60%	<60%	<60%

A secondary set of quantitative macroeconomic targets were identified and presented in the Regional Indicative Strategic Development Plan (RISDP) as summarised in Table 2 below.

Table 2: Secondary MEC Targets

Description	2008	2012	2018
Current Account deficit as a percentage of GDP	<9%	<9%	<3%
Economic growth (real GDP growth)	7%	7%	7%
External reserves (months of import cover)	3	6	6
Central bank credit to govt as a percentage of revenues	10%	5%	5%
Domestic savings as a percentage of GDP	25%	30%	35%
Domestic investment as a percentage of GDP	30%	30%	30%

2.2 SADC's Peer Regional Formations' MEC Indicators and Targets

Within the sub-Sahara region, a number of MEC programmes exist largely within the Regional Economic Communities (RECs) which are SADC peers. These include the Common Market for Eastern and Southern Africa (COMESA), Central Africa Economic and Monetary Community (CEMAC) and the Economic Community of West African States (ECOWAS).

The main purpose of including this information is to inform one on the type of MEC indicators and targets SADC's peers are following. This will be helpful in re-examining SADC's MEC indicators and their targets. The information on the description of the indicators and their respective targets for SADC and some of its peers are presented below. The data show that almost all the represented regional groupings have similar primary and secondary indicators save for minor variations and that the targets differ from one grouping to the other to some extent (see Table 3).

COMESA and ECOWAS have additional secondary indicators to those observed by SADC which include the real interest rates and the real exchange rate with a target of zero and "stable", respectively. Further, a limit on public service workers wages as a percentage of revenue is also imposed on both COMESA and ECOWAS as secondary MEC indicator targets. The targets under the SADC MEC Programme and those of its peers are generally almost the same with differences of either one or ten percentage points (in the case of the public debt ratio).

Description	SADC	COMESA	CEMAC	ECOWAS
Inflation (Average Annual)	<5% (2012) <3% (2018) This is a primary indicator target	Stage 1: ≤5% Stage 2: ≤3% The stage 2 target applies going forward. This is a primary indicator target	<3 Basic fiscal balance must be in balance or surplus.	5%
Fiscal Balance (Deficit as a % of GDP)	<3% (2012) <3% (2018) primary indicator target	primary indicator target < 4% of GDP Secondary indicator target 20% of tax revenue's expenditure on domestically financed investment	(Note: Basic fiscal balance = domestic revenue less domestic financed investment)	This is a primary indicator target 4% primary indicator target
Public Debt	<60% of GDP primary indicator target	"To stay within Sustainable levels" Secondary indicator target	<70% of GDP with no accumulation of arrears	–
Current Account (as a % of GDP)	<9% (2012) <3% (2018) secondary indicator targets	Must be within sustainable levels Secondary indicator target	–	–
Gross Foreign Reserves (months of import cover)	≥6% (2012) 6% (2018) secondary indicator targets	Stage 1: ≥4 Stage 2: ≥5 Stage 3: ≥6 primary indicator targets	–	6% primary indicator target
Economic growth (Real GDP growth)	7% secondary indicator target	7.0% secondary indicator target	–	– 10%
Central bank credit to government as a percentage of revenues	– 30% (2012)	–	–	primary indicator target –
Domestic savings as a percentage of GDP	35% (2018) secondary indicator target –	– 35% secondary indicator target	–	30% secondary indicator
Wage Bill/Tax Revenue	–	√ secondary indicator target	–	target ±5% secondary indicator
Real Exchange Rate Stability	–	√ secondary indicator	–	target √
Positive Real Interest Rates	– –	target √	–	secondary indicator target 20%
Public Investment/Tax Revenue	–	secondary indicator target –	–	secondary indicator target 20%
Tax Revenue/GDP Ratio		–	–	secondary indicator target √
Domestic Arrears (liquidation of existing arrears and prohibition of accumulation of new arrears)		√ secondary indicator		secondary indicator target

2.3 SADC Performance under the 2008 MEC Indicator Targets

In the period 2006 to 2008, only the inflation MEC indicator was not widely met by SADC member states out of the four primary indicators (see Table 4). In 2008, the year in which the primary indicators should have converged to the required first set of targets, performance was unsatisfactory in respect of inflation and the current account deficit. Only one country in the region, Malawi, satisfied the inflation outturn requirement. However, failure by many countries to meet the benchmark was largely due to a global rise in inflation, which was induced by high commodity prices particularly for food and fuel.

The current account MEC indictor was equally not met by many member countries for the reason that in the year 2008 the global financial crisis led to the collapse of commodity prices in the fourth quarter of the year leading to a fall in export earnings. Coupled with high energy, food and fertiliser import bills during the first three quarters of the year, the current account deficit for most countries widened to levels that compromised six member countries' ability to satisfy the MEC indicator requirement. This outturn compares unfavourably with the years 2006 and 2007 where only two countries in 2007 and three of them in 2006 failed to meet the target.

Table 4: MEC Indicators Performance Outcome, 2006 - 2008

	2006				2007				2008			
Description	Average Annual Inflation	Fiscal Balance	Debt	Current account	Average Annual Inflation	Fiscal Balance	Debt	Current account	Average Annual Inflation	Fiscal Balance	Debt	Current account
Angola	12.2	9.9	19.2	16.4	11.8	13.2	23.5	10.8	13.2	8.8	19.2	8.3
Botswana	11.6	11.8	5.6	17.4	7.1	6.2	4.9	16.1	12.6	4.2	4.5	0.2
DRC	18.2	-0.7	134.9	-7.5	9.9	-1.0	116.1	-7.7	17.9	-0.5	91.8	-8.9
Lesotho	6.0	12.4	51.2	4.4	7.9	10.3	47.1	13.3	10.8	4.7	55.0	14.8
Madagascar	10.8	37.4	32.2	-8.7	10.3	-2.8	30.3	-14.1	9.2	-2.1	30	-23.3
Malawi	13.9	-0.5	26.3	-14.0	8.0	-2.8	24.6	-0.6	8.7	-6.5	31.6	-15.5
Mauritius	6.1	-4.3	55.8	-9.3	9.8	-3.8	59.1	-5.1	9.7	-3.3	53.8	-10.4
Mozambique	13.3	-1.7	52.0	-9.3	8.2	-2.9	45.0	-8.3	10.3	-2.5	38	-14.0
Namibia	5.1	4.8	28.0	15.1	6.7	1.1	22.1	14.8	10.3	2.0	18.9	2.7
Seychelles	NA	NA	NA	NA	NA	NA	NA	NA	37.0	-3.4	223	-49.0
South Africa	4.7	-1.5	34.9	-6.5	7.1	0.6	31.8	-7.3	11.5	0.9	26.6	-7.4
Swaziland	5.3	10.1	17.2	1.0	8.1	-0.5	17.4	3.9	12.6	-1.5	16.0	-7.7
Tanzania	7.3	-5.0	40.6	-8.3	7.0	-3.6	42.4	-11.1	10.3	-1.7	31.5	-9.8
Zambia	9.1	-2.9	40.3	3.0	10.7	-0.2	36.2	-2.5	12.4	-2.2	26.7	-7.1
Zimbabwe	1281.1	-4.3	78.3	-5.4	66 212.3	-1.8	67.5	-8.5	231.2m	0	140.8	-24.5
SADC Average	100.3	4.9	44.0	-0.7	4737.5	0.44	43.3	-1.2	15.4m	1.8	53.5	8.3
Excl Zimbabwe	9.5	5.7	41.4	-0.3	8.7	0.6	41.3	-0.6	13.2	-0.2	47.6	0.2

Source: Various issues of the Committee of Central Bank Governors (CCBG) Integrated Paper on Recent Economic Developments in SADC

Note: Green cells indicate that the MEC indicator requirement was satisfied while orange implies an outcome depicting missing the MEC target marginally and the uncoloured cells indicate the MEC target being missed out rightly.
NA: Data Not Available.

III Empirical Approach

In this section presents a descriptive analysis of the performance of the MEC indicators during the two years they have been observed. It also provides an estimation of the MEC long run steady state and speed of convergence to the long run steady state.

3.1 Descriptive Analysis of the SADC countries' Performance on the MEC Indicators against the Targets

A comparison is made between the performances in 2009 against 2008 even though the targets have been revised. The second assessment is in respect of progress being made towards meeting the 2012 targets based on each country's 2009 and 2010 performance outcomes. The focus in the second part is on the frequency of indicator targets met by respective member countries under primary and secondary indicator targets.

3.1.1 Performance against the Primary Indicator Targets

3.1.1.1 Inflation

SADC member countries' performance in 2009 with respect to the 2012 MEC inflation target was relatively poor compared to performance under the 2008 target as only four countries met the target (see Tables 4 and 5). Nonetheless nine countries reported the average inflation to be in single-digit territory compared to an average of eight countries that met the 2008 target in the two years to 2008. The tightening of the indicator standard to 5% from less than 10% under the 2008 target explains why only four countries were reported to be compliant.

In 2010, the average inflation performance was more favorable compared to 2009. Eight countries met the target compared to four in the previous year and eleven of them had a single digit average inflation rate for the year as opposed to nine the previous year. This outturn was due to improved food supply following favourable weather conditions in most member countries. This was augmented by favourable pass-through effects of the exchange rates as most member countries exchange rates stabilised or appreciated following the recoveries achieved in the global economy. This was despite the euro debt crisis, which had an unfavourable influence on some SADC member countries' currencies.

Only three countries, namely Mauritius, Swaziland and Zimbabwe, met the target in the two consecutive years while Angola, Botswana, DRC, Madagascar, Malawi, Seychelles and Zambia consistently failed to meet the target in the two years under review.

3.1.1.2 Fiscal Balance

With regard to the fiscal balance performance in 2009, six countries were reported to be on track. However, this outcome was very poor compared to the performance under the 2008 target when almost all the countries met the target. The impact of the global financial crisis largely explains this poor performance as most member countries had to run expansionary fiscal policy to mitigate its effect in spite of the decline in their domestic revenue collection as a result of the global recession.

In 2010, the fiscal balance indicators performance was not much different from the 2009 outcome as only six countries met the target just like in the previous year (see Table 5). However, Madagascar fell short of meeting the target; nonetheless its performance was worse when compared to 2009. With regard to consistency, only four countries met the target for the two year period. These were the DRC, Seychelles, Zambia and Zimbabwe.

3.1.1.3 Debt Ratio

In terms of the debt ratio indicator, the year 2009 saw three countries failing to meet the new target (see Table 5). This performance does not compare well with the outcome under the 2008 target where on average only two countries failed to meet the target in the three years to 2008.

In 2010, only two countries reported to have failed to meet the indicator target compared to three in the previous year as the DRC joined the countries with a favourable public debt ratio. The remarkable improvement in the DRC's debt ratio follows a massive debt write-off by multilateral and bilateral lenders following the country's attainment of the Highly Indebted Poor Country (HIPC) completion point during the year.

Eight countries, namely Botswana, Lesotho, Malawi, Mauritius, Namibia, Swaziland, Tanzania and Zambia, were consistent in meeting the target in the two years under review.

Table 5: Primary MEC Indicators Performance Outcome, 2009 - 2010

	2009			2010		
Description	Average Annual Inflation	Fiscal Balance	Debt	Average Annual Inflation	Fiscal Balance	Debt
Angola	14.0	-9.1	n.a	15.3	1.5	19.1
Botswana	8.2	-5.4	6.8	6.9	-10.3	25.5
DRC	46.1	0.6	113.5	23.6	2.6	23.0
Lesotho	7.3	-3.8	40.1	3.6	-6.4	36.8
Madagascar	9.3	-1.9	26.1	11.9	-3.3	n.a
Malawi	8.4	-5.8	35.5	7.4	0.1	33.4
Mauritius	2.5	3.0	50.1	2.9	-4.5	58.4
Mozambique	3.2	-5.4	n.a	12.9	-4.7	54.0
Namibia	8.8	-4.1	16.8	4.5	-7.1	15.1
Seychelles	31.8	6.5	117.0	3.2	9.1	83.0
South Africa	7.1	-7.9	29.8	4.3	-5.4	n.a
Swaziland	4.5	-5.0	14.9	4.5	-13	14.4
Tanzania	12.1	-4.8	34.8	5.5	-4.9	40.0
Zambia	13.4	-2.7	26.4	8.5	-2.2	27.6
Zimbabwe	-7.7	0	120.3	3.2	1.0	103
Successful countries	4	6	10	8	6	11

3.1.2 Performance against the Secondary Indicator Targets[1]

3.1.2.1 Current Account (% of GDP)

With regard to the 2009 performance, data show that seven countries met the target, which was below the performance in 2008 when nine countries met the target. The performance in 2010 deteriorated marginally as only six countries met the target. Only four countries, namely Botswana, Namibia, South Africa and Zambia, met the target in both 2009 and 2010.

[1]The analysis excludes central bank lending to government as well as savings and investment indicators

Table 6: Secondary MEC Indicators Performance Outcome, 2009 – 2010

	2009			2010		
Description	Current account	Real GDP Growth	Months of Import Cover	Current account	Real GDP Growth	Months of Import cover
Angola	-10.6	2.4	3.8	3.2	3.2	5.3
Botswana	-2.1	n.a	19	-0.3	10.7	17.0
DRC	-11.2	2.8	2.0	-19.4	5.4	1.6
Lesotho	-0.9	1.9	6.8	-17.9	2.5	5.9
Madagascar	-16.1	-4.6	3.1	n.a	2.6	2.5
Malawi	-16.9	7.7	1.9	-17.5	7.1	3.1
Mauritius	-7.8	2.8	7.3	-9.4	4.2	7.3
Mozambique	-13.0	6.3	5.7	-13.6	6.5	4.9
Namibia	2.6	-1.1	4.0	1.9	4.6	3.0
Seychelles	-34.4	-7.6	1.6	-47	6.2	2.5
South Africa	-4.0	-1.8	4.7	-4.3	3.6	5.0
Swaziland	-13.5	0.4	4.1	n.a	2.0	2.9
Tanzania	-7.8	6.0	5.7	n.a	6.7	6.3
Zambia	-3.1	6.3	5.1	-2.4	7.1	4.1
Zimbabwe	-17.9	5.7	1.3	-17.1	8.3	1.4
Successful countries	7	1	3	6	4	3

Source: Various issues of the CCBG's Integrated Paper on Recent Economic Developments in SADC

3.1.2.2 Real GDP Growth Rate

In 2009, only one country, Malawi, met the target as most countries' outturn was relatively poor owing to the impact of the global financial crisis. Most member countries' export oriented sectors slumped as global demand fell during the crisis. It should, nonetheless, be noted that Zambia and Zimbabwe's real GDP growth rates improved during the year compared to the performance in the previous year. Zambia's progress was due to increased mining and agricultural output. Zimbabwe's progress was due to good performance virtually in all sectors of the economy with agriculture and mining being the leading performing sectors as the stabilisation measures put in place by the unity government started bearing fruit.

In 2010, the performance outturn improved as the number of countries reported to have met the target increased to four as Botswana, Zambia and Zimbabwe joined Malawi. In this regard, only Malawi consistently met the real GDP growth rate of 7.0% in the last two years.

3.1.2.3 Months of Import Cover

In 2009, only three countries, namely Botswana, Lesotho and Mauritius met the target of six months of import cover with regard to the foreign exchange reserves position. In 2010, Botswana and Mauritius were joined by Tanzania to be the only three countries that satisfied the MEC target on months of import cover.

3.1.3 Overall Performance

In discussing the overall performance, six status categories are identified being:

a. Improved remarkably - the case were a country improves its record by adding at least two targets met to the previous record;

b. Improved - the case were a country improves its record by adding one target to the number of targets met from the previous record of targets met;

c. Unchanged but satisfactory -the case were a country's number of MEC indicators

met remains unchanged but with at least one target met in the previous year;

d. Unchanged- the case were a country's status is such that no target has ever been met before;

e. Slump - the case were a country is one indicator less with regard to meeting the target when compared with the previous year's record; and

f. Deteriorated, the case where a country has two indicators less with regard to meeting the target when compared with the previous year's record.

3.1.3.1 Primary MEC Indicators

Overall, Angola had a remarkable improvement with regard to progress in meeting the primary MEC indicators for the periods 2009 and 2010 with a score of two in 2010 compared to none in 2009 (see Table 7 and Chart 1). Improvements were recorded in respect of DRC, Lesotho, Malawi, Namibia, Seychelles and Tanzania. There was, however, a slump in the performance by Mauritius. In similar vein, Madagascar's performance was unsatisfactory as it deteriorated in view of the country missing all the targets compared to a relatively good performance in the previous year when two targets were met. The status for the rest of the countries was unchanged but remained satisfactory in the sense that each country met at least one target.

The SADC overall progress in the two-year period can be regarded to be satisfactory since the frequency distribution is concentrated around improved (score of 7 countries) and unchanged but satisfactory (second popular, score of 6 countries) in respect of the status attributed to each country's performance yielding a total of 13 countries. Besides, only two countries recorded an overall decline in the indicator performance in the two year period.

3.1.3.2 Secondary MEC Indicators

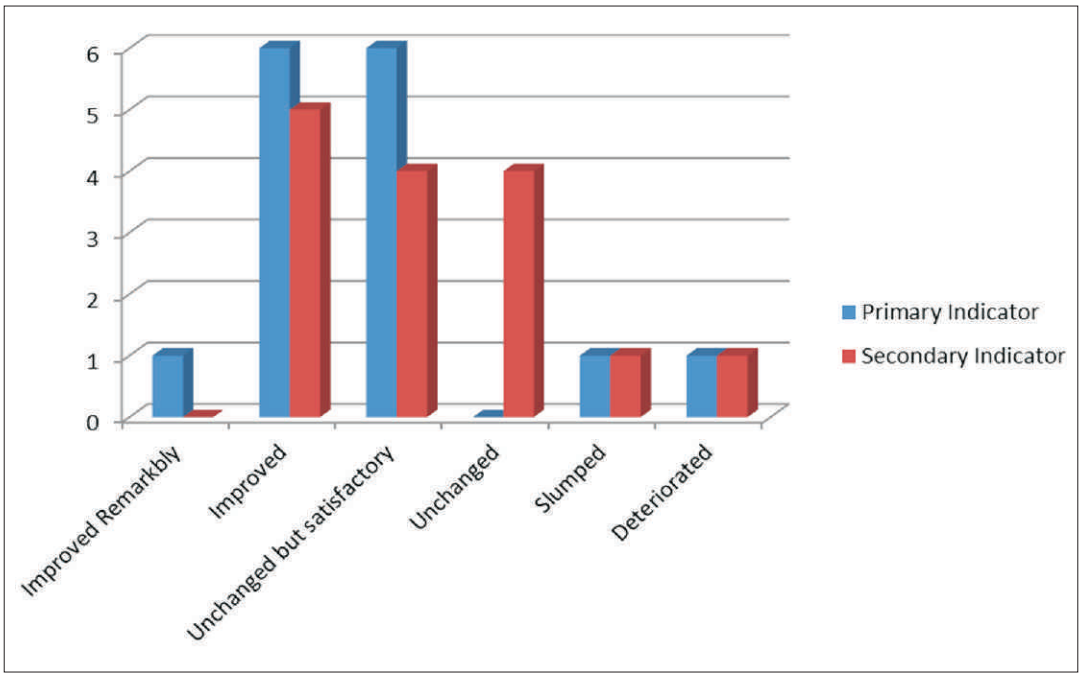
Four countries failed to meet any of the targets in the two-year period, with a further four having an unchanged but satisfactory status (see Table 7). The countries with an unchanged status included DRC, Madagascar, Mozambique, and Swaziland while countries with an unchanged but satisfactory status are Malawi, Namibia, South Africa and Tanzania. The countries whose status either slumped or deteriorated were only two namely Mauritius and Lesotho, whereas the rest of the countries recorded an improvement.

The overall progress in the two year period can be regarded as relatively poor since the relative frequency distribution is concentrated around the statuses unchanged-unchanged but satisfactory (8 countries) and slump-deteriorated (2 countries) giving a total of 10countries. Only five countries recorded an improvement in the status for the period between 2009 and 2010.

Table 7: Number of Indicator Targets Met by each SADC Country and Progress Status

Description	2009		2010		Status on Progress Between 2009 and 2010	
	Primary (out of 3 targets)	Secondary (out of 3 targets)	Primary (out of 3 targets)	Secondary (out of 3 targets)	Primary	Secondary
Angola	0	0	2	1	Improved Remarkably	Improved
Botswana	1	2	1	3	Unchanged but satisfactory	Improved
DRC	1	0	2	0	Improved	Unchanged
Lesotho	1	2	2	0	Improved	Deteriorated
Madagascar	2	0	0	0	Deteriorated	Unchanged
Malawi	1	1	2	1	Improved	Unchanged but satisfactory
Mauritius	3	2	2	1	Slumped	Slumped
Mozambique	1	0	1	0	Unchanged but satisfactory	Unchanged
Namibia	1	1	2	1	Improved	Unchanged but satisfactory
Seychelles	1	0	2	1	Improved	Improved
South Africa	1	1	1	1	Unchanged but satisfactory	Unchanged but satisfactory
Swaziland	2	0	2	0	Unchanged but satisfactory	Unchanged
Tanzania	1	1	2	1	Improved	Unchanged but satisfactory
Zambia	2	1	2	2	Unchanged but satisfactory	Improved
Zimbabwe	2	0	2	1	Unchanged but satisfactory	Improved

Chart 1: SADC Member Countries MEC Performance Score for 2009 and 2010



Given the performance in respect of both the primary and secondary MEC indicators, there is a greater chance that two primary indicators, the fiscal balance and debt ratio are likely to be met by the majority of member countries at the end of 2012. The inflation target has been elusive to many countries and it is most likely that the new target may not be met by many member countries by 2012 given the volatility in global commodity prices.

With regard to the secondary targets reviewed above, only the current account indicator is likely to be met by the majority of member countries by 2012. However, this is largely possible if the commodity prices continue to rally since most member countries' exports are extractive and agricultural based commodities.

3.2 Estimation of the Long Run Steady State and Speed of Convergence of the MEC Indicators

This subsection looks at empirical issues from the literature perspective, data issues, estimation procedure and presentation and discussion of the results.

3.2.1 Empirical Issues

Various methodologies have been used to test the convergence hypothesis and also to compute the speed of convergence. In the literature, macroeconomic convergence appears to be related to optimum currency area theory advocated by Mundell (1961) and Tavlas (1993), among others. This approach refers to convergence with regard to economic performance to an agreed upon target among the identified class of macroeconomic variables of a given set of countries. Other convergence approaches have been considered within the context of neoclassical growth theory, the case were one determines the period less developed countries will take to catch up with their developed counterparts in terms of per capita income.

Estimation of the macroeconomic convergence criteria has been generally achieved with a number of different approaches. Among them includes the beta convergence (Sala-i-Martin, 1996, Barrow and Sala-i-Martin , 1995 and Mankin et al -, 1992); sigma convergence (ECA-AU, 2008 and Sala-i-Martin, 1996); stochastic convergence (ECA-AU, 2008, Mutoti and Kahangire, 2006 and Bernard and Darlauf ,1995 with modifications applied in respect of Qual, 1992 and 1994 and Levin and Lin,1993 in Mutoti and Kahangire, 2006 by imposing homogeneity and thereby assuming common convergence rates); and the mean reversion (Hlivnjak - 2009 and Jiadong and Shang-Jin, 2007).

Under the beta convergence, a distinction is made between absolute and conditional beta convergence in which case the latter allows testing of convergence among countries with different steady states. This is necessitated by the fact that countries are likely to have different steady states owing to different technological and behavioural parameters arising from different levels of technology, savings and population growth. The beta convergence assumes that poor countries will grow faster than rich ones due to low capital as they will accumulate more capital in the process.

The sigma convergence states that the dispersion (as measured by standard deviation) of a given economic variable, say income, across a set of economies tends to decline over time. This is the case were standard deviation at period t is less than the standard deviation at time t-n, n= 1, 2, 3...T.

The stochastic convergence is based on the unit roots and cointegration concepts of time series data pioneered by Bernard and Darlauf (1995). This approach aims at determining whether, for instance, the long run forecasts of output differences tend to zero over time. This is under the assumption that if the series on the differences is a zero mean stationery process then convergence occurs. The proposition contends that if the outputs of two countries converge then their outputs must be cointegrated with cointegrating vector [1,-1].

The modification suggested by Qual (1992 and 1994) and Levin and Lin (1993) implies non-zero mean of the steady state and that different countries can have or share the same speed of adjustment to the steady state (group mean) in all variables.

The mean reversion proposition argues that countries with potentially adverse levels of a given macroeconomic variable's outturn will experience a significant degree of adjustment. This is by way of returning to some underlying long run cross-country mean rate/level. The adjustment is likely to be achieved if the adverse position is induced by two possible factors being transitory or indeed being permanent as a result of external shocks or poor policy management. Good policy management aimed at correcting the adverse condition will lead to an adjustment in the levels of the given macroeconomic variable to a desirable target that is consistent with its steady state.

3.2.2 Estimation Framework and Data

In estimating the long run steady state and the speed of adjustment/convergence for each SADC member country MEC variables the paper used the mean reversion proposition following Hlivnjak (2009) and Jiadong and Shang-Jin (2007)'s works. This is despite these authors restricting their works to the current account and in case of Jiadong and Shang-Jin (2007) extending the computation and testing of the current account convergence in the context of labour market rigidity, terms of trade and exchange rate regimes.

1. The speed of convergence in respect of each MEC indicator for individual member countries is determined by estimating equation (1) below:

$$?x_t = \alpha + \beta x_{t-1} + \theta_t \quad \text{.....} \quad (1)$$

Where:

? is the first differences of the variable of interest;

α is the constant term representing autonomous growth in the variable of interest;

β is the speed of convergence/adjustment to the variable's own long run mean; and

θ_t is the error term such that $\theta_t \sim N(0,\sigma^2)$.

From equation (1) we obtain

$x_t - x_{t-1} = \alpha + \beta x_{t-1} + \theta_t$

or $x_t = \alpha + x_{t-1} + \beta x_{t-1} + \theta_t$

or $x_t = \alpha + (1+\beta)x_{t-1} + \theta_t$

Condition on $0 \leq \beta \leq -1$ ..... (2)

The implication of equation (2) is that the speed of adjustment is supposed to be negative if convergence occurs and that if its absolute figure is close to one the greater the speed of adjustment and the opposite is true[2].

Specifically in this study, we test the null hypothesis that the variable of interest (i.e. individual MEC indicator) does not converge; hence $\beta = 0$ against the alternative hypothesis that the individual MEC indicators converges to a long run steady state for $\beta \leq -1$.

[2]A technical brief in understanding the implications of the speed of convergence/adjustment to the computed steady state is in appendix I

2. The Long run MEC steady state in respect of each member country is formally defined in equation (3) below:

$$\Rightarrow \text{Long run steady state} = {}^{-\alpha}\!/_{\beta} \quad \text{---------- (3)}$$

Using this equation, the steady state value in respect of each MEC indicator is computed for each member country. Using the highest and lowest computed value for each MEC indicator from the set of values for each member country, the mid-point is computed as the indicator of the SADC steady state value in respect of each MEC indicator. This is the value that is compared with the SADC existing MEC target.

3. However, if the computed long run steady state of each MEC indicator is higher than the MEC target, panel estimation is performed for the purpose of getting an empirically determined target and compares it with the mid-point obtained using the procedure described in the paragraph above. This follows the work of Hlivnjak (2009). The speed of convergence for each MEC indicator for the SADC region as a whole and their long run steady states are computed based on equation (4) as shown below:

$$\text{Let } ?X_{i,t} = \alpha + \beta Xi_{,t-1} + \mu_i + \gamma_t + \varepsilon_t \quad \text{.....} \quad (4)$$

With this model we estimate for SADC as a whole the common mean value for the intercept (α) and the individual difference in the intercept values of respective countries captured in the specific country error term (μ_i) and time effect (γ_t)

$$\text{Let } w_{i,t} = \mu_i + \gamma_t + \varepsilon_t \quad \text{.....} \quad (5)$$

Where,

$w_{i,t}$ is the error term made up of three components being the unobservable individual effect (μ_i) assumed to be fixed, the observable time effects (γ_t) and the error term (ε_t).

Making an assumption that the unobservable individual effect and the observable time effects are fixed and that the error term is such that $\varepsilon_t \sim N(0,\sigma^2)$, then

$$?X_{i,t} = \alpha + \beta_i X_{i,t-1} + w_{i,t} \quad \text{.....} \quad (6)$$

Where,

? is the first differences of each MEC indicator;

α is the constant term representing autonomous growth in each MEC indicator;

β_i is the speed of convergence to its long run mean for each country represented as i and i =10 as in Table 9 above.

t = 17 observations.

The null hypothesis is that inflation (individual MEC Indicator) does not converge; hence, $\beta_i = 0$.

This is against the alternative hypothesis that the individual MEC indicator converges to a long run steady state for $\beta_i \leq -1$.

The long run steady state for SADC as a whole is defined in equation (7) below:

4. Long run steady state of panel equation $= {}^{-\alpha}/_{\beta i}$ ..... (7)

3.2.3 Data Issues

3.2.3.1 Inflation[3]

Average annual data for the period 1994 to 2010 are used. The choice of the period coincides with the time when most member countries started experiencing a rapid decline in inflation after implementing structural adjustment policies. Inflation data for Angola, DRC and Zimbabwe contains some hyperinflation figures and in this regard an estimation result was going to reflect a very high level of steady state inflation and problems with the estimation of the speedy of adjustment. Specifically for DRC, an estimation of its data showed the results with problems of serial correlation and an attempt to correct for this problem gave results that showed inflation not converging to its own steady state. Data for Madagascar were not available. As a result, these four countries do not form part of the analysis.

Outliers were detected in the data for Botswana, Malawi, Mozambique, Seychelles, South Africa and Zambia due to various shocks and whose influence in estimation was checked by adding dummy variables. Botswana and South Africa's inflation was adversely affected by the high commodity prices of 2008 while Malawi's unfavourable inflation in 1995 was due to the pass-through effects arising from the depreciation of its currency as well as effects of drought on food prices.

The shocks arising from floods and drought in Mozambique experienced after 1998 had an influence on the inflation developments in that country. The economic reforms implemented around 2008 in Seychelles, which among others included price liberalisation, made the inflation that was artificially kept low to increase significantly in 2008 and 2009[4]. In the mid-1990s, Zambia experienced depreciation in its currency and an increase in inflation, partly due to unfavourable relations with the donor community, which withheld financial support to the country.

3.2.3.2 Fiscal Balance[5]

The estimations are based on the data from DRC, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe as data for other member countries were not available. The span of the data covers the period 1994 to 2010. Data for Namibia show a sudden jump in 2007 (budget surplus) and then declined.

[3]See Appendix II, Charts 1A-1K for the time series behaviour
[4]Explanation was provided by the Central Bank of Mozambique, April 2011.
[5]See Appendix II, Charts 2A-2K for the time series behaviour

Data for Seychelles show a jump in 2003 and this set a generally new level for fiscal balance oscillation for the proceeding years. This is because in 2003 the country started a home-grown macroeconomic reform programme (MERP) which focused on all aspects of the economy. This was in an effort to develop a sustainable economic programme designed to move from years of sizable annual deficits to achieve a budget surplus. The main elements of the fiscal reforms consisted of a broadening of the Goods and Services Taxes (GST) Act and a much more stringent and controlled programme of government expenditure. MERP has helped to achieve budget surpluses in each year since its implementation. Moreover, in November 2008 the country moved to the IMF supported macroeconomic reform programme. The latter set tight fiscal targets which have enabled the country to achieve budget surpluses and maintain strict fiscal procedures/practices. In view of this, a dummy variable was incorporated in the estimation of Seychelles long run steady state and speed of convergence[6].

Data for Swaziland showed an outlier in 2010 with the country recording a significant rise in the budget deficit. This was mainly explained by the fall in the share of its SACU revenue coupled by the rise in expenditure to deal with the effects of the global financial crisis of 2009[7].

3.2.3.3 Public Debt[8]

The data used for estimation were from the DRC, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe as data for other member countries were not available. Seychelles and Swaziland data had outliers associated with the years 2008 and 2000, respectively.

With regard to Seychelles, public debt as a percentage of GDP was rising steadily and reached its peak in 2008. In July 2008, the country defaulted on a structured external promissory note commitment which fell due and under the loan agreement this constituted a cause for accelerated repayment of the full principal. This was followed by a further default on interest payable on a US$200 million international bond placed in 2006, which was due in October 2008 and led to the obligation being accelerated too. The above mentioned chain of events caused the country's debt to GDP ratio to hit the peak and then fall significantly thereafter.

On the other hand, in early 2009 Seychelles started the debt restructuring negotiations with the Paris Club. An agreement was reached with the latter in April 2009, whereby 45 per cent of the country's debt with the grouping was cancelled and the remaining portion set to be repaid over a period of 18 years. Further negotiations were concluded with non-Paris Club countries on similar terms. Re-negotiation of commercial debts was also undertaken. These negotiations resulted in a marked decline in the country's external debt since 2008. Equally, the budget surpluses resulting from a strict fiscal stance since 2008 as part of the IMF supported macroeconomic reform programme, has enabled the government to retire a significant amount of its domestic debt[9].

With regard to Swaziland, the outlier observed is partly explained by the borrowings made in order to finance some infrastructure projects. Specifically, in the year 2000, several mega projects got started that included two huge dams, several freeway roads and revamping of the railway infrastructure that involved high finance partly obtained through debt thereby leading to the surge in the public debt stock[10].

[6]The explanation was provided by the Central Bank of Seychelles, May 2011.
[7]The explanation was provided by the Central Bank of Swaziland, April 2011.
[8]See Appendix II, Charts 3A-3K for the time series behaviour
[9]The explanation was provided by the Central Bank of Seychelles, May 2011
[10]The explanation was provided by the Central Bank of Swaziland, April 2011

3.2.3.4 Current Account[11]

Data from DRC, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe were used. Apart from Zambia, all the countries' current account series as a percentage of GDP have shown a persistent deteriorating trend disregarding a few fluctuations. This could partly be explained by the rise in the imports associated with the increase in Foreign Direct Investment (FDI) most member countries have experienced.

In Seychelles, the improvement in the current account in 2003 is attributed to MERP and a rise in the tuna canning industry exports. MERP introduced taxes on imports as well and instituted stringent import control measures that helped to lower imports. The increased tuna canning industry exports coupled with reduced imports helped to improve the current account. However, since 2004, there has been a gradual liberalisation of the Seychelles economy which has resulted in an increase in FDI especially in the tourism sector. The increase in FDI triggered a rise in imports, especially capital goods and raw materials required for the construction and operation of tourism establishments. This consequently led to the increase in imports and accordingly the deterioration of the current account balance[12].

In the case of Swaziland, the current account balance had registered deficits since 2005. Contributing to this development in 2005 was a fall in the value of export earnings resulting from the strengthening of the rand in 2004 and 2005 that led to the closure of several textile companies which caused a reduction in exports. This condition also fuelled the increase in import prices thereby resulting in a deficit in the visible trade balance in 2005. The upsurge in the world oil prices, which reached a high of $144.38 per barrel in July 2008, together with the depreciation of the rand against the US Dollar accelerated the import price increases resulting in a continued deterioration in the current account balance. Imports of services also played a pivotal role in the condition of the current account balance. In 2008 and 2009 the outflows of funds for the payment of royalties and license fees continued to reflect the continuing acquisition and usage of intellectual property rights for design and development of new products by the manufacturing sector. These outflows contributed to the widening of the services account balance which then resulted in a further deterioration of the current account balance in 2008 and 2009[13].

With regard to Zambia, the improvement in the current account is associated with the rise in both copper prices and volumes of export. After the privatisation of the mines in 2000, there was a steady increase in FDI to recapitalise the mines and setting up the green field mining projects. This resulted in the increase in copper export volumes by over 130% while copper prices had increased by over 300% during the period.

Further, an outlier was detected in the data for Mauritius as its current account recorded surpluses during the period 2000 and 2002 and prompted the use of a dummy variable to take care of this observation in the data.

3.2.4 Estimation Results

3.2.4.1 Unit Root Tests

The purpose of the unit root test is to establish whether or not the series is stationary. Non stationery series in this context poses challenges for the computation of the speed of adjustment/convergence to these countries' specific steady states. Unit root tests for the

[11]See Appendix II, Charts 4A-4K for the time series behaviour
[12]The explanation was provided by the Central Bank of Seychelles, May 2011
[13]The explanation provided by the Central Bank of Swaziland

series were conducted using the Philips-Peron test since the time series were short in terms of sample size.

3.2.4.1.1 Inflation

The results show that all the considered series are I(0) except for Lesotho, Mauritius, Namibia, Seychelles and South Africa, an indication that more policy interventions are needed to stabilise inflation for these countries (see Table 8a).

3.2.4.1.2 Fiscal Balance

The unit root test results show that the data for Lesotho, Namibia and Seychelles have a unit root i.e. I(1) (see Table 8a). On the other hand, Mauritius, Swaziland, Zambia and Zimbabwe data are I(0) and all of them at 10% level of significance.

3.2.4.1.3 Public Debt

With the exception of Lesotho, Namibia, Seychelles and South Africa, all the countries' public debt as a percentage of GDP data were I(0) (see Table 8a).

3.2.4.1.4 Current Account

All the series are I(1) except Lesotho (which is I(2)), Malawi, Mozambique and Tanzania, an indication of the various external shocks member countries have experienced that have in turn, disregarding minor fluctuations, resulted into some persistent trend (see Table 8b).

Table 8a: Philips-Peron Unit Root Test for Primary MECs

Description	Statistic	Prob.	Order of Integra'	Statistic	Prob.	Order of Integra'	Statistic	Prob.	Order of Integra'
Botswana	-4.0011***	0.0086	I(0)						
DRC	-4.1461**L	0.0247	I(0)	-1.9233*N	0.0543	I(0)	-1.164813	0.6620	1(1)
Lesotho	-2.133310	0.2354	I(1)	-1.420934	0.5458	I(1)	-1.397053	0.5572	I(1)
Malawi	-4.2190**L	0.0218	I(0)	-2.7747	0.0840	I(0)	-2.0452**N	0.0424	I(0)
Mauritius	-2.442046	0.1468	I(1)	-2.9644*	0.0600	I(0)	-1.978596	0.2921	I(1)
Mozambique	-5.0021***	0.0013	I(0)	-3.1603**	0.0421	I(0)	-4.7033***	0.0023	I(0)
Namibia	-2.214294	0.2089	I(1)	-2.285304	0.1877	I(1)	-2.8187*	0.0778	I(0)
Seychelles	-2.065060	0.2594	I(1)	-2.124866	0.2383	I(1)	-2.276518	0.1902	I(1)
South Africa	-2.354910	0.1685	I(1)	1.491206	0.5120	I(1)	-2.0215*N	0.0445	I(0)
Swaziland	-3.0720*	0.0494	I(0)	-2.7026*	0.0951	I(0)	-1.342532	0.5829	I(1)
Tanzania	-4.2614***	0.0052	I(0)	-3.6983*L	0.0531	I(0)	-3.6557**	0.0166	I(0)
Zambia	-3.7677**	0.0134	I(0)	-2.9857*	0.0578	I(0)			
Zimbabwe				-2.6766*	0.0995	I(0)	-2.086721	0.2616	I(1)

*, 10% level of significance; **, 5% level of significance; and ***, 1% level of significance
L: Constant with linear trend
N: No Constant and no linear trend

Table 8b: Philips-Peron Unit Root Test for Current Account MEC

Description	Statistic	Probability.	Order of Integration
DRC	-1.147479	0.6693	I(1)
Lesotho	-1.597197	0.4610	I(2)
Mauritius	-1.518628	0.4988	I(1)
Malawi	-4.1009***	0.0071	I(0)
Mozambique	-3.1238*	0.0450	I(0)
Seychelles	-1.064753	0.7024	I(1)
South Africa	-1.484218	0.5154	I(1)
Swaziland	-1.815280	0.3602	I(1)
Tanzania	-2.9386*	0.0629	I(0)
Zambia	-1.190120	0.6513	I(1)
Zimbabwe	-2.066072	0.2590	I(1)

*, 10% level of significance; **, 5% level of significance; and ***, 1% level of significance
L: Constant with Linear trend

3.2.4.2 Long Run Steady State and Speed of Convergence

3.2.4.2.1 Inflation

The results are presented in Appendix III Table A and show that all estimations have expected negative signs in respect of the speed of convergence to own steady state and are significant. The intercepts are also significant for all the estimations except for Seychelles and Tanzania. Further, all the estimated results have satisfactory diagnostics tests except for Mozambique and Seychelles whose serial correlation tests were not satisfactory. Furthermore, Seychelles did not satisfy the test on constant variance (heteroskedasticity test).

The results on the long run steady state in respect of inflation show that only one country, Seychelles, had a long run steady state inflation which is below the MEC target of 5% (see Table 9). South Africa, Mauritius and Tanzania's steady state inflation is just below the MEC target. On the other hand, Malawi, Mozambique and Zambia's steady state inflation is well above the target. Further, the results show that the range of inflation is between 2.4% (Seychelles) and 15.9% (Zambia) thereby yielding a mid-point of 9.2%, which is above the MEC target of 5%.

Table 9: Long Run Steady State and Speed of Convergence for Inflation

Description	Long Run Steady State (%)	Status with the 2012 MEC target of 5%	Speed of Convergence to the steady state	Implications of the Results
Botswana	8.3	Above target	-0.907 (-90.7%)	Given a very high speed of convergence to its own steady state, the country is likely to miss the target or not sustain the MEC target if met.
Lesotho	7.4	Above Target	-0.729 (-72.9%)	Given the high speed of convergence to its own steady and that the steady state is above the MEC target, Lesotho is unlikely to sustain the MEC target if achieved by 2012.
Malawi	15.5	above target	-0.616 (-61.6%)	Given the high speed of convergence to its own steady state, the country's status is likely to be like the one above.
Mauritius	5.8	Near the target	-0.689 (-68.9%)	Given the high speed of convergence to its own steady state, the country is likely to meet the MEC target and oscillate around the Target
Mozambique	15.0	Above target	-0.43 (-43.0%)	Given the relatively low speed of convergence to its own steady state, the country has a higher chance of inflation pushing slowly to its own steady state and therefore away from the MEC target. A favourable shock to inflation is likely to make it rise slowly to a higher level and therefore a shock resulting in inflation falling and meet the target will result in inflation taking time to rise again.
Namibia	7.2	Slightly above target	-0.493 (-49.3%)	Since the speed of convergence to its own steady state is relatively low, the country may meet the target as inflation pushes to its own steady state. Depending on the impact of the favourable shock to inflation, the country may sustain for some time the target once met.
Seychelles	2.4	Below target	-0.921 (-92.1%)	Given the very high speed of convergence to its own steady state, the country is very likely to meet the target and sustain it unless there is a severe unfavourable shock to inflation.
South Africa	6.0	Near the target	-0.635 (-63.5%)	Given the high speed of convergence to its own steady state, the country may miss the target or not sustain it if met.
Swaziland	7.2	Slightly above target	-0.585 (-58.5%)	Given the relatively high speed of convergence to its own steady state, the country may miss the target or not sustain it if met
Tanzania	5.6	Near the target	-0.264 (-26.4%)	There is a slim chance for the country getting to its steady state. But if the target is met it is likely to be sustained for some time owing to the slowness with which inflation converges to its own steady state.
Zambia	15.9	Above target	-0.536 (-53.6%)	Given the relatively high speed of convergence to its own steady state, the country is likely to be a perpetual miser of the target and will not sustain it if met.

Source: Results generated and computed from E-views estimations contained in Appendix (III)

Since the computed mid-point in respect of the inflation estimates among the member countries is above the MEC target of 5.0%, a panel estimation using a one way fixed effect model based on the Hausman[14] test following Baltagi (2008) was performed. The results are summarised in Table 10 with the SADC long run inflation computed as 9.6% and the speed of adjustment being 49.6%. The almost 50.0% speed of adjustment is relatively high and this means inflation in SADC has a relatively high tendency to revert back towards its 9.6% long run steady state once the shocks subsides.

Table 10: SADC Long Run Steady State Inflation and Speed of Adjustment

Description	**Percentage**
Steady State SADC inflation	0.9646599 (9.6%)
Speed of Adjustment	-0.49589 (49.6)

Source: Results generated and computed from E-views estimations contained in Appendix III

[14]Three tests, the Swamy-Arora, the Wallace-Hussain and the Wensbeek-Kapteyn were performed to examine the random effects and showed the need to adopt the fixed effect model

3.2.4.2.2 Fiscal Balance

All the results, presented in Appendix III Table B, have the expected negative sign in respect of the speed of adjustment and are significant. However, the intercept in respect of Swaziland and Zimbabwe's estimations are insignificant. Further, all the results have no problem with normality test except Zimbabwe. They all have satisfactory results in respect of serial correlation and heteroskedasticity. Further, satisfactory stability tests results were recorded for all except South Africa. The long run estimation shows that Mauritius and Zimbabwe's steady states are above target and that all the countries have exhibited high speeds of convergence to their own steady states (see Table 11). From the results, the range of fiscal balance as a percentage of GDP is from negative 6.1% (Zimbabwe) to negative 0.1% (Seychelles) giving a mid-point of negative 3.1%,which is broadly in line with the SADC target of negative 3.0%.

Table 11: Long Run Steady State and Speed of Convergence for Fiscal Balance

Description	Long Run Steady State	Status with the 2012 MEC target of -3%	Speed of Convergence to the steady state	Implications of the Results
DRC	-0.7	Below target	-0.451 (-45.1%)	Since the speed of adjustment is relatively low, the long run steady state is below target and the fiscal balance has been favourable (in surplus) in the last two years, the country will meet the target and sustain it.
Malawi	-2.7	Below target	-0.760 (-76.0%)	With a high speed of adjustment and the steady state being below target, the country is likely to meet the target and sustain it.
Mauritius	-4.4	Above target	-0.751 (-75.1%)	Given that the steady state is above target and the speed of convergence to its own steady state is high, there is a possibility of missing the target and if it is met then it might not be sustained.
Mozambique	-2.2	Below target	-0.807 (-80.7%)	The favourable speed of adjustment and the steady state being below target, the country is likely to meet the target and sustain it.
Namibia	-2.2	Below target	-0.631 (-63.1%)	Given the high speed of convergence to the steady state and that the country's long run steady state is below target, there is a high chance of the country meeting the target and sustain it.
Seychelles	-0.1	Below target	-1.00 (-100%)	With the very high speed of adjustment to its own steady state and the steady state being below target, the country is very likely to meet the target and sustain it.
South Africa	-1.3	Below target	-0.306 (-30.6%)	Given the unfavourable fiscal performance in the years 2009 and 2010 as well as the low speedy of adjustment to the steady state, the country mail fail to meet the target in 2012. However, if the target is met, then it is likely to be sustained.
Swaziland	-2.1	Below target	-0.743 (-74.3%)	Having a high speed of adjustment and the long run steady state being well below target, the country is very likely to meet the target and sustain it.
Tanzania	-2.2	Below target	-0.387 (-38.7%)	Given the relatively low speed of adjustment to its own steady state and the high level of fiscal deficit recorded in the last few years, the country may fail to meet the target in 2012. However, once the target is met it is likely to be sustained.
Zambia	-2.5	Below target	-0.767 (-76.7%)	With a high speed of adjustment and the long run steady state being below the target, the country is most likely to meet the target and sustain it.
Zimbabwe	-6.1	Above	-0.699 (-69.9%)	Given the high speed of adjustment and the long run steady state being above target, the country may miss the target or unlikely to sustain the target if met.

Source: Results generated and computed from E-views estimations contained in Appendix (I.2)

3.2.4.2.3 Public Debt

The results are presented in Appendix III Table C and show all the coefficients of the speed of adjustment being correctly signed and that all the coefficients are significant with the exception of DRC and South Africa. Satisfactory diagnostic tests were recorded except for Seychelles and Zimbabwe which shows problems with stability test based on the Ramsey RESET test. The data for Lesotho is estimated with dummy that takes care of the improvement in the indicator since the year 2000.

The results further show that Swaziland had the lowest long run steady state as well as a low speed of adjustment followed by Namibia, whose long run steady state was low and below target but had a high speed of adjustment to its own long run steady state (see Table 12).

Furthermore, the results show that the mid-point based on the lowest of 17.2% (Swaziland) and the highest figure of 173% (Democratic Republic of Congo, DRC) was 95.5%. Excluding DRC and Seychelles (123.6%) whose long run steady states are outliers, the mid-point based on Malawi (92.7%) and Swaziland's is 55.0%, which is below the MEC target of less than 60%.

Table 12: Long Run Steady State and Speed of Convergence for Public Debt

Description	Long Run Steady State	Status with the 2012 MEC target of <60% of GDP	Speed of Convergence to the steady state (%)	Implications of the Results
DRC	173.0	Well above target	-0.418 (-41.8%)	A very high steady state public debt figure and with a relatively low speed of adjustment implies that the country is likely to miss the target. However, with the massive debt write off in 2010 the country has enjoyed after attaining the HIPC completion point and given its low speed of adjustment to its own steady state, DRC is likely to meet the target and may sustain it.
Malawi	73.2	Above target	-0.490 (49.0%)	Given a low speed of adjustment but with the long run steady state being above target, there is a highly possibility of failing to sustaining the target. However, if the current low level of the public debt is maintained, sustainability is guaranteed.
Mauritius	92.7	Above target	-0. 389 (-38.9%)	With a low speed of adjustment to its own steady state and given an above target long run steady state figure, the country is likely to miss the target.
Mozambique	52.4	Below target	-0.288 (-28.8%)	Given the low speed of adjustment to its own steady state, which is below target, the country is likely to meet the target and sustain it.
Namibia	40.0	Below target	-0.165 (-16.5%)	A below target long run steady state figure coupled with a very low speed of adjustment to its own steady state, Mozambique will most certainly meet the target and sustain it.
Seychelles	21.4	Below target	-0.680 (-68.0%)	Given the high speed of convergence to the steady state and that the country's long run steady state is below target, there is a high chance of the country meeting the target and sustain it.
South Africa	123.6	Well above target	-0.541 (-54.1%)	With the high speed of adjustment to its own steady state and the steady state being above target, the country is very unlikely to meet the target and sustain it.
Swaziland	35.1	Below target	-0.104 (-10.4%)	A very low speed of adjustment combined with a below target steady state level of public debt implies the country will most likely meet the target and sustain it if it remains within the same level of public debt recorded since 2002.
Tanzania	17.2	Below target	-0.319 (-31.9%)	Despite having a low speed of adjustment to its steady state, the country's low long run steady state that is well below target makes it very likely to meet the target and may be sustained once met.
Zambia	35.5	Below target	-0.143 (-14.3%)	The country is likely to meet the target and sustain it given its below target long run steady state and very low speed of adjustment.
Zimbabwe	84.3	Above target	-0.518 (-51.8%)	Given the relatively high speed of adjustment and the long run steady state being above target, the country may miss the target or unlikely to sustain the target if met by 2012.

Source: Results generated and computed from E-views estimations contained in Appendix (I.3)

3.2.4.2.4 Current Account

The results are presented in Appendix III Table D and show that the speeds of adjustment for all the estimations are correctly signed with the exception of results for Lesotho. Further, all of the member countries except Seychelles and Lesotho had their speeds of adjustments statistically significant (see Table 13). Further, satisfactory diagnostic tests have been recorded for all the series except Lesotho, which had stability problems. In addition, the results show Seychelles to have the largest current account steady state deficit while Swaziland had the lowest. Furthermore, the results show that the range of the current account deficit, excluding Seychelles which was an outlier in this case, was from negative 18.3% (Lesotho) to negative 0.2% (South Africa) giving a mid-point of negative 9.3%, which is within the target of negative 9.0% of GDP.

Table 13: Long Run Steady State and Speed of Convergence for Current Account

Description	Long Run Steady State	Status with the 2012 MEC target of <-9% of GDP	Speed of Convergence to the steady state (%)	Implications of the Results
DRC	-3.1	Below target	-0.746 (-74.6%)	With a very high speed of adjustment and a below target long run steady state, the country is likely to meet the target and sustain it.
Malawi	-18.3	Above target	0.468 (46.8%)	Given the long run steady state which is above the MEC target with the speed of adjustment moving slowly away from its own steady state, the country is at risk of not meeting the target at all unless drastic measures are put in place to reverse the current trend.
Mauritius	-14.9	Above target	-0.967 (-96.7%)	Since the speed of adjustment is very high and the long run steady state is above target, the country is likely to miss the target.
Mozambique	-4.8	Below target	-0.432 (43.2%)	The country is likely to meet the target and may sustain it.
Namibia	-13.6	Above target	-0.516 (-51.6%)	The country is most likely to miss the target as result of having a long run steady state that is above target and having a relatively high speed of adjustment.
Seychelles	-35.3	Well above target	-0.267 (-26.7%)	Given the very low speed of convergence to the steady state and that the country's long run steady state is well above target, there is a high chance of the country missing the target. This is because at the moment the current account outcome is even below its own steady state.
South Africa	-0.2	Below target	-0.315 (-31.5%)	The country is very likely to meet the target given its below target long run steady state.
Swaziland	-5.6	Below target	-0.413 (-41.3%)	With the relatively low speed of adjustment to its own steady state and the steady being below target, the country is very likely to meet the target and sustain it given the improvement recorded in the year 2010.
Tanzania	-5.5	Below target	-0.328 (-32.8%)	The country is likely to meet the target and may sustain it.
Zambia	-14.5	Above target	-0.374 (-37.4%)	Despite having a low speed of adjustment to its steady state, the country's high long run steady state that is well above target may make the country miss the target. But if target is met it is likely to be sustained since the speed of adjusting to the steady state is low.
Zimbabwe	-9.6	Almost on target	-0.502 (-50.2%)	Given the relatively high speed of adjustment and the long run steady state being almost on target, the country may meet the target and likely to sustain it.

Source: Results generated and computed from E-views estimations contained in Appendix (I.3)

IV Conclusion and Recommendation

4.1 Conclusion

After 2001, SADC developed the principles and process of achieving economic convergence in the SADC region. This is aimed at being achieved through primarily and secondary macroeconomic convergence (MEC) indicators that have since been identified and are regularly monitored.

The descriptive analysis showed that the overall progress in the two year period the 2012 targets have been observed to be satisfactory although the inflation target seems to be a challenge to most member countries among the primary indicators. With regard to the secondary indicators, the current account target is likely to be achieved by most member countries.

Econometric analysis showed that among the primary indicators only inflation had its long run steady state mid-point among the member countries analysed to be above the MEC target. In terms of secondary indicators, only one indicator was analysed and it's computed long run steady state mid-point is below the SADC target.

4.2 Recommendations

Based on the information above, the following are the recommendations:

i. Inflation: It is advisable that threshold inflation for each member country be taken into consideration in coming up with the specific inflation target for SADC under the MEC Programme. In the absence of this, a single digit inflation target of at most 9% is recommended in order to give room for robust economic growth for those member countries that are underdeveloped.

ii. Fiscal Balance: Since the mid-point of the steady state of fiscal balance as a percentage of GDP for member countries reviewed is the same as the MEC target, no revision should be considered. The target should be maintained.

iii. Public Debt: Since the mid-point is within the target set by SADC after excluding DRC and Seychelles, this target too should be maintained.

iv. Current Account: The mid-point obtained from the analysis shows that the 9.0% target is realistic. Based on this the recommendation is that the target should be maintained.

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Appendices

Appendix I: Technical Note to the understanding of the Speed of Convergence/Adjustment.

I. The speed of adjustment refers to how fast or slow the variable will move to its own steady state after some shocks.

II. If the speed of convergence is high, the variable will have a tendency of moving fast to its own steady state and conversely if the speed is low, the variable will have a tendency of moving slowly to its own steady state.

III. Depending on the speed of adjustment and the level of the steady state as well as the MEC target, the following outcomes are possible:

   a. If the steady state is above the MEC target and the shock on the MEC indicator variable has resulted into that variable being below the MEC Target:

      i. A high speed of convergence will tend to make the variable overshoot the MEC target quite rapidly as the indicator variable recovers from the shock(s).

      ii. Conversely, a low speed of convergence will make the MEC indicator variable to move slowly to its steady state and may therefore delay to pass through the MEC target.

   b. If the steady state is above the MEC target and the shock on the MEC indicator variable has resulted into that variable being above the MEC Target:

      i. A high speed of convergence will cause the indicator variable to rapidly move to its own steady state and will certainly not meet the MEC target

      ii. A low speed of convergence will result into the indicator variable move slowly to its own steady state and will certainly take a relatively longer period to reach its own steady state. In this case too, it will not meet the MEC target.

   c. If the steady state is below the MEC target and the shock on the MEC indicator variable has resulted into that variable being below the MEC Target:

      i. A high speed will cause the indicator variable to move fast to its own steady state and will never meet the target.

   d. If the steady state is below the MEC target and the shock on the MEC indicator variable has resulted into that variable being above the MEC Target:

      i. A high speed will cause the indicator variable to move fast to its own steady state and surpass the MEC target.

IV. The following percentages describe speed in terms of high and low:

   I. Above 80% - Very high

   ii. Between 60% and 79% - High

   iii. Between 50% and 59% - Relatively high

   iv. Between 40% and 49% - Relatively low

   v. Between 30% and 39% - Low

   vi. Below 30% - Very low.

Appendix II: Country Charts for Various MEC Indicators

Chart 1A: Botswana Inflation

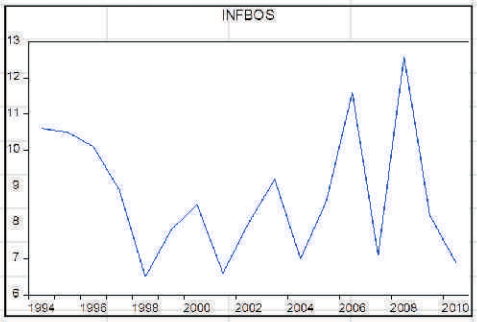


Chart 1B: Lesotho Inflation

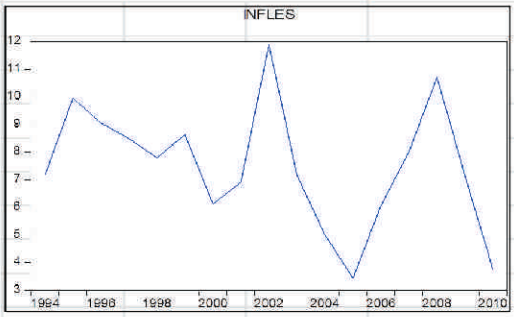


Chart 1C: Malawi Inflation

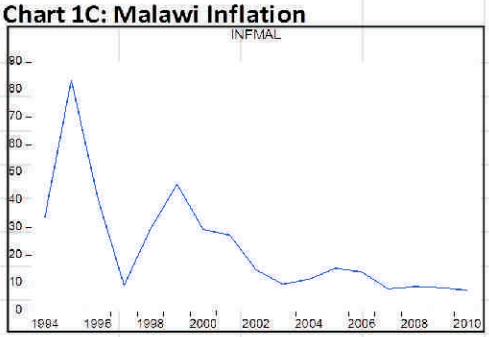


Chart 1D: Mauritius Inflation

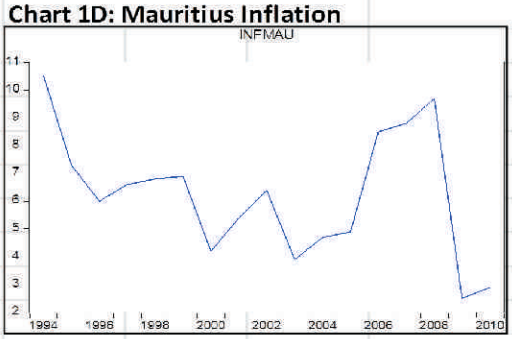


Chart 1E: Mozambique Inflation

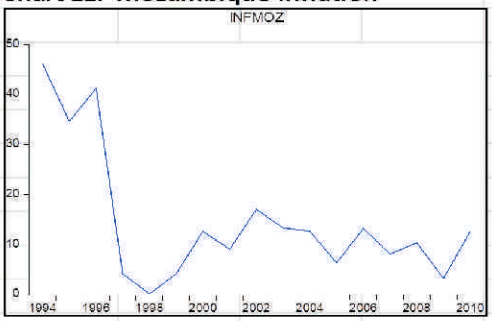


Chart 1F: Namibia Inflation

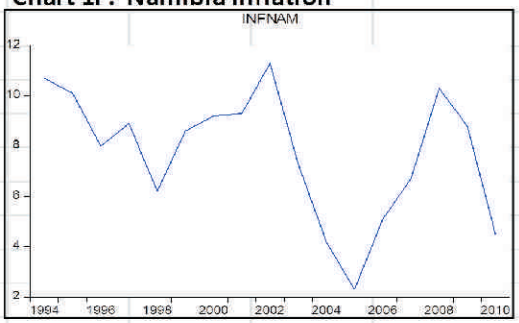


Chart 1G: Seychelles Inflation

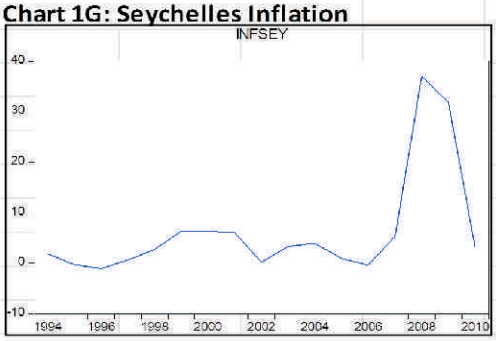
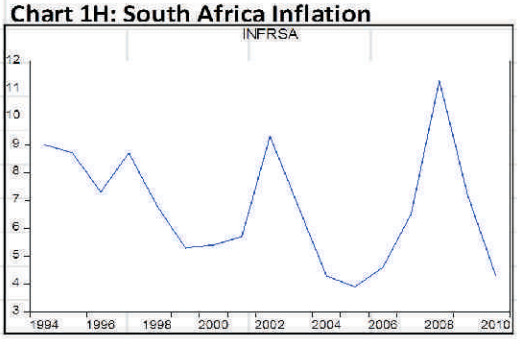


Chart 1H: South Africa Inflation



Charts generated using e-views 7 based on the data provided by SADC member countries.

Chart 1I: Swaziland Inflation

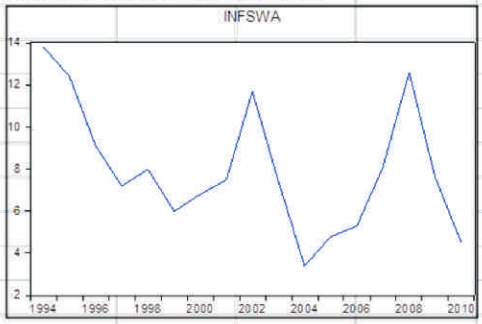


Chart 1J: Tanzania Inflation

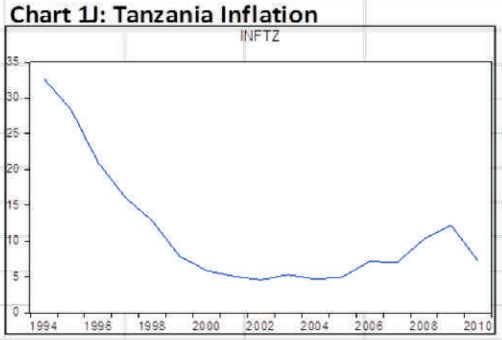


Chart 1K: Zambia Inflation

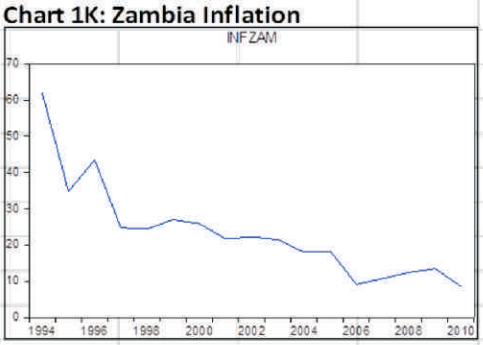


Chart 2A: Congo DR Fiscal Balance

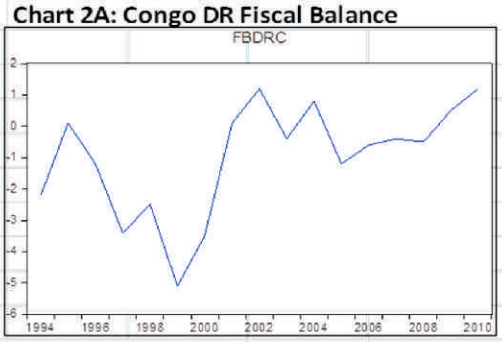


Chart 2B: Malawi Fiscal Balance

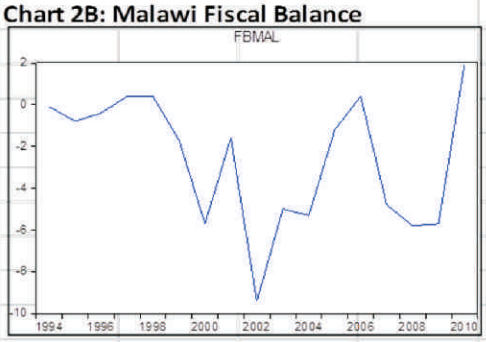


Chart 2C: Mauritius Fiscal Balance

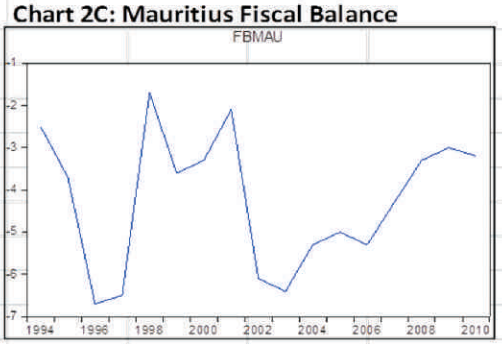


Chart 2D: Mozambique Fiscal Balance

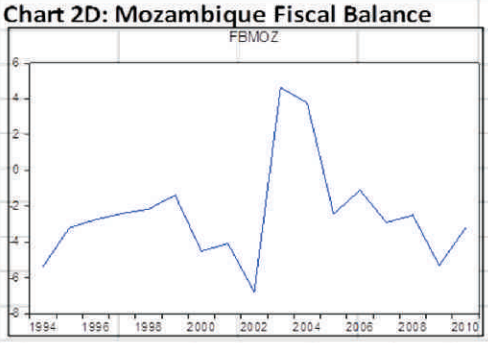
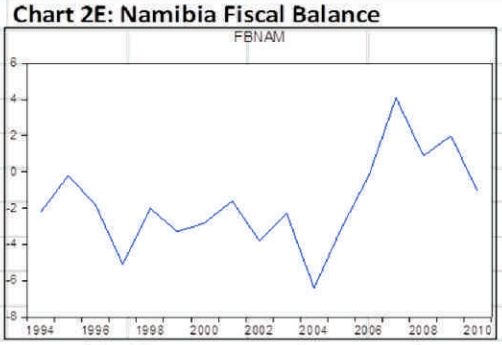


Chart 2E: Namibia Fiscal Balance



Charts generated using e-views 7 based on the data provided by SADC member countries.

Chart 2F: Seychelles Fiscal Balance

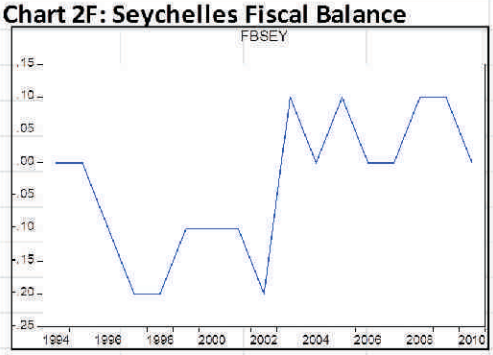


Chart 2G: South Africa Fiscal Balance

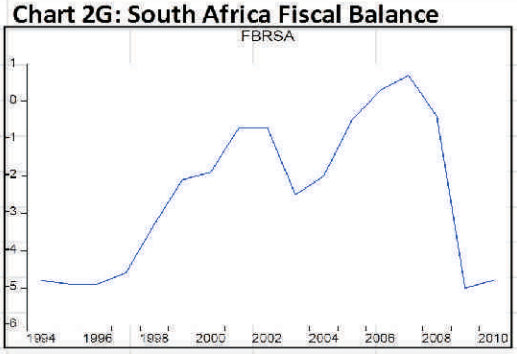


Chart 2H: Swaziland Fiscal Balance

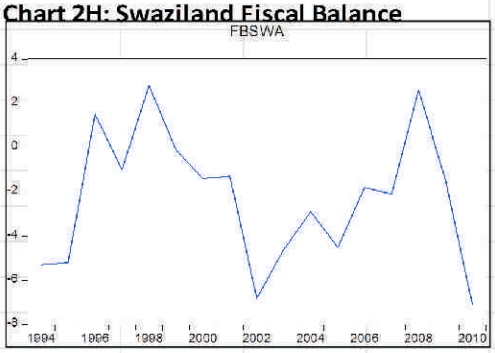


Chart 2I: Tanzania Fiscal Balance

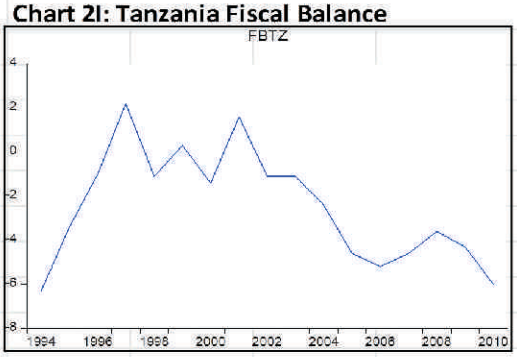


Chart 2J: Zambia Fiscal Balance

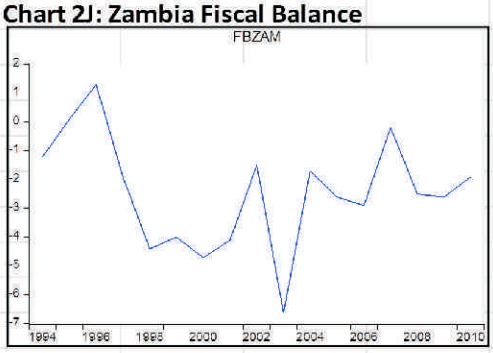


Chart 2K: Zimbabwe Fiscal Balance

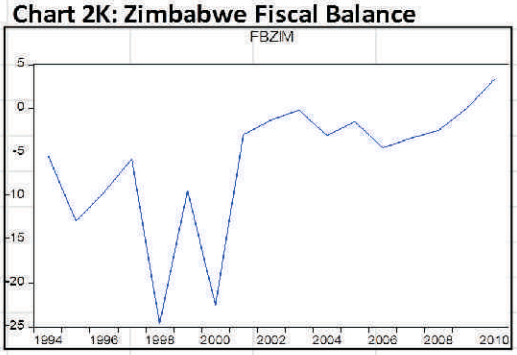


Chart 3A: Congo DR Public Debt

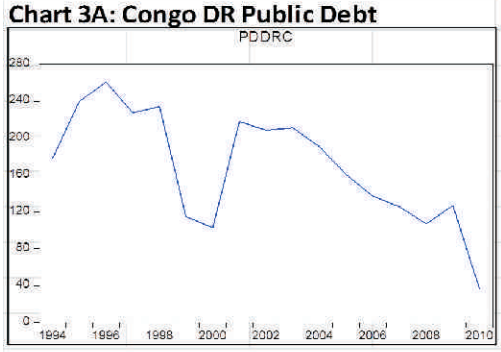
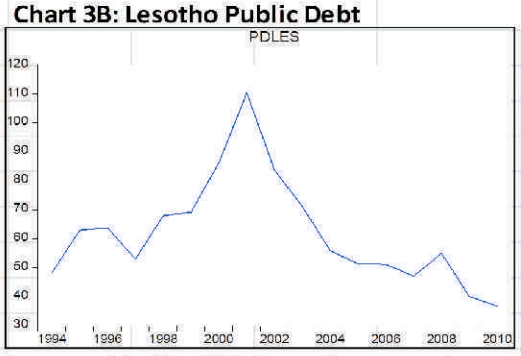


Chart 3B: Lesotho Public Debt



Charts generated using e-views 7 based on the data provided by SADC member countries.

Chart 3C: Malawi Public Debt

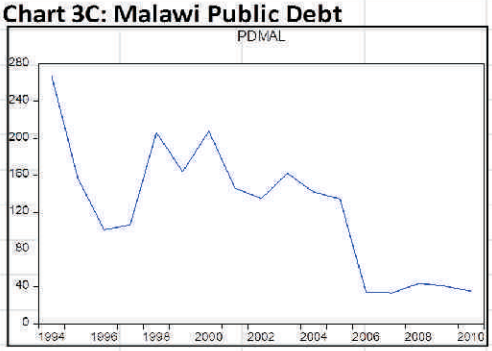


Chart 3D: Mauritius Public Debt

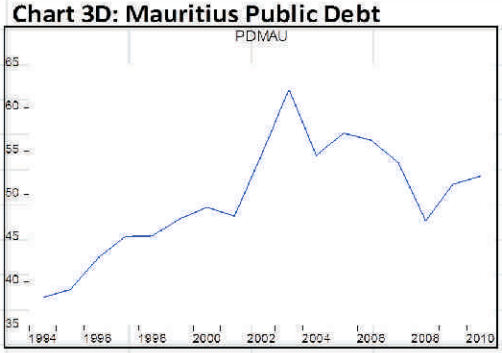


Chart 3E: Mozambique Public Debt

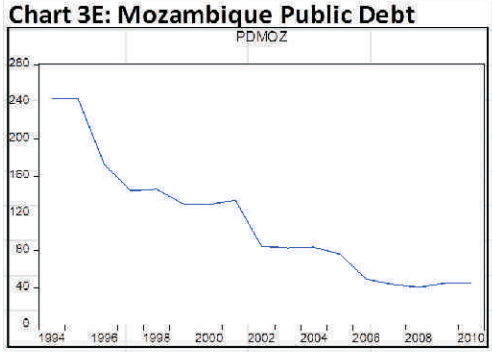


Chart 3F: Namibia Public Debt

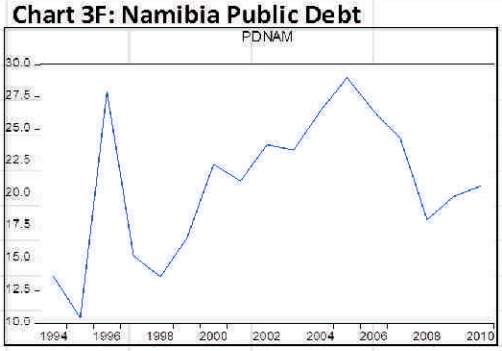


Chart 3G: Seychelles Public Debt

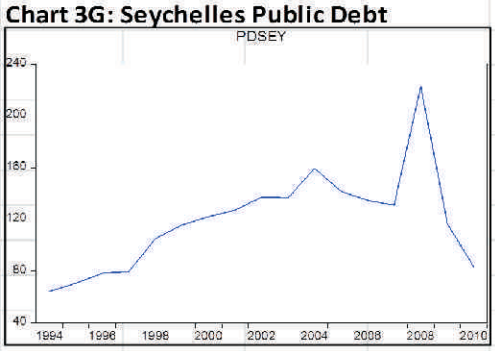


Chart 3H: South Africa Public Debt

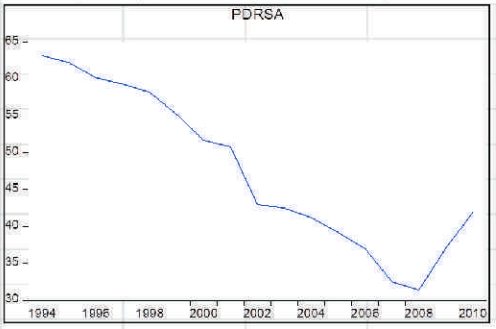


Chart 3I: Swaziland Public Debt

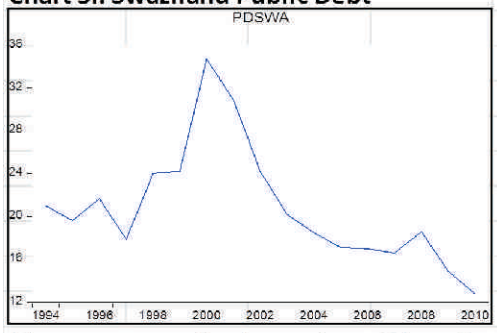
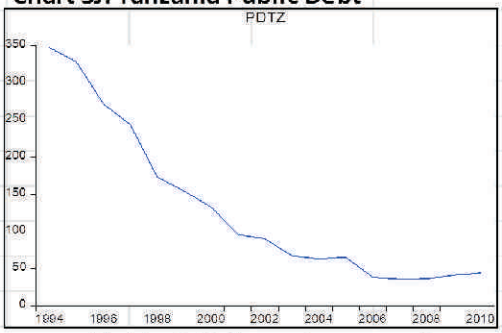


Chart 3J: Tanzania Public Debt



Charts generated using e-views 7 based on the data provided by SADC member countries.

Chart 3K: Zimbabwe Public Debt

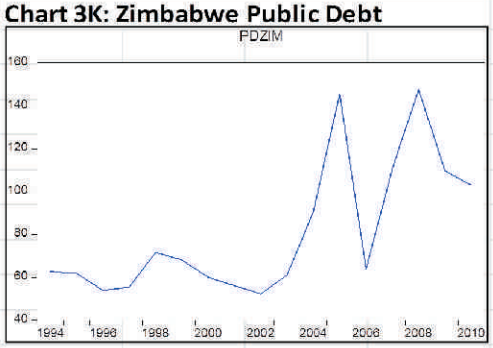


Chart 4A: Congo DR Current Account

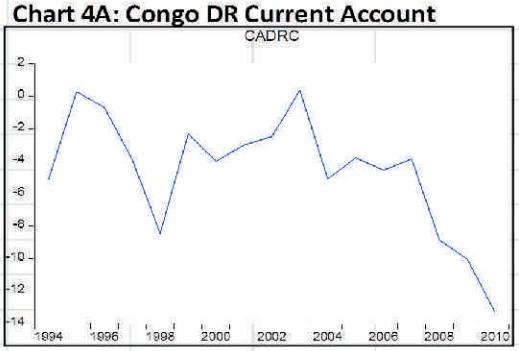


Chart 4B: Lesotho Current Account

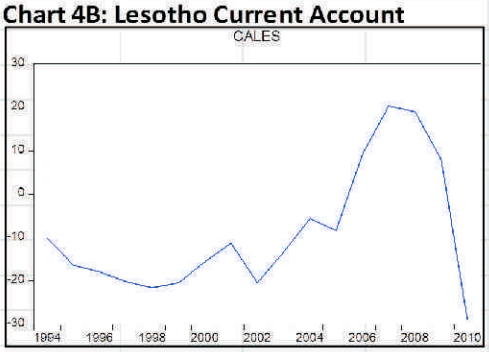


Chart 4C: Malawi Current Account

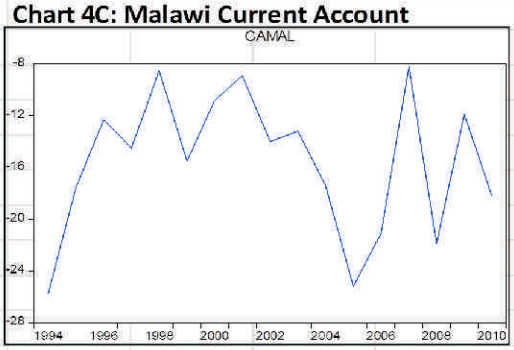


Chart 4D: Mauritius Current Account

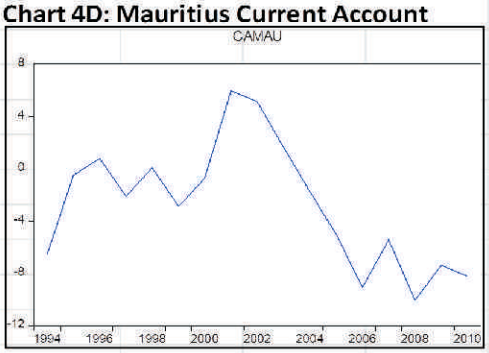


Chart 4E: Mozambique Current Account

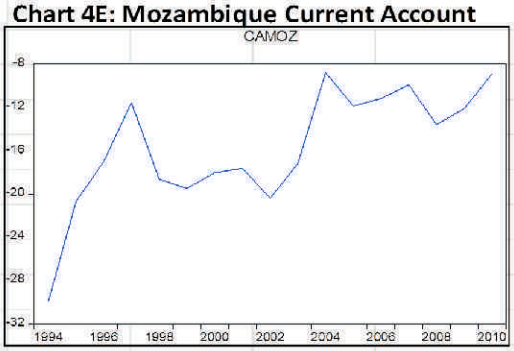


Chart 4F: Seychelles Current Account

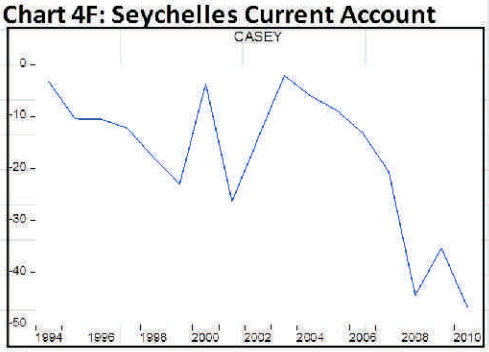
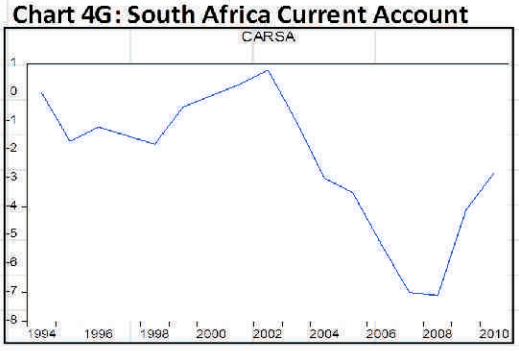


Chart 4G: South Africa Current Account



Charts generated using e-views 7 based on the data provided by SADC member countries.

Chart 4H: Swaziland Current Account

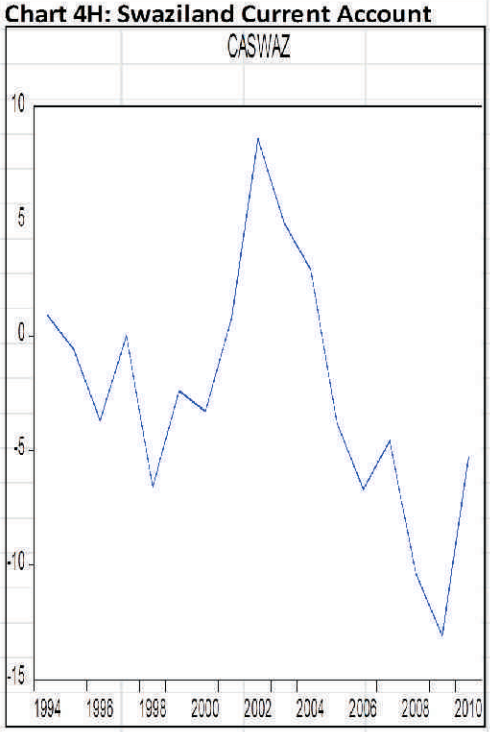


Chart 4I: Tanzania Current Account

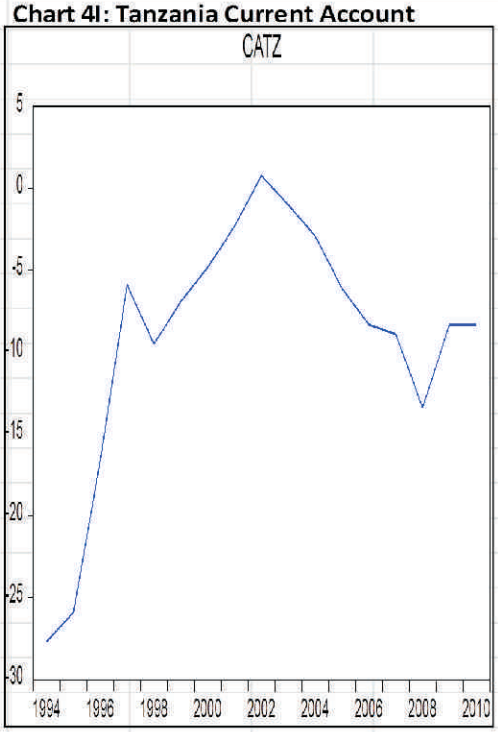


Chart 4J: Zambia Current Account

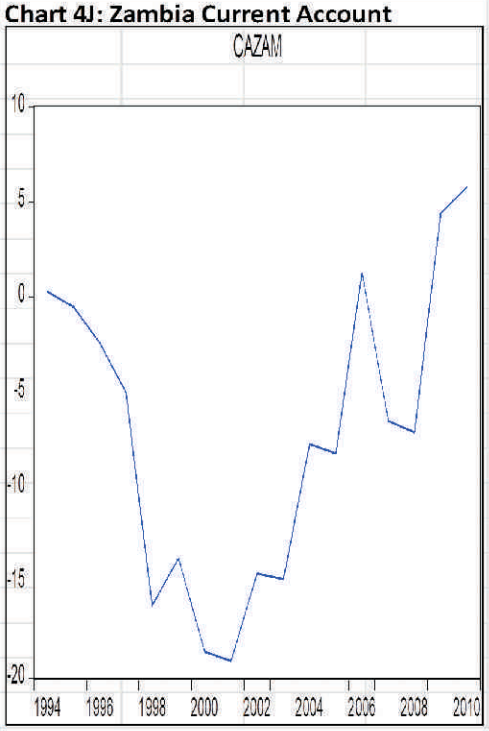
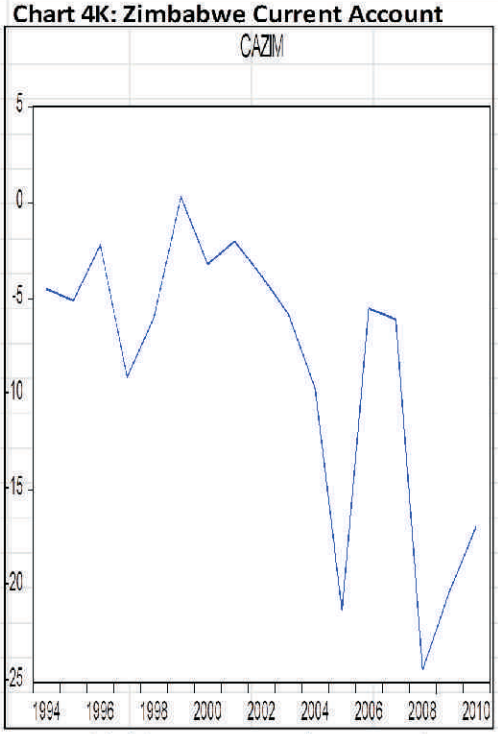


Chart 4K: Zimbabwe Current Account



Charts generated using e-views 7 based on the data provided by SADC member countries.

Appendix III: Estimation Results

Table A: Inflation Estimation

Country	Constant	Inflation(-1)	Dummy
Botswana	7.529824 (2.111738) [3.565699] {0.0035}	-0.90681 (0.230878) [-3.927657] {0.0017}	4.40853 (1.66228) [2.652098] {0.0199}
Lesotho	5.424638 (2.28672) [2.372236] {0.0326}	-0.729335 (0.28594) [-2.550658] {0.0231}	
Malawi	9.535881 (4.13758) [2.3047] {0.0383}	-0.615557 (0.133543) [-4.609435] {0.0005}	60.89305 (10.72706) [5.676585] {0.0001}
Mauritius	3.962644 (1.619723) [2.446495] {0.0282}	-0.688674 (0.238807) [-2.88381] {0.012}	
Mozambique	6.431427 (2.673388) [2.405722] {0.0317}	-0.429599 (0.137066) [-3.134253] {0.0079}	-17.20806 (5.520308) -3.117228 {0.0082}
Namibia	3.522579 (1.935315) [1.820158] {0.0902}	-0.492608 (0.23324) [-2.112021] {0.0531}	
Seychelles	2.16576 (2.620614) [0.826432] {0.4235}	-0.921213 (0.261508) [-3.5227] {0.0037}	15.70759 (6.551805) [2.397445] {0.0322}
South Africa	3.785002 (1.45468) [2.601948] {0.0219}	-0.635427 (0.200603) [-3.16758] {0.0074}	5.145273 (1.653957) [3.110886] {0.0083}
Swaziland	4.229912 (1.893079) [2.234409] {0.0423}	-0.5845 (0.21699) [-2.693676] {0.0175}	
Tanzania	1.478476 (0.891737) [1.657973] {0.1196}	-0.263994 (0.06195) [-4.261418] {0.0008}	
Zambia	8.550784 (2.329925) [3.669983] {0.0028}	-0.536381 (0.086226) [-6.22068] {0.0000}	18.81529 (4.602997) [4.087617] {0.0013}

Table B: Fiscal Balance Estimation

Country	Constant	Fiscal Balance (-1)	Dummy
DRC	-0.303638 (0.482682) [-0.629066] {0.5394}	-0.451269 (0.235753) [-1.914161] {0.0763}	
Malawi	-2.075248 (1.128362) [-1.83917] {0.0872}	-0.760345 (0.274026) [-2.774721] {0.0149}	
Mauritius	-3.275181 (1.153329) [-2.839763] {0.0131}	-0.751496 (0.251692) [-2.985775] {0.0098}	
Mozambique	-1.652709 (0.612784) [-2.697049] {0.0183}	-0.491798 (0.176276) [-2.789922] {0.0153}	9.728322 (2.115905) [4.597712] {0.0005}
Namibia	-1.374138 (0.64556) [-2.128599] {0.053}	-0.630872 (0.203238) [-3.104103] {0.0084}	5.547964 (2.131089) [2.603347] {0.0219}
Seychelles	-0.125 (0.029946) [-4.174236] {0.0011}	-1.000000 (0.191805) [-5.213619] {0.0002}	0.175 (0.040405) [4.331199] {0.0008}
South Africa	-0.382685 (0.450706) [-0.84908] {0.4112}	-0.305881 (0.145807) [-2.097849] {0.056}	-2.643193 (0.863621) [-3.060594] {0.0091}
Swaziland	-1.580481 (0.929108) [-1.701073] {0.111}	-0.743281 (0.275027) [-2.702573] {0.0172}	
Tanzania	-0.852661 (0.677876) [-1.257843] {0.229}	-0.387294 (0.20681) [-1.872701] {0.0821}	
Zambia	-1.937293 (0.807095) [-2.40033] {0.0308}	-0.767005 (0.256893) [-2.985699] {0.0098}	
Zimbabwe	-4.249832 (2.691109) [-1.579212] {0.1366}	-0.699155 (0.270656) [-2.583192] {0.0217}	

Table C: Public Debt Estimation

Country	Constant	Public Debt	Dummy
DRC	72.26167	-0.4177	-109.1138
	(44.66861)	(0.237138)	(50.26351)
	[1.617728]	[-1.761417]	[-2.170836]
	0.1297	0.1017	0.0491
Lesotho	35.8886	-0.490135	-14.50972
	(16.76831)	(0.227164)	(8.142272)
	[2.140264]	[-2.157627]	[-1.782023]
	{0.0519}	{0.0503}	0.0981
Malawi	36.03242	-0.388735	
	(25.74374)	(0.176561)	
	[1.399658]	[-2.201705]	
	{0.1834}	{0.045}	
Mauritius	15.09564	-0.287925	
	(7.277001)	(0.146051)	
	[2.074431]	[-1.971399]	
	{0.057}	{0.0688}	
Mozambique	6.58036	-0.164505	
	(10.0427)	(0.076297)	
	[0.655238]	[-2.156119]	
	{0.5229}	{0.049}	
Namibia	14.52794	-0.679671	
	(5.078097)	(0.236819)	
	[2.860902]	[-2.87001]	
	{0.0126}	{0.0124}	
Seychelles	65.73168	-0.584363	102.8199
	(18.50792)	(0.145811)	(22.69321)
	[3.551544]	[-4.007663]	[4.530866]
	{0.0035}	{0.0015}	{0.0006}
South Africa	3.660886	-0.104452	
	(3.490258)	(0.071274)	
	[1.048887]	[-1.465496]	
	{0.312}	{0.1649}	
Swaziland	5.496267	-0.319072	12.70805
	(2.880332)	(0.132281)	(2.81943)
	[1.908206]	[-2.412082]	[4.50731]
	{0.0787}	{0.0314}	{0.0006}
Tanzania	0.507131	-0.142883	
	(6.682763)	(0.039085)	
	[0.075886]	[-3.65572]	
	{0.9406}	{0.0026}	
Zimbabwe	43.69095	-0.518215	
	(20.11403)	(0.23591)	
	[2.172163]	[-2.196666]	
	{0.0475}	{0.0454}	

Table D: Current Account Estimation

Country	Constant	Current Account (-1)	Dummy
DRC	-2.332764	-0.746293	-4.959416
	(1.243019)	(0.290782)	(1.965603)
	[-1.876692]	[-2.566505]	[-2.523102]
	0.0832	0.0234	0.0255
Lesotho	8.546007	0.468214	-32.36577
	(4.739306)	(0.300907)	(10.56035)
	[1.803219]	[1.556011]	[-3.064838]
	{0.0946}	{0.1437}	{0.009}
Malawi	-14.43353	-0.966896	
	(3.875143)	(0.236979)	
	[-3.724644]	[-4.080088]	
	{0.0023}	{0.0011}	
Mauritius	-2.087728	-0.432316	5.107817
	(1.010742)	(0.178758)	(2.073865)
	[-2.065541]	[-2.418444]	[2.462946]
	{0.0594}	{0.031}	{0.0285}
Mozambique	-7.005066	-0.516093	
	(2.798978)	(0.165215)	
	[-2.502722]	[-3.12377]	
	{0.0253}	{0.0075}	
Seychelles	-9.443716	-0.267281	20.17228
	(3.977709)	(0.202887)	(7.035216)
	[-2.37416]	[-1.317388]	[2.86733]
	{0.0337}	{0.2105}	{0.0132}
South Africa	-0.046916	-0.314642	-2.266117
	(0.296892)	(0.086722)	(0.43231)
	[-0.158025]	[-3.628178]	[-5.241875]
	{0.8769}	{0.0031}	{0.0002}
Swaziland	-2.313689	-0.413053	7.747372
	(1.055985)	(0.170152)	(2.747606)
	[-2.191025]	[-2.427556]	[2.819681]
	{0.0473}	{0.0305}	{0.0145}
Tanzania	-1.816547	-0.32813	
	(1.388154)	(0.114336)	
	[-1.308606]	[-2.869875]	
	{0.2117}	{0.0124}	
Zambia	-5.407244	-0.374194	6.286689
	(2.493193)	(0.184208)	(2.678857)
	[-2.168803]	[-2.031363]	[2.34678]
	{0.0492}	{0.0632}	{0.0354}
Zimbabwe	-4.816429	-0.502431	
	(2.607572)	(0.242172)	
	[-1.847093]	[-2.074689]	
	{0.086}	{0.0569}	

Key: Standard errors in ( ), t-statistics in [ ] and probability values in {}

CHAPTER SIX

Foreign Exchange Swaps as Instruments of Monetary Policy in Zambia

By

Nancy Mwilwa

Abstract

This paper explores the possibility of using foreign exchange swaps as additional tools of monetary policy. Foreign exchange swaps have been used by many central banks for influencing the liquidity of domestic markets, managing international reserves and nurturing domestic financial markets but their use has generally declined the world over. However, there are a number factors that contribute to the motivation of using foreign exchange swaps in the implementation of monetary policy in Zambia outlined as follows: these instruments can be used in both an interest and monetary aggregate targeting regimes; the relatively healthy level of foreign reserves permits us to undertake these operations; they are cheaper than term deposits and repurchase transactions; they are flexible and reversible; they can be used where there is limited depth in the domestic securities market while the foreign exchange market is very liquid; and they do not exert direct influence on the spot exchange rate unlike outright foreign exchange transactions. In the Zambian context, we advocate the use of foreign exchange swaps sparingly, for liquidity management purposes at the central bank's initiative.

I Introduction

Foreign exchange swaps have been utilised by a number of central banks as one of the intervention tools in financial markets. The reasons for central banks engaging in these swaps have been threefold, that is, mainly to influence liquidity in domestic markets, manage international reserves and nurture domestic financial markets. However, their use has been on the decline even in countries like Switzerland where they had remained popular right up to early 2000 due to the virtual absence of short-term government securities before this period. Other jurisdictions where foreign exchange swaps (FX swaps) are still used by central banks to some extent are the Eurozone, Norway, South Africa, Australia and New Zealand.

With the adoption of a liberalised economy in Zambia in the 1990s, the conduct of monetary policy underwent significant changes. Prominent among these changes was the heavy reliance on indirect instruments such as Open Market Operations (OMO) in influencing monetary aggregates. These tools were designed to influence the monetary base, specifically reserve money in order to attain the central bank's ultimate goal of price stability. Among the tools under OMO at the central bank's disposal are term deposits and secured loans, repurchase transactions (repos) and reverse repurchase transactions (reverse repos) as well as outright sales and purchases of government securities and foreign exchange. These tools will still remain relevant under an interest rate targeting regime which Zambia intends to pursue[1].

[1]This paper was done in March 2011, before the Bank of Zambia's migration to interest rate targeting.

Notwithstanding the instruments currently available, there is a need to increase the array of instruments in order to improve the efficacy of monetary policy management. Therefore, the introduction of FX swaps as an additional OMO tool is now under consideration. With this mandate, this paper explores the possibility of using FX swaps in the implementation of monetary policy.

There are number of factors that contribute to the motivation of using FX swaps in the implementation of monetary policy. These include: the possibility of using these instruments in both interest and monetary aggregate targeting regimes; they are cheaper than term deposits and repurchase transactions; they are flexible and reversible. Further, according to the Bank of International Settlement (1999), FX swaps can be used where there is limited depth in the domestic securities market while the foreign exchange market is very liquid and they do not exert direct influence on the spot exchange rate unlike outright foreign exchange transactions.

The rest of the paper is organised as follows: Section Two provides a description of an FX swap. Section Three outlines how FX swaps can be used in the implementation of monetary policy and their effect on the central bank balance sheet. The advantages and disadvantages of using FX swaps are presented in Section Four while Section Five explores the possibility of using this tool in the Zambian context. The recommendations and concluding remarks are provided in Section Six and Section Seven, respectively.

II Foreign Exchange Swaps

A foreign exchange swap refers to a financial transaction where two parties exchange two agreed amounts of two currencies as a spot transaction, simultaneously agreeing to unwind the exchange at a future date, the forward transaction, based on a rule that reflects interest and principal payments (Bartolini, 2002). This means that there are two foreign exchange transactions or legs involved. In a way, an FX swap can be perceived as a repurchase transaction with foreign currency substituting securities as the underlying asset.

By combining spot and forward transactions, FX swaps can be priced on the premise of the availability of forward quotations and generally satisfying the covered interest parity (CIP) condition. CIP refers to the spot and futures exchange rate relationship that prevails in well-functioning markets. More specifically, the CIP condition refers to the practice of the forward purchase of foreign currency that will result in the effective interest rate being the same whether funds are borrowed domestically or overseas (Hunt and Terry, 1993).

Therefore, the CIP condition is the formula used for the calculation of the forward price or quotation. This can be expressed as follows:

$$F = S\frac{(1+(D/C)i_v)}{(1+(D/B)i_b)} \quad \text{.....} \quad (1)$$

where

F = Forward Rate

S = Spot exchange rate quotation of variable currency per unit of base currency

D = Number of Days

i_v = Interest rate per annum for the variable currency

i_b = Interest rate per annum for the base currency

C = Day Convention in the variable currency money market

B = Day Convention in the base currency money market

The difference between the spot exchange rate and the forward exchange rate is referred to as the forward margin. The forward margin on a currency is expressed as a number of points above or below the spot exchange rate and is called a discount or premium, respectively. Pilbeam (2006) further explains that a currency is at a forward premium if the forward exchange rate quotation for that currency represents an appreciation for that currency compared to the spot quotation. On the other hand, if the forward exchange rate quotation for that currency is a depreciated one compared with the spot exchange rate, the currency is said to be at a forward discount.

Forward margins can also be referred to as swap points. Swap points modify the spot exchange rate to show the funding effects of carrying cash flows until the forward date. They are determined by subtracting the spot rate from the forward rate or using the formula below.

$$\text{Swap point} = S \ \frac{((i_v(D/C) - (i_b(D/B))}{(1 + (i_b(D/B))}$$

S = Spot exchange rate quotation of variable currency per unit of base currency

D = Number of Days

iv = Interest rate per annum for the variable currency

ib = Interest rate per annum for the base currency

C = Basis of the variable currency (Day Convention in the variable currency money market)

B = Basis of the base currency (Day Convention in the base currency money market)

III Application of FX Swaps by Bank of Zambia

If we were to introduce FX swaps in Zambia, the domestic currency, the Kwacha, would most likely be paired with the US dollar (the intervention currency). Given the fact that US interest rates are comparably lower than the ones that prevail in Zambia, the implication is that the Kwacha would normally be traded at a forward discount. An example of how we can use FX swaps in our Open Market Operations (OMO) is presented below using a 90 day FX swap with the central bank intervention of K5.0 billion. The cost and income generated from the swaps are also considered. Thereafter, the analysis is extended for 180 and 365 day swaps in Table 1.

Forward Rates

The 90 day forward exchange rate

$$F = 5{,}268.45 \frac{(1 + (90/365)0.137129)}{(1 + (90/360)0.00198)} = 5{,}443.90$$

In the above scenario, if BoZ's intention was to withdraw (inject) K5.0 billion from the money market on 25 June 2009, it would have entailed selling (buying) US$ 949,045.73. With this transaction, the intended amount would have been withdrawn (injected) with an obligation of acquiring (relinquishing) the foreign currency 90 days later for K5,166,505,730.35. The cost (revenue) would be K 166,505,730.35.

Table 1: Forward Rates and Cost/Revenue Implications

25 June 2009

Description	K/US Dollar	USD T-bill Interest Rate (%)	ZMK T-bill Interest Rate (%)	Interest Cost/Revenue (ZMK)
Spot Ex Rate	5,268.45	-	-	
3 Month Fwd Ex Rate	5,443.90	0.198	13.7129	166,505,730.35
6 Month Fwd Ex Rate	5,664.71	0.340	15.6222	376,065,619.95
1 Year Fwd Ex Rate	6,275.74	0.453	19.6663	955,959,773.09

The challenge noted at this juncture would be obtaining intermittent rates between 3 and 90 days or 90 and 180 days, for instance, which would involve the process of interpolation. This underscores the need to develop a short term money market yield curve to facilitate the orderly pricing of those instruments.

Cost Considerations

If by comparison the BoZ undertook contractionary operations under OMO of the same tenors, using the rates prevailing on Treasury bills since the longest operation conducted during this time was for 60 days, the following costs would have emerged. Withdrawing K5.0 billion for 3, 6 and 12 months would have resulted in the following costs (See Table 2), using the simple interest formula.

Table 2: Cost Implications for OMO Deposits

Tenor	Interest Rate	Principal ZMK	Interest Cost ZMK
90 days	13.7129%	5,000,000,000.00	169,063,150.68
180 days	15.6222%	5,000,000,000.00	385,204,931.51
365 days	19.6663%	5,000,000,000.00	983,315,000.00

In comparison, in terms of cost considerations, swaps are relatively cheaper. This phenomenon would be no different in a low interest environment but the depreciation in the exchange rate would be less (See Appendix I).

From the examples portrayed above, there is no doubt that when a central bank undertakes foreign exchange swaps it has significant repercussions on the money market. When the central bank undertakes a Reverse FX swap through the purchase of foreign currency from a commercial bank in the first leg of the transaction (liquidity injecting operation), commercial bank domestic reserves improve by the local currency equivalent of the foreign exchange purchases. The inevitable increase in reserve money would cause an expansion in money supply. Conversely, if the central bank had done an FX swap (liquidity draining operation), that is, exchanged foreign exchange for domestic currency spot to domestic banks and repurchased it forward, reserve money would decline. It is thus appropriate that we now discuss their effect on the central bank's balance sheet.

The Effect of Foreign Exchange Swaps on the Central Bank Balance Sheet

There are two ways of looking at the effect of foreign exchange swaps on the central bank's balance sheet depending on the institutional arrangement (Hooyman,1993). The first way is as alluded to before, FX swaps being perceived as collateralised transactions in a manner similar to repurchase transactions with foreign exchange being the underlying asset instead of government securities. The second way is considering both legs as outright transactions.

Using the collateralised loans approach, the effect on the central bank's balance sheet can be perceived as follows:

Contractionary Operation

Foreign exchange swaps will be used in a liquidity withdrawing operation. This being the case, if we treat swaps as collateralised loans, the central bank's balance sheet would be affected as follows, while bearing in mind that the foreign exchange will continue to be considered as assets for the central bank: On BoZ's balance sheet, domestic assets (claims on commercial banks) would reduce and on the liability side, commercial bank reserves would fall by the Kwacha equivalent of the foreign exchange purchased. Thus, reserve money would decline consequently causing a reduction in money supply. This is described in the model below.

Domestic Currency lent by commercial banks

BOZ ⟵ COMMERCIAL BANKS

BOZ ⟶ COMMERCIAL BANKS

Foreign Exchange provided as collateral by BoZ

When the swap matures, both the domestic assets and the banks' reserves go back to their previous levels with the interest payment being paid to the commercial banks. The model below depicts the flow of funds in the second leg.

Repayment of loan in domestic currency to banks

BOZ ⟶ COMMERCIAL BANKS

BOZ ⟵ COMMERCIAL BANKS

Foreign Exchange returned to BoZ

Expansionary Operation

The Reverse FX swap shall be considered in a liquidity injecting operation. This being the case, if we treat swaps as collateralised loans to the commercial banks, the central bank's balance sheet will be affected as follows: The foreign exchange will continue to be reflected as assets for commercial banks. On BoZ's balance sheet, domestic assets would increase (claims on domestic banks) and on the liability side, commercial bank reserves would rise by the Kwacha equivalent of the foreign exchange sold to BoZ. Thus, reserve money will be augmented causing an increase in money supply. The model below shows the flow of funds in the first leg of the transaction.

Domestic Currency lent by BoZ

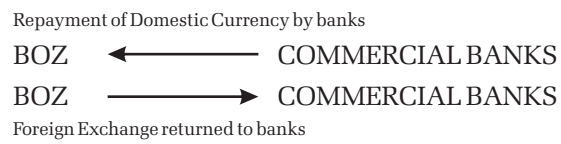
BOZ ⟶ COMMERCIAL BANKS

BOZ ⟵ COMMERCIAL BANKS

Foreign Exchange provided as collateral by banks

At maturity, in the second leg of the swap, both the domestic assets and banks' reserves revert to their previous levels with the interest payment being paid to the central bank's profit and loss account.

This is depicted in the model below.



The other approach, considering an FX swap as outright transactions, can be described as follows: if an FX swap is being carried out where the central bank buys foreign exchange with domestic currency, the central bank's foreign assets increase as the commercial banks' reserves are credited with the Kwacha equivalent of the foreign exchange purchase. Consequently, banks' foreign assets decline. This would result in an upward movement in reserve money which would cause an expansion in money supply. The converse would be the case if the BoZ conducted a reverse swap. Since we have adopted the International Financial Reporting Standards (IFRS), we would follow the collateralised loan approach.

V The Advantages and Disadvantages of Using Foreign Exchange Swaps

In as much as foreign exchange swaps can be used as instruments of monetary policy, they possess both advantages and disadvantages. These are presented in Tables 3a and 3b below with mitigating factors for the negative aspects.

Table 3a: Advantages of Foreign Exchange Swaps

	Advantages
(a)	It is important for central banks to have an array of instruments at their disposal. They can be utilised when OMO proves to be impotent after other instruments have been offered to the market particularly in circumstances when banks have exhausted their exposure limits to OMO.
(b)	From the viewpoint of central bank risk management, FX swaps have the same level of risk as the standard repo operations since the central bank does not assume any of the underlying foreign exchange risk, by virtue of the covered nature of the swap position (Bartolini, 2002). If the central bank is supplying funds and has foreign exchange as collateral, it is not exposed to the foreign exchange rate risk as it has the foreign asset to cover the forward foreign liability.
(c)	There is some level of protection between the time the transaction is executed and settlement against adverse foreign exchange movements. For example, in the illustration given on page 4 for the 90-day scenario, had the exchange rate moved to K5,600.00/US$ 90 days after the transaction had been effected, the central bank would only have been obliged to transact the US$1.0 million at K5,443.90/US$.
(d)	They work well in markets where the domestic short-term secondary market is not deep enough but there is generally an active market in foreign exchange.
(e)	It is important for central banks to have an array of instruments at their disposal. They can be utilised when OMO proves to be impotent after other instruments have been offered to the market particularly in circumstances when banks have exhausted their exposure limits to other instruments.
(f)	They are flexible and easily reversible instruments.
(g)	If monetary policy targets monetary aggregates, swaps can be effective because they affect high powered money directly. If monetary policy targets interest rates, central bank credit may be a more suitable instrument (Hooyman, 1993).
(h)	They have no direct effect on the spot or forward exchange rates (Hooyman, 1993).

Disadvantages	Mitigating Factors
(1) Any benefit from favourable exchange rate movement is foregone from the time the transaction is executed and settlement.	(1) The essence of a FX swap is liquidity management and what is important at that particular point in time is whether we have achieved our objective of siphoning the required amount of funds from the market. How the exchange rate evolves over the duration of the contract is not the primary concern.
(2) There is exchange risk if the asset or liability disappeared, that is, if the counterparty defaults before the swap matures or the country runs out of foreign reserves (Balance of Payment (BOP) problems) (Hooyman, 1993). Argentina had a BOP crisis in 1982 where the central bank was unable to cover its foreign liabilities adequately leaving it exposed to exchange rate risk.	(2) A master dealing agreement which stipulates the obligations of all parties involved in the transaction as well as elements for mitigating counterparty risk needs to be signed by eligible counterparties. Barkbu and Ong (2010) explain that the propagation of international standards and regulations attempts to capture all presented risks and to ensure greater transparency in their disclosure. This encompasses the application of the Basel accords (Basel I and Basel II) as well as IFRS. Traders in over the counter (OTC) foreign exchange derivatives enter into standardised International Swaps and Derivatives Association (ISDA) contracts. Barkbu and Ong (2010) point out that there is low counterparty risk if instruments are traded in a centrally cleared market, where an adequately capitalised clearing house assumes this risk which is mitigated by posting initial collateral by participants with the clearinghouse and the meeting of margin maintenance requirements. In OTC derivatives markets, which would apply to our operations, counterparties may initially trade up to an agreed threshold of exposure, the margin threshold, and then one counterparty may invoke a margin call when the amount of its exposure to the other counterparty exceeds the threshold. In addition to this, the factors that the BoZ will utilise in determining counterparty risk are as follows: - A commercial bank's compliance levels in relation to monetary ratios: - A commercial bank's credit history in terms of any default on the overnight lending window; and - Supervisory reports.
(3) There is a small element of settlement risk (Herstatt risk) as is the case in any foreign exchange operation due to time differences.	(3) These are delivery versus payment issues. The master dealing agreement should stipulate the counterparties' obligations.
(4) Swaps may not be used for swift operations because they take two days to effectively affect liquidity.	(4) Since we are using the monthly average reserve money target, we have to ensure that the settlement date is before the month-end. In an interest targeting regime, they can be used at a time when no swift action is required (See Appendix II for use of FX swaps in an interest targeting regime.)
(5) Swaps may be less desirable due to their limited catchment since only commercial banks are the only eligible participants. The securities market is more open to the rest of the economy which makes it more efficient and competitive.	(5) The attributes of an FX swap are similar to a repurchase transaction in the manner of its implementation and area of catchment.
(6) Only a few banks may sufficiently have foreign exchange on hand to act as counterparties. Smaller banks may not effectively participate due to the cost disadvantage i.e. cost of obtaining foreign exchange in the international market.	(6) The bigger banks are the main holders of domestic liquidity (about 80%) and are the most effective contributors to our OMO.
(7) Swaps may effectively influence the exchange rate due to a strong announcement effect (Hooyman, 1993).	(7) Forward rates are not good predictors of the direction and even the magnitude, of the expected change in the current spot exchange rate. Helliwell (2002) and Manuell (2001) argue that forward rates are poor predictors of future exchange rates. This can be attested by fact that the forward rates portrayed on Tables 4a and 4b are nowhere close to the actual spot rates. In this regard, it would be important to clearly inform the market participants that the forward rate is by no means an indicator of where the central bank expects the rate to be.

Table 4a: Forward Rates Vs Spot Rates on Date of Maturity

Forward Rates for 25 June 2009 and Spot Rates on the Date of Forward Contract's Maturity

Tenor	Forward Dates	Forward Rates	Spot Rates
3 Months	23.09.09	5,443.90	4,622.19
6 Months	22.12.09	5,664.70	4,663.65
1 Year	25.06.10	6,275.73	5,150.52

Note: The spot exchange rate for 25 June 2009, was K5,268.45/US$

Table 4b: Forward Rates Vs Spot Rates on Date of Maturity

Forward Rates for 25 June 2010 and Spot Rates on the Date of Forward Contract's Maturity			
Tenor	Forward Dates	Forward Rates	Spot Rates
3 Months	23.09.10	5,296.51	4,833.96
6 Months	22.12.10	5,696.51	4,656.88
1 Year	25.06.11	5,489.53	4,855.11

Note: The spot exchange rate for 25 June 2010, was K5,150.52/US$

VI Using Foreign Exchange Swaps in the Zambian Context.

In terms of the monetary policy framework, FX swaps can be used by central banks that target interest rates or inflation as reflected in Appendix II. Hooyman (1993) outlines that FX swaps can also be used as money market instruments in less developed countries that:

- wish to conduct monetary policy in a market-oriented manner;
- target a monetary aggregate;
- do not have a well-developed market for short-term securities; and
- have deep spot and forward foreign exchange markets, a factor considered to be the most binding criterion.

Even if the prescription is to use swaps in a monetary aggregate regime because they impact on reserve money, they can also be effective in an interest rate targeting setting. Their purpose will be to manage liquidity to influence interest rates in the appropriate direction. As regard the foreign exchange market, it is fair to point out that there has been an improvement in development of the spot and forward segments overtime.

Further, there are a number of important factors that have to be taken into account when using swaps as follows:

1) The healthy level of the international reserves gives the central bank the necessary muscle to undertake FX swaps.
2) The intention for using swaps should be clear from the outset. In the Zambian case, swaps should be used for liquidity management purposes. Thus, in line with the BoZ September 2008 report, foreign exchange swaps are more of money market instruments targeted for liquidity management and not designed for foreign exchange management objectives including moderating volatility of the exchange rate. However, caution must be exercised due to the announcement effect that can influence the rate in the market.
3) Undertaking longer term swaps would be synonymous to being a financing facility. Tenors of more than 6 months may be too long as conditions in foreign exchange market are very dynamic.
4) Using swaps under OMO implies that that these products are being used at the initiative of the central bank and not the commercial banks. This would entail that all banks have access to the instrument when BoZ is in the market and would be informed via an OMO Statistical Release.
5) The effective use of swaps requires price stability, depth of the underlying forward market as well as ready and available quotes.
6) Since our market is normally liquid, the norm would be to sell foreign exchange in the first leg. In other jurisdictions where FX swaps are used, the monetary framework in place is either interest rate or exchange rate targeting; the money markets are expected to be constantly short. In these circumstances, the first leg of the operation involves the supply of domestic liquidity to the money markets by buying foreign exchange and the

active trading of the foreign currency which is received. (See Appendix II for other country experiences).

7) Since our open market operations are skewed towards mopping up funds, using FX swaps would directly impact our international reserves. The use of swaps, where the first leg involves the sale of foreign exchange, should be done in close liaison with the Reserves Management Unit because the foreign exchange which will be used will emanate from our international reserves, particularly the operational balance (working capital). It also has to be clearly understood whether or not the foreign exchange supplied by BoZ in these operations continues to count as the central bank's asset.

8) Under OMO, the market would determine the interest rates they want to use in arriving at the swap points. The spot rate and the number of days used for the computation of swap points would be disseminated by the central bank. The rest would depend on convention. The interest rates that will be used by the central bank will serve as a benchmark in the pricing mechanism. Therefore, those commercial banks that submit swap points which are very far from the benchmark points are likely to have unsuccessful applications.

Using the 90 day example, the benchmark swap points would be 175.45 determined as follows:

$$\text{Swap point} = 5{,}268.45\frac{[(0.137129(90/365)) \quad (0.00198(90/360))]}{[1 \quad (0.00198(90/360))]} = 175.45$$

9) When would it be ideal to use Foreign Exchange Swaps? The temporary nature of swaps makes them suitable both for liquidity management and influencing interest rates in a particular direction by creating a temporal market imbalance. For instance they can be used for mitigating unanticipated or seasonal factors such as periods of tax payments or heavy Government spending.

VII Recommendations

This paper makes the following recommendations:

1) FX swaps should be introduced as an additional monetary policy tool but they should be used sparingly in close liaison with the Foreign Exchange Dealing Unit and the Reserves Management Unit.

2) Using swaps under OMO implies that that these products should be used at the initiative of the central bank and not the commercial banks.

3) The intention for using FX swaps should be clear from the outset. In the Zambian case, swaps can be used for liquidity management purposes. FX swaps are more of money market instruments targeted for liquidity management and not foreign exchange management objectives including moderating volatility of the exchange rate.

4) FX swaps should be conducted for periods of 180 days or less, due to the large uncertainties that normally exist in the longer term. For a start, their use should be mostly for periods less than a month and it is important that the short term money market yield curve is developed to facilitate the orderly pricing of those instruments of these tenors.

5) The temporary nature of FX swaps makes them suitable both for liquidity management or influencing interest rates in a particular direction by creating a temporary market

imbalance. Their short term nature would enable them to smoothen intra month fluctuations in liquidity. Therefore, as the BoZ fully moves towards interest rate targeting, FX swaps may be effective instruments to seriously consider.

VIII. Conclusion

This paper has explored the possibility of using FX swaps as additional monetary policy tools of in Zambia. Swaps have been used worldwide by central banks for influencing the liquidity of domestic markets, managing international reserves and nurturing domestic financial markets though their use is slowly declining. In the Zambian context, the current level of reserves permits the inclusion of FX swaps, as an additional instrument but they have to be used sparingly. It then has to be clearly spelt out that their purpose is for managing domestic liquidity. In this vein, they should be used at the central bank's initiative under OMO. In this way they can be used for neutralising unanticipated or seasonal flows such as periods of corporate tax payments or heavy Government spending. However, it is important that use of FX swaps be coordinated with the function of foreign exchange trading and the reserves management.

A number of factors contribute to the motivation of using FX swaps in the implementation of monetary policy. These instruments can be used in both an interest and monetary aggregate targeting regimes; they are cheaper than term deposits and repurchase transactions; they are flexible and reversible; they can be used where there is limited depth in the domestic securities market while the foreign exchange market is very liquid; and they do not exert direct influence on the spot exchange rate.

In summary, BoZ should consider having FX swaps in its OMO toolkit but prominence should be given to repurchase transactions and deepening the financial markets.

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Appendix I

In a low interest environment, the depreciation in the exchange rate would be less. Similarly, we make a cost comparison of Swaps and OMO deposits.

Forward Rates

The 90 day forward exchange rate

$$F = 5{,}150.52 \frac{(1 \quad (90/365) \quad 0.048927)}{(1 \quad (90/360) \quad 0.001300)} = 5{,}210.96$$

In the above scenario, if BoZ's objective was to withdraw (inject) K5.0 billion from the money market on 25 June 2010, it would have entailed selling (buying) US$ 970,775.77. With this transaction, the intended amount would have been withdrawn (injected) with an obligation of acquiring (relinquishing) the foreign currency 90 days later for K5,058,676,888.92. The cost (revenue) would be K58,676,888.92. The same procedure is applied to 180 days and 365 days and the costs and revenue are reflected in the table below.

Table 5: Forward Rates and Cost/Revenue Implications of Foreign Exchange Swaps

Description	K/US Dollar	USD T-bill Interest Rate (%)	ZMK T-bill Interest Rate (%)	Interest Cost/Revenue (ZMK)
Spot Ex Rate	5,150.52	-	-	58,676,888.92
3Month Fwd Ex Rate	5,210.96	0.130	4.8927	141,649,583.29
6Month Fwd Ex Rate	5,296.51	0.200	5.9532	328,881,607.83
1 Year Fwd Ex Rate	5,489.53	0.290	6.8910	

If by comparison the BoZ undertook contractionary operations under OMO of the same tenors using the prevailing on Treasury bills since the longest operation conducted so far is for 60 days, the following costs would have emerged. Withdrawing K5.0 billion for 3, 6 and 12 months would have resulted in the following costs:

Table 6: Cost Implications of OMO Deposits

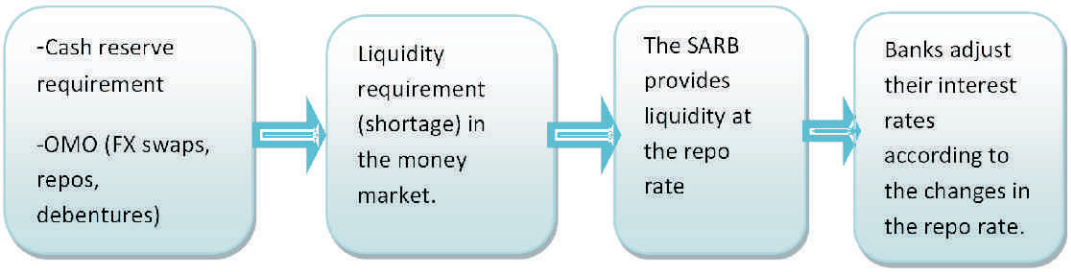
Tenor	Interest Rate	Principal ZMK	Interest Cost ZMK
90 days	4.8927%	5,000,000,000.00	60,320,958.90
180 days	5.9532%	5,000,000,000.00	146,791,232.88
365 days	6.8910%	5,000,000,000.00	344,550,000.00

From the information provided in the table above, the swaps appear less expensive than OMO deposits.

Appendix II

1. South Africa

The South African Reserve Bank (SARB) conducts monetary policy within an inflation targeting framework. The current target is for CPI inflation to be within the target range of 3 to 6 per cent on a continuous basis. According to SARB (2011), the Reserve Bank implements monetary policy by regulating the money supply by influencing its cost. In order to achieve this, the Reserve Bank conducts open market operations to create a liquidity shortage in the money market. To this end, the bank uses its own debentures, longer term repurchase transactions and FX swaps. The reserve bank then refinances the commercial banks at the repo rate, that is, the fixed interest rate determined by the monetary policy committee. This is the price at which the central bank lends cash to the banking system, has become the most important indicator for short-term interest rates. This repo rate is meant to exert an influence on the interest rates charged by banks, the general level of interest rates in the economy and consequently other economic aggregates such as money supply, bank credit extension and ultimately the inflation rate. The monetary policy framework can be presented as follows as depicted by the SARB:



The repo rate has an influence on market rates by affecting the marginal cost of funding and reflecting the SARB's stance on monetary policy.

With the FX swaps (US dollar for rand), in normal conditions, the SARB (2011) highlights uses them to withdraw liquidity from the money markets on a temporary basis. The swaps are short term targeted at smoothing intra-month fluctuations in liquidity with maturities before the month-end. In June 2010, the Reserve Bank reported difficulties in the management of overall liquidity conditions due to reduced participation in debenture auctions. In August 2010, the reserve bank started to use longer-term foreign exchange swaps with maturities of up to 12 months as instruments of managing money market liquidity more effectively. The consequence of conducting longer-term foreign exchange swap transactions to siphon funds from the banking system is that the Bank will reflect an overbought forward position on its monthly releases of official gold and foreign exchange reserves.

2. Switzerland

The Swiss National Bank's (SNB) primary goal is to ensure price stability in order to create a conducive environment for economic growth. According to the SNB website, monetary policy strategy consists of three elements. Firstly, as mentioned before, the SNB is responsible for maintaining price stability. Secondly, it bases its monetary policy decisions on a medium-term inflation forecast. Thirdly, it sets an operational target range for its chosen reference interest rate, the three-month Swiss Franc Libor. Using Open Market

Operations, the central bank steers the three month libor indirectly by regulating liquidity in the short term money market. In the 1980s and 1990s the SNB mainly used foreign exchange swaps as the main instrument for managing bank reserves. Currently, in the implementation of monetary policy, the SNB relies heavily on the repurchase transactions. On occasion, the SNB does use other instruments such as foreign exchange spot and forward transactions, foreign exchange swaps and the purchase or sale of securities in Swiss Francs. With particular regard to swap transactions, the SNB normally selects maturities of between one week and six months. However, since conditions on the Swiss Franc money market have improved and the demand for EUR/CHF foreign exchange swaps has fallen, the use of foreign exchange swaps have been discontinued with effect from 25 January 2010. Despite this development, the foreign exchange swap still remains a tool for monetary policy.

3. Norway

In Norway, monetary policy, the monetary policy wing is formulated to contribute to balanced economic developments and to the attainment of the inflation target. The key policy rate, which is the interest rate on banks deposits in Norges Bank, is the most important monetary policy tool. This key rate influences short-term money market rates. Norges Bank (2009) explains that it can also opt to use foreign exchange swaps to supply krone liquidity to the banking system. Foreign exchange swaps can also be used if the fixed-rate loans (F-loans) supplied by the central bank are insufficient to meet the demand from the banks. Foreign exchange swaps can also be used to supply liquidity in foreign currency (normally USD) to Norwegian banks but this is reserved for extraordinary circumstances (very special situations) based on an assessment of the stability of Norwegian financial markets and the Norwegian payment system. Maturities for foreign exchange swaps vary and depend on the liquidity situation in the banking system. Prices for foreign exchange swaps are normally determined by means of multiple-rate auctions.

4. Reserve Bank of Australia

The Reserve Bank of Australia is responsible for the formulation and implementation of monetary policy. According to the Reserve Bank of Australia, the stance of monetary policy is expressed in terms of a target for the cash rate, the interest rate on unsecured overnight loans between banks. The Reserve Bank Board determines the target cash rate at its monthly monetary policy meeting. The Reserve Bank undertakes both outright transactions and repurchase agreements in its open market operations. Until the mid-1980s, the Banks open market operations were conducted exclusively relied on outright transactions in Commonwealth Government Securities (CGS). Throughout the 1990s, repurchase agreements became an increasingly important instrument.

Despite the broadening of the range of domestic securities in which the Reserve Bank reports that it is willing to deal, increases in the size of the Banks balance sheet coupled with greater seasonal concentration of flows between the Bank and the private sector has meant that the Bank has had to augment its open market operations with foreign exchange swaps. These swaps are however not conducted frequently and are for short periods. From the data collected from the Reserve Bank of Australia on Open Market Operations, the Reserve bank has only conducted two swaps since August 2009.

5. Reserve Bank of New Zealand

The Reserve Bank of New Zealand reports that it uses monetary policy to maintain price stability as defined in the Policy Targets Agreement (PTA). The current PTA requires the

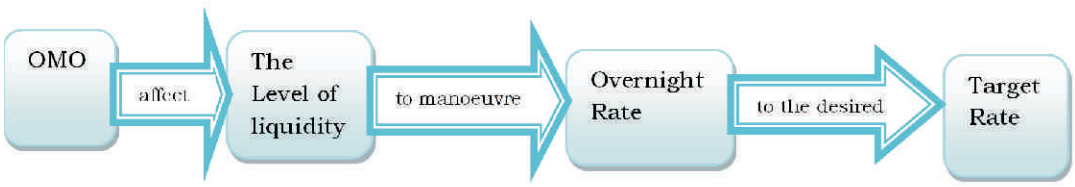
Bank to keep inflation between 1 and 3 per cent on average over the medium term. The Bank implements monetary policy by setting the Official Cash Rate (OCR), which is reviewed eight times a year.

The Reserve Bank (2009) elaborates that its Domestic Markets Section is responsible for implementing monetary policy. It forecasts both the Crown's and the Reserve Bank's liquidity flows, conducts daily Open Market Operations (OMO), including FX swaps and repurchase transactions, and provides standby facilities for cash and government bonds. The Bank uses FX swaps for liquidity operation. These are transacted for value date 'tomorrow', 'spot' or can be 'forward starting'. The term of FX swaps transacted for liquidity operations is predominantly one day to six month period. However, the Bank may also transact in longer dated FX swaps.

6. The ECB and the Fed

The interbank market plays a crucial role in the implementation of monetary policy in the Eurozone and the United States. Bartolini and Prati (2003) highlight this role in this arena where banks lend on an unsecured basis to each other mostly on an overnight basis. They emphasize that there are four main reasons which drive these transactions, that is, to meet customer originated transactions, their own speculative needs for liquidity, reserve requirements as well as to offset unforeseen reserve imbalances. In the Eurozone and the US, the ECB and the Fed target the Euro Overnight Index Average (EONIA) rate and the effective federal funds rate, respectively. By controlling the liquidity in the interbank market, the two central banks influence their overnight rates[2] toward their desired levels, that is, the minimum bid rate on the Eurosystem's main refinancing operations and the federal funds target rate for the Fed. Changes in policy rates, in turn, are implemented by the two central banks through a change in current liquidity conditions, or by a commitment to change future conditions to levels supporting a new desired level for market rates.

From the foresaid, FX swaps can be used in OMO to influence liquidity in the desired direction so that the overnight rate is steered in the desired direction towards the target rate.



Since 2008, the Fed has informally adopted a corridor system which relies on interest rate on reserves to help keep federal funds rate above its zero lower limit.

7. The Corridor System

In a corridor system, the central bank selects a target for the overnight policy rate that is consistent with its inflation and economic growth targets. OMO, where FX swaps can be used, is directed at influencing liquidity levels in the banking system. Thereafter, the central bank has to set up a lending facility where overnight loans are supplied at a fixed interest rate. "The lending facility rate is set above the target policy rate to impose a penalty on the banks that borrow from the central bank rather than from the interbank market" (Khan 2010,

[2]These are transaction weighted rates that banks charge each other on interbank loans

p13). The last factor considered is the establishment of a floor of the corridor and the rate attached to it has to be below the overnight policy rate. This floor can be perceived in two ways. Firstly, it is an avenue where excess reserves can be deposited overnight at a fixed interest rate. This rate is meant to encourage banks to trade in the interbank market rather than depositing funds with the central bank as it is below the target policy rate. Secondly, the deposit rate can be viewed as interest paid on reserves.

The overnight policy rate is meant to fluctuate within this corridor. When banks are in deficit, they have no incentive to pay more than the overnight lending rate and when they in a surplus there is no reason for them to trade at rate lower than the deposit rate.

CHAPTER SEVEN

Inflation and Economic Growth in Zambia: A Threshold Autoregressive (TAR) Econometric Approach

By

Andrew Phiri[1]

Abstract

This study examines threshold effects of inflation on economic growth for the Zambian economy using quarterly data collected between 1998 and 2011. The study applies a threshold autoregressive (TAR) model and the conditional least squares (CLS) estimation technique to achieve its objectives. The paper attempts to identify an optimal inflation level at which the adverse effects of inflation on economic growth are subdued, or at which the positive effects of inflation on economic growth are maximized. In this respect, the paper estimates an inflation threshold level of 22.5% for the observed data. These results indicate that economic growth in Zambia can be stimulated even in a moderately high inflation environment. Particularly, causality analysis identifies credit and the exchange rate developments as being crucial channels towards ensuring enhanced economic performance in the Zambian economy.

I. Introduction

The study of inflation is essential for any economy whose primary monetary policy objective is price stability. In Zambia, the central bank has been granted exclusive responsibility of maintaining price stability by the Bank of Zambia Act No. 43 of 1996. The implementation of price stability-focused macroeconomic objectives is based on the popular presumption that low levels of inflation should instantaneously result in an economic environment that is conducive for the attainment of increased economic policy effectiveness and efficiency. Through the establishment of a low inflation environment, it is inexplicitly assumed that the Bank of Zambia can acquire better control and alignment of stabilization policies even in the presence of macroeconomic shocks. Henceforth, price stability is not deemed as being isolated in itself, as this policy objective stems from the consideration that the Bank of Zambia can best contribute to maximizing social welfare and promoting economic growth through the practical achievement of price stability (Juhasz, 2008).

The concept of price stability indirectly prioritizes the Bank of Zambia's central role in ensuring that inflation is attained and maintained within a certain mean or targeted steady-state equilibrium level. Ideally, this equilibrium inflation level is supposed to be at par with an inflation target set by the Government. This article is primarily motivated by the lack of

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empirical evidence which defines the most efficient inflation rate at which the Bank of Zambia should maintain inflation.

Generally, the available literature tends to, more often than not, support the intuition that inflation is detrimental to economic growth and that price stability, defined as a low and stable inflation rate, is at least an important condition for the attainment of higher economic growth. Examples of the adverse costs of inflation on economic growth are not difficult to find in the academic literature. For instance, high inflation can interfere with the price signaling mechanism, resulting in a misallocation of resources (Hodge, 2006). Inflation can reduce a country's international competitiveness by making exports expensive, hence impacting the balance of payments (Gokal and Hanif, 2004). Moreover, inflation can interact with the tax system to distort borrowing and lending decisions within the economy (Papapetrou, 2001).

Despite a number of shortcomings associated with the empirical revelations, studies frequently provide support for a negative relationship between inflation and growth, which is consistent with predictions of the theoretical literature. Taking the above mentioned into consideration, it can be deduced that low inflation is considered a necessary condition for the attainment of increased economic growth and thus policymakers should direct their efforts at creating a low inflation environment. This statement in itself gives rise to a critical question; how low should policymakers keep inflation within a particular economy? Ideally, policymakers should opt to choose the inflation rate that maximizes output growth gains, or similarly, minimizes output growth losses. In this regard the breakpoint or inflation threshold established for the data can be thought of as the optimal level of inflation, at which monetary policy should strive to keep inflation in order to attain the maximal possible economic growth (Mubarik, 2005).

Determining threshold effects in the inflation-growth correlation can be useful for policy analysis. The threshold effects in the inflation-growth correlation suggest that if monetary policy were to achieve maximum economic growth, or similarly, minimal growth losses, the policy objectives should be concerned with keeping inflation at a specific threshold level. This implies that the goal of monetary policy should not necessarily be aimed at attaining and maintaining a low inflation but rather, monetary policy should focus on consistently holding inflation at a certain level. An important implication of the inflation threshold is that it represents that inflation level at which the economic welfare gains are maximized or the inflation level at which welfare losses are minimized. It is via this implication that an established inflation threshold of inflation has direct relevance towards the conduct of monetary policy in an economy (Singh and Kalirajan, 2003).

Even though the described investigations into the relationship between inflation and economic growth signify an important focus area of academic research for the conduct of monetary policy, no available research seems to exist for the exclusive case of the Zambian economy. This study aims at filling the void in the literature. The remainder of the study is organized as follows. The following section provides the literature review to the study. The third section of the paper outlines the empirical framework to be used in the paper whilst the fourth section presents the data and estimation results of the study. The paper is concluded in section five in the form of policy implications and recommendations of the study.

II. Literature Review

Recently, an escalating body of academic research suggest that inflation and growth may be positively or insignificantly related up to some inflation threshold, of which beyond, this relationship alters such that inflation begins to adversely affect economic growth. This

ideology relates to the possibility of a nonlinear correlation between the two macroeconomic variables which in early studies was captured through the use of spline (continuous piecewise) regression functions. Fischer (1993) was among the first to econometrically acknowledge such nonlinearity by observing that the marginal effects of inflation on economic growth fluctuate across escalating bands of inflation ranges. Other studies which concluded similar observations include Bruno and Easterly (1995), who established that a number of economies can withstand moderate inflation rates of about 20 to 30% without suffering any undesirable consequences on growth, but once inflation reaches some critical high level (which the authors approximate to be 40%), then inflation may prove unfavourable for economic growth. Ghosh and Phillips (1998) ascertain that at low levels (which the authors establish to be in the region of 2-3%) inflation may be helpful for economic growth; while at higher levels the adverse effects of inflation begin to gradually emerge. However, a notable shortcoming with the studies of Fischer (1993), Bruno and Easterly (1995) and Ghosh and Phillips (1998) is that the suggested breakpoints are established by judgment rather than through an empirical search which makes it difficult to pinpoint the exact optimal inflation rate associated with these studies.

Nonetheless, seminal works by Sarel (1996) and Khan and Senhadji (2001) were the first to identify exact inflation breakpoints or thresholds in the inflation-growth correlation. These influential studies took into account the fact that the exact threshold level of inflation is unknown and conducted a search among a predetermined range of possible breakpoints for an optimal inflation level at which economic growth is maximized. This empirical 'breakthrough' set a trend for studies that were concerned with either establishing inflation thresholds in pragmatic data or incorporating inflation thresholds into theoretical frameworks. These studies identify country specific and panel-data empirical approaches into investigating threshold effects in the inflation-growth nexus. Whilst country specific studies estimate thresholds for data pertaining to an individual economy, panel data studies opt to segregate the data into observations of industrialized and non-industrialized economies, before providing threshold estimates for each of the sample groups.

As more evidence emerges on inflation thresholds estimates for country-specific studies, certain biasness can be ascribed towards the relatively higher inflation thresholds estimated for grouped non-industrialized economies in panel data studies. For instance, Zambia, South Africa, Ghana, Nigeria, Jordan, Bangladesh, Pakistan and Malaysia have been categorized as non-industrialized economies in the panel data studies of Khan and Senhadji (2001), Drukker et al (2005), Mi (2005) and Kremer et al,(2009). In conducting empirical investigations for these specific economies (with the exception of Zambia for which no country-specific empirical evidence currently exists), the obtained thresholds are of a lower value in comparison to those obtained in the aforementioned panel data studies (see table 1 in the Appendix). Possible attributes of this inconsistency include the grouping of economies with vast differences in 'inflation experiences' and the generalization of the estimated threshold for the entire group of observations, of which the result may well be driven by the high outliers (Temple, 2000). Hence, country-specific studies can be deemed as providing more reliable inflation threshold estimates in comparison to panel data studies due to homogeneity in the estimation process.

Nonlinearities in the relationship between inflation and growth have also emerged in the theoretical literature. Contributions include Gillman, Harris and Matyas (2001) who developed a model of endogenous growth in which money and capital are incorporated into a credit exchange technology. In this model, the initial rate of inflation increases capital accumulation but as inflation continue rising, the adverse effects of inflation on capital accumulation begins to emerge[2]. However, these adverse effects diminish at high rates of

2Specifically, initial rates of inflation produce a Tobin (1965)-type positive effect on economic growth whereas higher rates result in a negative effect of inflation on economic growth similar to that realized in Stockman (1981)

inflation as a result of the optimizing agents' increasing reliance on the credit technology. The authors verify that the calibrations of the theoretical model comply with Asian Pacific Economic Cooperation (APEC) and Organisation for Economic Cooperation and Development (OECD) data. In separate studies, Huybens and Smith (1999) and Bose (2002) proposed a dynamic general equilibrium model of endogenous growth in which credit market imperfections rise due to asymmetric information between lenders and borrowers in the capital market. A rise in inflation reduces the funds available for lending while simultaneously altering the behaviour of lenders such that the adverse effects of inflation are magnified and a critical level or threshold effect is obtained. Hung (2005) expands on Bose (2002) by including non-productive consumption loans into a model of asymmetric information. These loans allow for the concurrent existence of positive and negative effects of inflation on capital accumulation and economic growth resulting in two thresholds in the relationship. For inflation rates below the first threshold, either negative or positive effects may be dominant. Above the first threshold, the magnitude of the negative effect of inflation increases until a second threshold is attained of which beyond this level, the significance of the negative effect dampens.

The theoretical and empirical propositions associated with the existence of an exact threshold level of inflation integrates contradictory arguments advanced by structuralist and monetarist schools of thought[3]; by adhering to the idea that low inflation may initially be supportive of growth gains but once the economy achieves faster growth then inflation can be deemed as being detrimental towards the sustainability of such growth (Ahmed and Mortaza, 2005). From an empirical point of view, Sarel's (1996) model framework and estimation technique is commonly used for estimating thresholds for single-country case studies (i.e. Ahmed and Mortaza (2005); Mubarik (2005); Frimpong and Oteng-Abayie (2010); Salami and Kelikume (2010); and Phiri (2010)) whereas Hansen's (2000) threshold autoregressive (TAR) specification tends to be applied to panel data-sets (i.e. Khan and Senhadji (2001), Rousseau and Wachtel (2002), Barnes and Duquette (2002) and Mi (2006)). In order to draw more precise comparisons with the obtained results from previous panel data studies, the paper opts to estimate an inflation threshold for Zambian data within Hansen's (2000) framework. Such an empirical exercise may be regarded as a more reliable attempt in "sifting the wheat from the chaff" with regards to making comparisons between threshold estimates for single-country evidence of Zambia against its panel data counterpart studies. Besides, Sarel's (1996) empirical framework fails to take into account for inference problems associated with the estimation of the unknown threshold estimate. On the other hand, Hansen's (2000) framework circumvents these problems.

III. Empirical Framework

It has become standard practice in the literature to econometrically quantify inflation thresholds in the inflation-growth nexus by making use of Hansen (2000)'s threshold autoregressive (TAR) econometric model. Although the TAR model is informed by the theoretical inflation threshold growth model, it does not exactly correlate in functional form to the theoretical models and can be best thought of as a reliable representation of the theory's predictions (Barnes, 2001). In its base form, the TAR model assumes the following regression function:

[3]With respect to the inflation-growth nexus, structuralists believe that inflation is essential for economic growth, whereas this argument is countered by monetarists who view inflation as detrimental to economic growth

$$Y_t = \beta_{i1} X_t I.(\tau \leq \pi^*) + \beta_{i2} X_t I.(\tau > \pi^*) + \xi_t \quad \ldots\ldots\ldots\ldots \quad (1)$$

Where Yt represents a vector measuring the GDP growth rate and Xt is the vector of control variables including the inflation threshold variable τ with π^* denoting its threshold estimate. The paper's choice of dependent and explanatory variables is guided by Salai-I-Martin (1997) who runs a growth regression of plausible independent variables and concludes that the inflation rate, interest rate, investment, credit and exchange rate variables are appropriate explanatory variables to include in the growth regression. The logic of including these variables, according to Salai-I-Martin (1997), is that they tend to be cointegrated and produced minimal biasedness in the error terms of the growth regression.

Regime-switching of the data is facilitated by the indicator function, I(.) with the 'π_1' parameters denoting the autoregressive slopes when $\pi \leq \pi^*$ and 'π_2' when $\pi > \pi^*$. The error term π_t is assumed to be an independent and identically distributed, $N(0,\pi^2)$ process. Since the inflation threshold is unknown a-priori, regression equation (1) is estimated for different values of π^* which are chosen from an ascending range of possible threshold values and the optimal value of π^* is obtained by finding the value that maximizes the explanatory power of the regression (Sweidan, 2005). Based on the resulting vector of residuals obtained in equation (1), the residual sum of squares is computed as, $\pi^2(\pi^*) = \pi_t(\pi^*)'\pi_t(\pi^*)$; and the least squares (LS) estimator of π^* is attained by minimizing the following objective function:

$$\pi^* = \text{argmin}_{(\pi\pi\pi\pi\,\pi\pi)} \pi^2(\pi) \quad \ldots\ldots\ldots\ldots \quad (2)$$

Where the grid search region for the optimal threshold estimate is given by $\pi = [\pi^*_{min}, \pi^*_{max}]$,. Once π^* is obtained, the conditional-heteroskedastic covariance vector of slope coefficients is estimated as:

$$\beta(\tau) = \sum_{t=1}^{n} x_t(\tau) x_t(\tau)')^{-1} (\sum_{t=1}^{n} x_t(\tau) y_t) \quad \ldots\ldots\ldots\ldots \quad (3)$$

A particular econometric issue is associated with the estimation of threshold models. Inference methods need to be developed as to determine whether the threshold effect is statistically significant. Conventional tests of the null hypothesis of a linear model against the alternative of a threshold model have nonstandard distributions as the threshold parameter is not identified under the null hypothesis of linearity (Chan and Tsay, 1998). This results in the asymptotic distribution of the standard F-statistic used in the inference testing not being chi-square. Hansen (2000) suggests the circumvention of this problem via an estimation technique known as the conditional least squares (CLS) method. As a prior step to the estimation procedure, it must be determined whether an inflation threshold actually exists, that is, if the parameter coefficients are different from each other i.e. $\pi_{i1} \neq \pi_{i2}$. This hypothesis can be tested by a conventional F-test statistic. By denoting RSS0 as the residual sum of squares for the linear model, an F-test of the null hypothesis of a linear model is based on:

$$F_n(\tau) = [\sigma_n^2 - \sigma_n^2(\tau)]/\sigma_n^2(\tau) \quad \ldots\ldots\ldots\ldots \quad (4)$$

Hansen (2000) has shown that the conventional F-test has a nonstandard asymptotic distribution since the threshold parameter is not identified under the null hypothesis of linearity i.e. $\pi_{i1} = \pi_{i2}$. Hansen (2000) utilizes a bootstrap method to approximate the asymptotic distribution of the F-statistic. In view of existing threshold effects, a second consideration deals with whether the inflation threshold is statistically significant i.e. $\pi^* \neq \pi$. A likelihood ratio (LR) statistic is used to test the null hypothesis of $\pi^* = \pi$ and the resulting statistic is computed as follows:

$$LR_n(\pi) = [\sigma_n^2(\tau) - \sigma_n^2(\pi^*)]/\sigma_n^2(\tau) \quad \text{.....} \quad (5)$$

To construct asymptotic valid confidence intervals for the threshold parameter, Hansen (2000) suggests the inverting of the likelihood ratio (LR) statistic associated with the threshold parameter. A bootstrap method is used to simulate the asymptotic distribution of the likelihood ratio (LR) test by attaining the first-order asymptotic distribution, so that the p-values constructed from the bootstrap are asymptotically valid. The asymptotic distribution of the likelihood ratio (LR) is used to form valid asymptotic confidence intervals about the estimated threshold values (Lee and Wong, 2005). Hence, construction of confidence intervals is a natural by-product of the estimation method (Hansen, 2000).

One of the most important tasks for empirical analysts is to find evidence that any specified relationship discovered between inflation and economic growth is more than a correlation, and there is indeed a causal relationship in the background (Juhasz, 2008). Granger's (1969) theorem of causality is used as a means of examining the direction of causality between paired combinations of the time-series variables employed in the study. The vector autoregressive (VAR) model provides a natural framework to test Granger causality. Considering the following pair-wise VAR regressions:

$$Y_t = \sum_{i=1}^{k} \alpha_1 Y_{t-i} + \sum_{i=1}^{k} \alpha_2 X_{t-1} + \varepsilon_1 \quad \text{.....} \quad (6.1)$$

$$X_t = \sum_{i=1}^{k} \beta_1 X_{t-1} + \sum_{i=1}^{k} \beta_2 Y_{t-1} + \varepsilon_2 \quad \text{.....} \quad (6.2)$$

A π^2–test statistic is used to test following null hypothesis of no causality from Y to X as well as from X to Y:

H_0: $\pi_2 \pi\pi\pi\pi or \pi_2 \pi\pi\pi$ ..... (7)

Granger causality tests, as Toda and Phillips (1993) note, are valid asymptotically as π^2 criteria only when there is sufficient cointegration with respect to the variables whose causal effects are being tested. The cointegration aspects of the employed data are addressed in the following section of the paper.

IV. Data and Analysis

4.1 Data Description and Compatibility

The data utilized in the study were obtained from the World Bank database as well as from various publications from the Bank of Zambia annual reports and comprises of quarterly data for the periods ranging from 1998-2011. The data was collected in the spirit of Mutoti (2006), who encourages the use of data which corresponds to the monetary targeting and post liberalization era. The dataset consists of the annual growth in the gross domestic product (Δgdp); inflation in total consumer prices (π); the real interest rate (interest); the ratio of foreign direct investment to GDP (fdi); the ratio of exports to GDP (exp); domestic credit as a ratio of GDP (credit) and the real effective exchange rate (reer). Referring back to the TAR regression (1), the dependent variable, Y_t, is Δgdp, the threshold variable is represented by inflation (i.e.$\pi = \pi$) and the vector of explanatory variables in the growth regression is specified as:

$$X_t = (\pi^{\pi\pi\pi}, interest^{\pi\pi\pi}, fdi^{(+)}, credit^{(+)}, reer^{(+)}) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

Where the sign denoted in parenthesis represents the expected impact of the variable on economic growth as depicted in conventional growth theory. It is a well acknowledged fact that most economic time-series variables are non-stationary and tend to exhibit processes with a long memory of past errors. Based on economic theory, we can expect a set of economic variables to be related to each other, such that these variables don't drift away from each other.

However, economic time series variables tend to contain unit roots which are subject to fluctuations, such that random shocks to these time series variables usually have permanent effects (Cheung and Tan, 2000). Hence, the error terms produced by non-stationary time-series are not white noise processes and the statistical properties of regression analysis becomes 'spurious' or 'nonsense' (Malik and Chowdury, 2001).

To ensure the compatibility of the analyzed data in view of what could otherwise be spuriously correlated regressions, two statistical conditions must be satisfied. Firstly, all observed time series must be integrated of similar order I(1). Secondly, there should exist at least one cointegration vector which is representative of a combination of the observed macroeconomic variables. The integration properties of the variables are examined through the use of the Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP) unit root tests. The ADF unit root test is designed to accommodate autoregressive moving-average (ARMA) models with unspecified autoregressive (AR) or moving-average (MA) orders. For a given a time series variable Yt, the ADF test is based on the following test regression:

$$\Delta Y_t = \mu + \bar{t} + \alpha Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \zeta_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

Since it is widely believed that the ADF test does not consider the case of heteroskedasticity and non-normality frequently revealed in raw data of economic time-series variables, the PP test for unit root test has been also used in the empirical analysis. Moreover, ADF tests are unable to discriminate between non-stationary and stationary series with a high degree of autocorrelation and are sensitive to structural breaks which the PP test accounts for. In particular, where the ADF tests use a parametric autoregression to approximate the autoregressive moving-average (ARMA) structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression. Therefore, the PP test provides robust estimates over the ADF test and is based on the following test equation:

$$\Delta Y_t = \mu + \beta(t-\tfrac{1}{2}T) + \alpha Y_{t-1} + \zeta_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

The results of the unit root tests are presented in Table 2 below and the test statistics are compared to the critical values derived in Mackinnon (1996). With both a drift and a trend inclusive of a drift, the implemented Augmented Dicker-Fuller (ADF) and the Phillips and Person (PP) unit root tests confirm that all time series are integrated of order I(1) whilst retaining complete stationarity in their first differences.

Table 2: UNIT ROOT TESTS

	adf test statistics		*pp test statistics*		*decision*
	drift	*trend*	*drift*	*trend*	
Δgdp	1.34	-3.11*	-1.13	-3.11	I(1)
	(-8.05)***	(-7.93)***	(-8.05)***	(-7.93)***	
	-0.52	2.59	-0.52	-2.59	I(1)
	(-8.01)***	(-7.96)***	(-8.01)***	(-8.67)***	
Interest	-2.39	-2.74	2.14	-2.42	I(1)
	(-4.04)***	(-4.00)***	(-7.19)***	(-7.11)***	
Credit	0.77	-1.98	0.61	-1.71	I(1)
	(-3.56)***	(-3.52)**	(-5.17)***	(-5.11)***	
Fdi	-2.44	-2.51	-2.44	-2.51	I(1)
	(-7.91)***	(-7.81)***	(-7.91)***	(-7.81)***	
0reer	-0.89	-2.46	-0.89	-2.46	I(1)
	(-7.68)***	(-7.61)***	(-7.68)***	(-7.61)***	

Significance Level Codes:"***", "**' and '*' denote the 1%, 5% and 10% significance levels respectively. P-values are reported in (). The lag length for the time series associated with the ADF test is selected through the minimization of the AIC and BIC

The next step, into ensuring compatibility of the data is achieved via cointegration analysis. The existing number of cointegration vectors (r) within the system of the data is examined by two likelihood ratio tests as proposed by Johansen (1991):

The lambda-maximum test

This test is based on the log-likelihood ratio In[Lmax(r)/Lmax(r+1)] and is conducted for sequentially for r = 0,1,...,k-1. The test statistic involved is a maximum generalized eigenvalue. The test tests the null hypothesis that the cointegration rank is equal to r0 against the alternative that the cointegration rank is equal to r+1.

The trace test

The test is based on the log-likelihood ratio In[Lmax(r)/Lmax(k)], and is conducted sequentially for r = k-1,...,1,0.The involved test statistic is the trace of a diagonal matrix of generalized eigenvalues and is designed to test the null hypothesis that the cointegration rank is equal to r against an alternative of the cointegration rank being equal to k.

As shown below in Table 3, the computed Eigen and trace test statistics are able to reject the null hypothesis of less than two cointegration relations up to 5 percent significance level. Therefore, we can conclude that cointegration exists among the variables and the estimation of the econometric models described in the previous section can be conducted without concern for spurious results.

Table 3: JOHANSEN'S TESTS FOR COINTEGRATION VECTORS

h_0	h_1	*eigen statistic*	*99% CV*	*95% cv*	*trace Statistic*	*99% cv*	*95% cv*
$r \leq 5$	$r=5$ $(r \geq 6)$	0.24	11.65	8.18	0.24	11.65	8.18
$r \leq 4$	$r=4$ $(r \geq 5)$	6.33	19.19	14.90	6.57	23.52	17.95
$r \leq 3$	$r=3$ $(r \geq 4)$	9.34	25.75	21.07	15.91	37.22	31.52
$r \leq 2$	$r=2$ $(r \geq 3)$	23.30	32.14	27.14	39.20	55.43	48.28
$r \leq 1$	$r=1$ $(r \geq 2)$	35.76***	33.78	33.32	76.96**	78.87	70.60
$r \leq 0$	$r=0$ $(r \geq 1)$	52.56***	44.59	39.43	119.52***	104.20	85.18

Significance Level Codes:"***",and "**' denote the 1% and 5% significance levels respectively. The alternative hypotheses of the trace tests are stated in parentheses

4.2 Threshold Regression Estimates

As a prior step to estimating the TAR model, the LR test for significant threshold effects was conducted. Owing to the relatively small sample size, the asymptotic p-values for the employed threshold tests are obtained by using 500 bootstrapped replications. The null hypothesis of linear framework is rejected at all significance levels and the results are reported at the bottom of Table 4. Hansen (2000) suggests eliminating the smallest and largest 5% of the data to allow for computation ease in searching for the optimum threshold point. By setting the search range for selecting a threshold between ?*min=7% and ?*max=28%, the optimal inflation threshold is established at 22.5%. However, it should be noted that the derived confidence intervals of the inflation threshold estimates are not rigid as they range from 16.9% to 24.8%. This implies that the inflation threshold of 22.5% represents an estimate which optimizes the explanatory power of the TAR regression rather than estimate optimal level of inflation which would maximize growth. In particular, the obtained threshold estimates seems to be biased towards the upper portion of the confidence intervals, thus suggesting that optimal inflation threshold may infact be at a lower level than that estimated within the regression. This explanation is warranted as average inflation levels in Zambia have undergone dramatic declines within the last decade and this has been accompanied with steadily improved economic growth (Mutoti, 2006).

TABLE 4: CLS Estimation of Threshold Regression

	dependent variable: Δgdp	
explanatory variable	$_{1i}$	$_{2i}$
	-0.02	0.10
	(0.03)	(0.11)
Interest	-0.01	0.05
	(0.02)	(0.04)
fdi	0.05	-1.30
	(0.04)	(0.39)
Credit	0.08	0.15
	(0.03)*	(0.23)
Reer	0.48	0.69
	(0.11)**	(0.07)*
% of observations	59	41
threshold value	22.5% {16.9, 24.8}	
LR( )	94.04[0.00]***	
Jarque-Bera *test statistic*	p = 0.196	

Significance Level Codes: '***', '**' and '*' denote the 1%, 5% and 10% significance levels respectively. t-statistics which are based on errors corrected for heteroscedasticity are reported in () and the asymptotic bootstrapped p-values of the LR statistic is reported in ( ). The critical values for the LR(l) test statistic are: 1%(78.20), 5%(76.48); and 10%(74.33). The 90% confidence intervals for the inflation threshold estimate are given in {}.

The estimation results of the TAR model presented in Table 4 provide evidence of regime switching behaviour between inflation, economic growth and other growth determinants. For instance, only at very high levels of inflation (above inflation rates of 22.5%) are inflation and real interest rates found to be positively correlated with economic growth. However, this is accompanied with a negative effect of foreign direct investment on economic growth as is indicated by the negative coefficient on fdi in the higher regime of the TAR regression estimates. At moderate and low inflation rates (below inflation rates of 22.5%) the adverse effects of inflation and real interest rates begin to manifest on economic growth and foreign direct investment is positively correlated with economic growth. Overall, it should be noted that the coefficient signs of the variables in the lower regime are in alignment with their expected signs as discussed in the previous section of the paper. The opposite is also true as the coefficient signs of the variables in the lower regime seem to contradict growth theory, that is, with the exception of credit and reer which remain positively correlated with economic growth in either regime. In interpreting the above-discussed regression results, caution should be taken as the coefficients of inflation, interest rates and foreign direct investment are insignificant in both regimes. In addition, the coefficient on credit is only significant in the lower regime; that is at levels of inflation below 22.5%. Robustness of the results is ensured through computed errors corrected for heteroscedasticity as well as on a test for normally distributed errors via the Jarque-Bera test.

4.3 Granger Causality Analysis

Beyond correlation analysis, it would prove useful to examine causality between inflation, economic growth and the other included control variables. Taking into consideration the number of macroeconomic variables under consideration, 21 pair-wise regressions can be derived for Granger (1969) causality analysis which is investigated in a bi-causal sense. Since it is well-known that the Granger (1969) causality tests are sensitive to the number of employed lags, two-system VAR specifications are initially run for the 21 pair-wise regressions of variables so as to determine the appropriate number of lags to be used in each system. The Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC) are used to determine the optimal lag lengths of the VAR systems in which the minimized values of the information criterion are preferred and selected.

As discussed by Nguyen and Wang (2010), causality analysis of inflation, economic growth and other growth determinants is sensitive to structural breaks. This study ensures robustness of the causality tests to structural breaks by limiting the analysis over a singular monetary regime period. A standard F-distribution test is used to evaluate the significance of granger causality against a derived ? 2 critical statistic. Table 5 presents the results of the performed Granger (1969) tests and a flow diagram of the obtained results is sketched in Figure 1.

Table 5: Granger Causality Tests

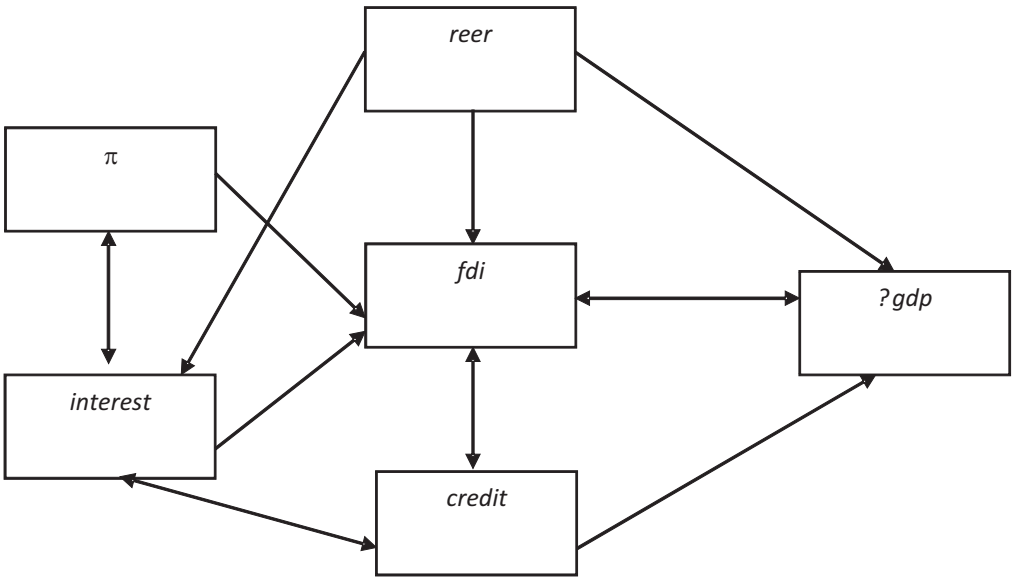
Y	*x*	*causality [y->x]*		*causality [x->y]*	
		f-stat	*critical value*	*f-stat*	*critical value*
Δgdp		0.26	1.57	1.11	1.57
	interest	0.40	2.32	0.38	2.32
	fdi	1.38*	0.36	0.641*	0.36
	credit	0.02	2.62	10.42*	2.62
	reer	0.65	1.88	3.59*	1.88
	interest	4.86*	0.04	0.41*	0.04
	fdi	1.15*	0.26	0.17	0.26
	credit	0.82*	0.38	0.12	0.38
	reer	0.58	15.95	0.06	15.95
interest	*fdi*	5.19*	0.33	0.30	0.33
	credit	1.94*	0.52	1.13*	0.52
	reer	0.07	0.75	1.69*	0.75
fdi	*credit*	2.14*	0.32	2.30*	0.32
	reer	0.92	3.38	6.89*	3.38
credit	*reer*	0.44	2.08	5.79*	2.08

Asterisk denotes that the null hypothesis of no causality is significantly rejected

Contrary to popular economic belief, the results presented in Table 5 above establish no direct causal effects between inflation and economic growth. Given that conventional growth theory further identifies investment as the intermediary channel in transmitting effects between inflation and economic growth, it is not surprising to find causality running from ≤ and fdi, on one hand, and bi-directional causality between fdi and Δgdp, on the other. An additional identified channel through which inflation may affect GDP growth is via the credit channel. The bi-directional causal effects established between inflation and interest rates concur with the results presented in Odihambo (2009) and may be considered equivalent to confirming the fundamental monetarist's view of inflation dynamics within the Zambian macroeconomy. Both inflation and interest rates are also found to be indirectly linked with Δgdp via univariate causality running through the channels of credit and fdi.

Another observation worth highlighting from Table 5 concerns the unidirectional causality which reer exerts upon interest, fdi and Δgdp. These interactions emphasize the importance of exchange rate developments relative to financial sector stability (as proxied by the real interest rate) as well as to stability in the real economy (as proxied by the GDP growth rate). Even though no direct causality effects exist between □□and reer, the aforementioned variables are linked through the real interest rate. The remaining causality results can be summarized as follows. Univariate causality runs from credit to Δgdp and thus depicts that the availability of credit to the private sector is instrumental in enhancing economic growth and exports of goods and services to foreign economies. In turn, developments in the credit sector are enhanced by developments in inflation, interest rate and foreign direct investment as is implied by the uni-directional causality from the latter variables to the former.

Figure 1: FLOW DIAGRAM OF CAUSALITY ANALYSIS



A ⟷ *Indicates bi-directional causality between two variables.*
B ⟶ *Indicates the direction of uni-directional causality from one variable to another.*

Conclusion

Motivated by the lack of empirical evidence assessing the correlation between inflation and economic growth in Zambia, this study undertook an analysis of inflation threshold effects in a growth regression for the Zambian economy. An inflation threshold estimate of 22.5% is estimated for the data and is relatively higher than those obtained for developing countries in previous panel data studies. Generally, the results imply that moderate inflation may not be harmful towards economic growth in Zambia and supports the notion that monetary policy efforts should be more directed towards credit and exchange rate developments instead of actively targeting a predetermined inflation level.

In light of the above mentioned, the granger-causality analysis presented in the study may further reveal some important policy considerations. For instance, the overriding goal of disinflation could be accomplished through exchange rate stabilization and credit sector developments which were found to be related with foreign direct investment and GDP growth. This assessment is derived based on the strong causal effects observed from exchange rate movements and credit towards real interest rates which, in turn, are found to be strongly correlated with the inflation rate. Besides, the inflation rate in the Zambian economy is found to be directly related to directly influencing the climate for foreign direct investment without exerting a direct influence on credit and the exchange rate.

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Appendix

Table 1: Summary of Reviewed Studies

type of study	*Author(s)*	*sample period*	*no. of countries investigated*	*estimated inflation threshold*
panel data studies	*Sarel (1996)*	1970-1990	87	8%
	Khan and Senhadji (2001)	1960-1998	140	11%
	Drukker et. al. (2005)	1950-2000	138	19%
	Mi (2006)	1961-2004	118	14%
	Kremer et. al. (2009)	1950-2004	124	17%
country specific studies	*Sweidan (2004)*	1994-2002	*Jordan*	2%
	Ahmed and Mortaza (2005)	1981-2005	*Bangladesh*	6%
	Hussian (2005)	1973-2005	*Pakistan*	5%
	Munir and Mansur (2009)	1970-2005	*Malaysia*	3.89%
	Frimpong and Oteng-Abayie (2010)	1960-2008	*Ghana*	11%
	Salami and Kelikume (2010)	1970-2008	*Nigeria*	8%
	Phiri (2010)	2000-2010	*South Africa*	8%

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