

Central Bank Intervention and Exchange Rate Volatility in Zambia

By

Jonathan Mpundu Chipili,
Bank of Zambia
Financial Markets Department
Lusaka, Zambia

AERC Research Paper 268
African Economic Research Consortium, Nairobi
April 2014

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 – City Square
Nairobi 00200, Kenya

Printed by: Signa; Press (K) Ltd
P.O. Box 12714
Nairobi, Kenya

ISBN 978-9966-023-29-0

© 2014, African Economic Research Consortium.

Contents

List of tables

List of figures

Abstract

Acknowledgements

1.	Introduction	1
2.	Objectives of the study	3
3.	Exchange rate policy in Zambia	4
4.	Intervention strategy	6
5.	Theoretical framework	9
6.	Empirical literature review	12
7.	Estimation procedure and empirical results	14
8.	Conclusion and policy implications	18
	Notes	19
	References	20

List of tables

1.	Exchange rate movement and intervention	7
2.	Weekly exchange rate and intervention statistics (1996-2010)	16

List of figures

1.	Weekly average BoZ exchange rate movement	5
2.	BoZ intervention and exchange rate movement	7

Abstract

The study analyses the impact of central bank intervention on the volatility of the exchange rate in Zambia over the period 1996-2010. The empirical findings reveal a statistically weak negative impact of intervention on exchange rate volatility. Further, there is little empirical support for a central bank decision to intervene in the foreign exchange market on account of volatility in the exchange rate. The results seem to suggest that the Bank of Zambia should not rely entirely on intervention to dampen volatility in the exchange rate; domestic policy changes are required to reinforce intervention. Triggers for intervention should also be re-examined within the context of the exchange rate policy objective.

Keywords: *Exchange Rate Volatility, Intervention*

JEL classification: *F30, F31*

Acknowledgements

This study benefited from comments made at the AERC conferences by resource persons and fellow researchers, as well as my colleagues in the Financial Markets Department at the Bank of Zambia. I remain indebted to the AERC for financial support rendered towards the completion of this study and my employer for all the support during this endeavour. Views expressed in this paper are entirely my own and do not in any way implicate either the AERC or the Bank of Zambia.

1. Introduction

Foreign exchange intervention is widely used by many central banks to achieve a particular objective. Countering market disorderliness, correcting exchange rate misalignment away from fundamental values, offsetting volatility in the (nominal) exchange rate, resisting short-term trends in exchange rates, accumulating official reserves, limiting exchange rate pass-through to prices and defending an exchange rate target are cited as some motivating factors for intervention (see Bonser-Neal, 1996; Baillie and Osterberg, 1997; Dominguez, 1998; Neely, 2000; Schwartz, 2000).

It is against this background that central banks all over the world strive to stabilize the exchange rate in order to mitigate the adjustment and uncertainty costs that a volatile exchange rate imposes on the economy. A volatile exchange rate causes undesirable changes in aggregate and sectoral output, the price level, volume of international trade and foreign investment (Chipili, 2010).

Many empirical tests regarding central bank intervention have been conducted on the deutschmark/US dollar and yen/US dollar exchange rates with very little work done on other currencies (Aguilar and Nydahl, 1998). The reason why these three currencies have been widely studied is because the authorities want to establish the effectiveness of intervention in achieving the intended policy objective. For example, the G-5 countries decided to use intervention to achieve an orderly depreciation of the US dollar against the deutschmark and yen during the Plaza period (1985-1987), and stabilize these currencies around their current levels during the Louvre period (1987-1989).

By and large, empirical evidence shows that, the effect of intervention on the level and volatility of the exchange rate is mixed, with overwhelming support for the leaning-against-the-wind proposition (Schwartz, 2000; Neil and Fillion, 1999). Comprehensive empirical evidence on the effectiveness of official intervention is provided by Dominguez (1998) and Edison (1993).

Available empirical work done in Zambia on the exchange rate has concentrated on analysing its factor determinants (Chipili, 1998; Mwenda, 1996; Mungule, 2004). The effect of the Bank of Zambia (BoZ) intervention as a policy instrument has received little empirical investigation. This study attempts to bridge this gap.

Thus, this study analyses the impact of the BoZ intervention on the volatility of the exchange rate and also assesses whether intervention is driven by volatility in the exchange rate. The study results reveal a weak negative impact of intervention on exchange rate volatility and that intervention is not necessarily driven by volatility in the exchange rate.

The rest of the paper is organised as follows. Section 2 outlines the objectives of the study. Section 3 briefly reviews Zambia's exchange rate policy. Section 4 presents

the BoZ's intervention strategy. The theoretical framework relating to intervention and exchange rate behaviour is given in Section 5, while Section 6 reviews the empirical literature on the impact of intervention on the exchange rate. The estimation procedure and empirical results, including data sources, are contained in Section 7. Section 8 concludes and provides policy implications of the study results.

2. Objectives of the study

This study attempts to test the hypothesis that intervention by the BoZ in the foreign exchange market stabilises the exchange rate. In particular, the study endeavours to establish:

1. The impact of the BoZ intervention on the volatility of the kwacha¹/US dollar exchange rate over the period April 1996 – December 2010; and
2. Whether volatility in the exchange rate influences the BoZ's decision to intervene in the foreign exchange market.

3. Exchange rate policy in Zambia

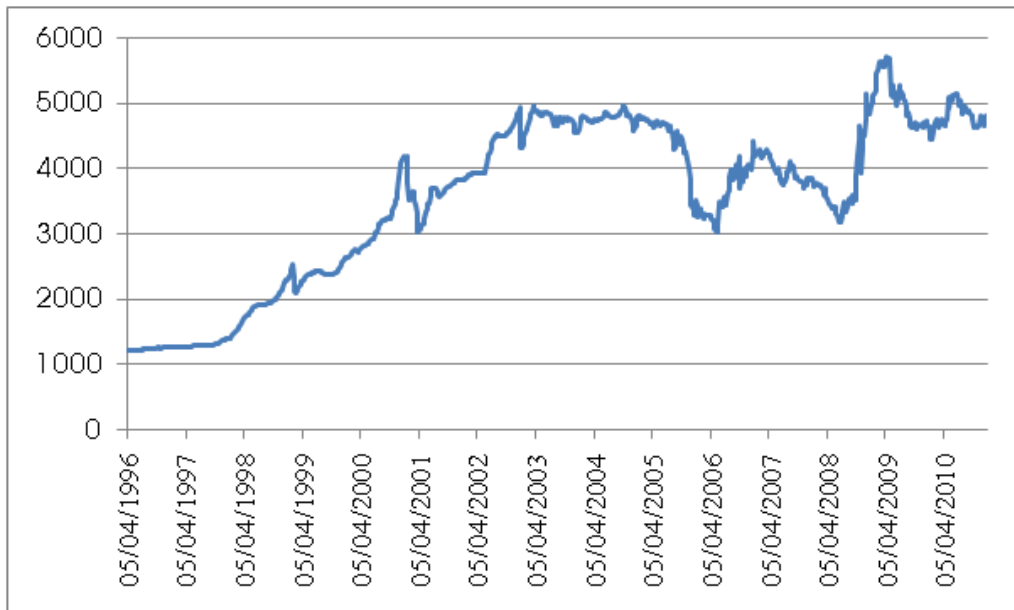
Increased exchange rate volatility, misalignment of the exchange rate from equilibrium levels for long periods, prolonged current account imbalances and the rise in capital mobility prompted most central banks, such as the Bank of Japan, Bank of England and most emerging economies in Latin America and Asia to manage exchange rates as opposed to having a freely floating exchange rate arrangement.

Likewise, Zambia adopted a managed float exchange rate system in 1994, when the kwacha was made fully convertible. Prior to that, the exchange rate was fixed from the time of independence, in 1964. The kwacha was first pegged to the British pound sterling and subsequently alternated between the US dollar, Special Drawing Rights and a basket of currencies of major trading partners. However, between 1985 and 1987, the exchange rate was allowed to float, during which the Dutch auction system was used to allocate foreign exchange. Nevertheless, the Dutch auction system was abandoned in May 1987, due to excessive depreciation of the exchange rate, a reflection of the misalignment of the exchange rate, and inflationary pressures that arose from a depreciated exchange rate. Thereafter, the kwacha was fixed to the US dollar again and the Foreign Exchange Management Committee (FEMAC) undertook the allocation of foreign exchange. Between 1990 and 1991, a dual exchange rate system managed by FEMAC was adopted. The system included a retail window for importers, an open general licence (OGL) system and an official window with a lower rate. Later in 1991, the OGL and official exchange rates were unified. For most of 1992, the exchange rate was fixed, with the unified market rate determined as the weighted average of commercial bank and bureau de change market rates until 1994.

Consistent with the International Monetary Fund (IMF) classification of Zambia's post-1994 exchange rate system as initially independently floating and later as a managed float, the BoZ does not target the exchange rate and instead allows the exchange rate to be determined by market conditions. Thus, the exchange rate policy in Zambia is aimed at achieving a stable and competitive exchange rate consistent with macroeconomic conditions (Bank of Zambia Annual Reports, 1996-2010).

In terms of exchange rate behaviour, it is observed that the post-float period is distinguished by wide fluctuations in the exchange rate, with the kwacha exhibiting a rising trend with some volatility (Figure 1), similar to experiences of most countries that switch from fixed to floating exchange rate regimes.

Figure 1: Weekly kwacha/US dollar exchange rate



4. Intervention strategy

Consistent with the exchange rate policy, the BoZ interventions in the foreign exchange market are undertaken to smooth out short-term fluctuations in the exchange rate without influencing the underlying trend. This intervention strategy is in line with the independently floating and managed float exchange rate system classification by the IMF, which stipulates that interventions in the foreign exchange market by the central bank should be aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate rather than establishing a level for it.

The BoZ interventions in the spot foreign exchange market involve direct purchases and sales of foreign currency, mainly US dollars, the intervention currency. The BoZ also indirectly intervenes in the foreign exchange market by influencing money market liquidity conditions through instruments such as open market operations, reserve requirements and moral suasion (Bank of Zambia Annual Reports, 1996-2010).

The main sources of BoZ intervention funds include foreign exchange purchases from the market (i.e., export earnings) and donor inflows (balance of payments support). In terms of donor inflows, the government receives the local currency value of the balance of payments while the BoZ retains the foreign exchange. This transaction inevitably leads to an expansion in reserve money and, consequently, broad money. Given the monetary framework adopted by the BoZ, where monetary aggregates are used as the nominal anchor for monetary policy, the central bank seeks to sterilize liquidity arising from foreign exchange transactions whenever reserve money expansion exceeds the set target (Bank of Zambia Annual Reports, 1996-2010).

In terms of the actual BoZ intervention activities in the foreign exchange market, it is observed that the floating of the kwacha was accompanied by a rise in the frequency and scale of interventions by the BoZ. The bulk of the intervention by BoZ prior to April 1996 was mere onward re-sale of the surrendered foreign exchange proceeds by exporters, particularly Zambia Consolidated Copper Mines (ZCCM).² The BoZ interventions were intense between April 1995 and May 1996, when the BoZ used to intervene daily in the foreign exchange market. Prior to that (December 1993 to March 1995), the BoZ intervened three times a week and the volume of sales and purchases were lower compared with the April 1995 to May 1996 period.³ Increased interventions by the BoZ during that period were aimed at developing the inter-bank market, besides stabilising the exchange rate following the liberalization of the foreign exchange market. However, the presence of the BoZ in the foreign exchange market reduced drastically after April 1996, following the abolition of the ZCCM retention scheme and subsequent establishment of the interbank foreign exchange market (IFEM) system in July 2003.

Interventions in the foreign exchange market by the BoZ became limited and occasional, aimed at smoothing out short-term fluctuations in the exchange rate.

Table 1 and Figure 2 show the annual rate of change of the kwacha/US dollar and the volume of intervention in millions of US dollars (in absolute terms) between April 1996 and December 2010.

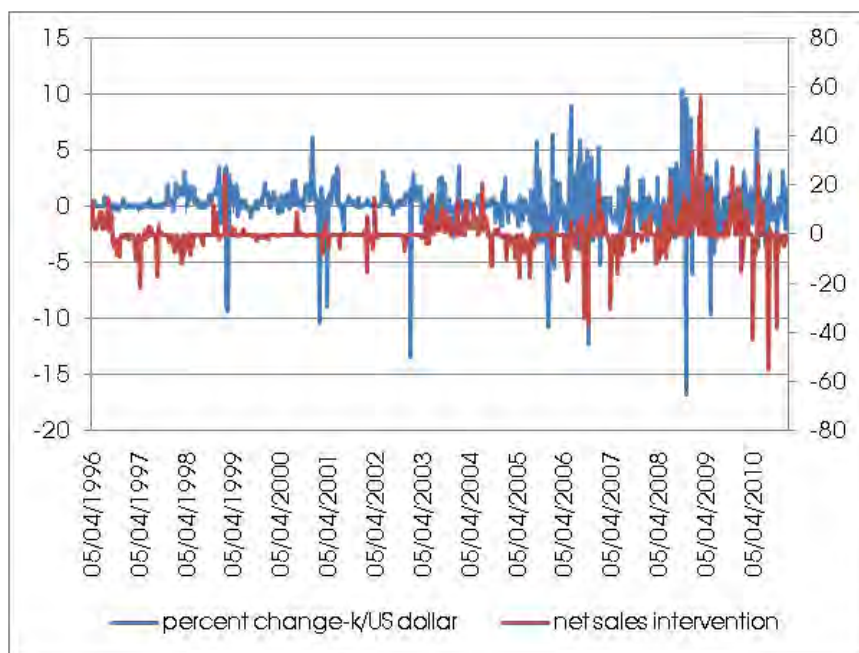
Table 1: Exchange rate movement and intervention

Period	% change in K/US dollar exchange rate	Intervention (million US dollars)
April-Dec 1996	4.2	55.9
1997	8.7	36.9
1998	63.7	30.8
1999	13.7	30.3
2000	58.4	52.8
2001	-3.1	89.0
2002	24.1	81.4
2003	-3.4	146.3
2004	1.6	96.7
2005	-26.6	123.3
2006	20.8	291.6
2007	-7.1	221.9
2008	27.3	314.5
2009	-4.4	435.0
2010	1.5	292.4

Source: Computed from BoZ Annual Reports and the Bank of Zambia Statistics Fortnightly Bulletins

Note: A positive % change in the exchange rate implies a depreciation while a negative % change in the exchange rate implies an appreciation

Figure 2: BoZ intervention and exchange rate movement



A casual inspection of the data in Table 1 and Figure 2 reveals that the relationship between intervention and exchange rate movement is not systematic over the sample period. Further, although not apparently clear in Figure 2, there are periods when large changes in the exchange rate are followed by large changes, and small changes followed by small changes. This is an indication of volatility clustering, implying the presence of autoregressive or generalized conditional heteroscedasticity (ARCH/GARCH). Section 7 aims to confirm the conclusion drawn about the effect of the BoZ intervention based on Table 1 and Figure 2 through a formal investigation.

5. Theoretical framework

The exchange rate is affected by both fundamental and transitory reversible factors. The effect of intervention on exchange rate volatility depends on the extent to which the former influences the causes underlying the latter. Volatility in the exchange rate is caused by volatility in market fundamentals such as money supply, income and interest rates as well as changes in expectations due to new information and speculative bandwagons (Bonsear-Neal, 1996).

Dominguez (1998) argues that, it is standard to model the exchange as a forward-looking process that is expectationally efficient with respect to public information. In this regard, the current spot exchange rate can be represented as:

$$s_t = (1 - \delta) \sum_{k=0}^{\infty} \delta^k E_t(z_{t+k} | \Omega_t) \quad (1)$$

where s_t is the logarithm of the current exchange rate; δ is the discount factor such that $\delta = \beta / (1 + \beta)$ where β is the interest semi-elasticity of money demand in the monetary model; z_t is a vector of exogenous driving variables; E_t is the expectations operator; and Ω_t is the information set in period t .

According to Equation 1, intervention operations denoted as I_t provide relevant information to the market, and, as such, enlarge the market's information set Ω_t and, consequently, influence the spot exchange rate as $\Omega_t < \Omega_t + I_t$.

Intervention is narrowly defined as any official sale or purchase of foreign assets against domestic assets in the foreign exchange market (Dominguez, 1998). In general, foreign exchange market intervention is any transaction or announcement by an official agent of government intended to influence the value of the exchange rate. Foreign exchange intervention can either be sterilized or unsterilized. Sterilized intervention involves an offsetting domestic asset transaction that leaves the monetary base unchanged, whereas unsterilized interventions alter the monetary base. Sterilized intervention does not affect prices or interest rates directly. On the other hand, unsterilized intervention changes the interest rate differentials and, consequently, the exchange rate. According to the monetary model of the exchange rate determination, unsterilized intervention affects the exchange rate in proportion to the change in the relative supplies of domestic and foreign money.

Neil and Fillion (1999) argue that, there are at least four mechanisms by which sterilized intervention might affect the exchange rate. These are signalling, portfolio-balance, noise-trading and liquidity approaches. The asset market model, abstracted from Aguilar and Nydahl (1998), is used to explain how intervention affects the exchange rate through these various channels. In this model, the exchange rate is specified as

$$s_t = f_t + \alpha [E_t (s_{t+1} | \Omega_t) - s_t] \quad (2)$$

where f_t is current period fundamentals; and, s_t , E_t and Ω_t are as earlier defined.

According to Equation 2, the exchange rate at time t is determined by the current period fundamental factors and the expected capital gain $[E_t (s_{t+1} | \Omega_t) - s_t]$ of holding the currency until the next period. Equation 2 can be simplified further to obtain the following expression

$$s_t = \frac{1}{1 + \alpha} \sum_{j=0}^{\infty} \left[\frac{1}{1 + \alpha} \right]^j E (f_{t+j} | \Omega_t) + \left[\frac{1}{1 + \alpha} \right] E (b_{t+1} | \Omega_t) \quad (3)$$

Everything else is as defined in above except b_{t+1} which represents a rational bubble. According to Equation 3, the exchange rate is expressed as the expected present value of future fundamentals $(\frac{1}{1 + \alpha} \sum_{j=0}^{\infty} \left[\frac{1}{1 + \alpha} \right]^j E (f_{t+j} | \Omega_t))$ and a bubble $(\left[\frac{1}{1 + \alpha} \right] E (b_{t+1} | \Omega_t))$. Using this model, intervention affects the exchange rate through various channels as follows.

Signalling approach

The signalling approach works on the assumption of information asymmetry where the central bank has an information advantage over market agents with regard to future monetary policy or the long-run equilibrium value of the exchange rate. By intervening in the foreign exchange market, the central bank changes market agents' expectations of future fundamentals by providing information about future monetary policy. When the central bank buys domestic currency, a contractionary future monetary policy is signalled to the market: this induces agents to revise their expectations of the future exchange rate, given that the exchange rate is forward-looking as shown in Equation 3, resulting in an appreciation. The signalling theory predicts that the exchange rate will depreciate following a sterilized purchase of a foreign currency by the central bank, if the purchase is assumed to signal a more expansionary domestic monetary policy. A depreciation of the exchange rate occurs because the central bank does not alter the domestic monetary base to avoid the agents misconstruing it as a change in the monetary policy stance.

Intervention in this context is effective if and only if the signal about future monetary policy arising from intervention is credible.

Portfolio-balance approach

Through the portfolio-balance channel, investors diversify their holdings among domestic and foreign assets as a function of both expected returns and the variance of returns. Intervention, therefore, affects the level of the exchange rate through the portfolio-balance channel by altering the relative supply of foreign and domestic securities, compensating investors by a risk premium for holding foreign securities, provided that these securities are imperfect substitutes. This creates disequilibrium in the investors' portfolio. Equilibrium is restored through a change in the risk premium, which causes a change in asset returns imbedded in capital gains in Equation 2, thereby producing changes in the spot exchange rate. In an event that intervention increases the supply of domestic — relative to foreign — assets held by the market, a higher expected return on domestic assets will be demanded on domestic assets for the market to willingly hold them, resulting in the depreciation of the domestic currency. However, if these securities are perceived to be perfect substitutes, intervention is predicted to have no effect on the exchange rate.

Noise-trading approach

In this approach, the exchange rate is allowed to move away from its fundamental value due to a rational bubble, which reflects the behaviour of “noise traders”.⁴ Noise traders can, therefore, move asset prices away from their fundamental equilibrium when induced by the central bank through intervention to either buy or sell currency. This affects the noise traders' perception of the trend in the exchange rate changes. Intervention in this case either increases or reduces exchange rate volatility by leaning with or against the wind, respectively, when noise traders move the exchange rate away or towards its fundamental value. Theory is ambiguous on the effects of central bank intervention on exchange rate volatility. Central bank intervention can reduce exchange rate volatility if it helps resolve market uncertainty about future fundamentals and policies, or if it reduces the likelihood of speculative attacks on the currency and vice versa.

Liquidity approach

This approach presupposes that intervention might have a direct impact on the exchange rate volatility, but not its level. Intervention is expected to have a short-term, flow-driven impact on the exchange rate if the size of intervention is large relative to the market turnover within a brief period of time. The size of the intervention influences fundamentals, which, in turn, affect the current exchange rate. In addition, intervention reduces the risk of market making through the provision of more liquidity on the market, which induces dealers to provide additional liquidity, thereby affecting fundamentals and, ultimately, the exchange rate.

6. Empirical literature review

The literature on the effect of central bank intervention on exchange rate volatility is extensive and the results of empirical research are mixed. The variation in empirical results is explained by intervention strategies used by central banks (sterilized or unsterilized), type of currencies studied, sample period investigated, models used and the amount of intervention involved.

During the 1980s and early 1990s, efforts by researchers concentrated on analysing the effect of sterilized intervention on the level of the exchange rate and the channels through which it works. Over the past few years, focus has shifted to analysing the effect of intervention on exchange rate volatility.

Intervention has been found to be effective through both signalling and portfolio-balance channels (Neely, 2000). However, Rogoff (1984), Humpage (1988), Obstfeld (1989), Klein and Rosengren (1991) and Ghosh (1992) have generally found little empirical support for the liquidity approach due to the fact that the size of the intervention by central banks is relatively smaller than the total market liquidity. Conversely, Dominguez and Frankel (1993) found empirical support for the portfolio-balance approach. Due to diverse empirical results regarding these two channels, Galati and Melick (1999) conclude that, there is a general consensus in the literature that intervention does not affect exchange rates through the portfolio channel in favour of the signalling approach despite the view that signals from intervention are not always clear and credible with respect to future monetary policy.

Dominguez and Frankel (1993) provide leading evidence of intervention (both coordinated and non-coordinated) having a significant impact on the level of exchange rate. Later studies that confirm Dominguez and Frankel's finding include Catte et al. (1994) for the yen/US dollar and DM/US dollar exchange rates. However, intervention is found to be ineffective in influencing the level of the exchange rate (see Aguilar and Nydahl, 1998). Similarly, Aguilar and Nydahl (1998), in examining the impact of Riksbank's intervention on the krona/US dollar and DM/US dollar exchange rates over 1993-1996 period, find weak evidence of intervention affecting the level of the exchange rates over the whole study period, although in some sub-periods, a significant relationship is observed.

Several measures of volatility have been employed in analysing the impact of intervention on the volatility of the exchange rate. The commonly used measures of volatility are GARCH and implied volatility methods. Baillie and Humpage (1992) find a positive relationship between the Federal Reserve, Bank of Japan and Bundesbank intervention and the conditional volatility of the DM/US dollar and yen/US dollar

exchange rates, respectively. Hung (1997), using the noise-trading model, discovered that intervention reduced both the yen/US dollar and DM/US dollar exchange rate volatilities during the period 1985-1986 but increased them in the period 1987-1989. However, Aguilar and Nydahl (1998) find little empirical support for intervention systematically decreasing exchange rate volatility of the krona/US dollar and DM/US dollar exchange rates. Baillie and Osterberg (1997), in a two-country inter-temporal asset-pricing model, find evidence of intervention increasing rather than reducing exchange rate volatility in the yen/US dollar forward market besides affecting the conditional mean of the risk premium.

The empirical evidence on the effect of intervention on implied volatility of the exchange rate is also mixed. Bonser-Neal (1996) and Bonser-Neal and Tanner (1996) establish varied effects of the Federal Reserve, Bundesbank and Bank of Japan intervention on the volatility of the exchange rate across time. Intervention had no significant effect on the volatility of the exchange rate during the Plaza period, but increased it during the Louvre period, with some evidence of a reduction in volatility of the DM/US dollar exchange rate but no effect on the yen/US dollar exchange rate during the post-Louvre period.

Although intervention has been found to generally increase volatility in the exchange rate, Dominguez (1993) argues that the impact of intervention on exchange rate volatility depends on how central banks conduct them. Officially announced interventions reduce volatility while undetected interventions by the market increase volatility. Galati and Melick (1999) find perceived intervention insignificant in influencing the exchange rate level and the skewedness of the probability density functions while it increases traders' uncertainty about future exchange rate movements.

Triggers for intervention by central banks have also been examined empirically. Baillie and Osterberg (1997) find intervention to be granger caused by high volatility of the changes in the nominal exchange rate while weak support for intervention granger causing the conditional variance of the changes in the nominal exchange rate is reported. In addition, the authors find little evidence of granger causality running from implied volatility to intervention; a similar conclusion arrived at by Dominguez (1993; 1998). Evidence of central banks basing intervention decisions on volatility in the exchange rate is found (see Chaboud and LeBaron, 1999). Dominguez (1998) find that intervention is correlated with volatility although causation runs from intervention to volatility. The Federal Reserve intervened when it was observed that an intervention would be successful given the market conditions that existed over the September 1993 and April 1996 period (Galati and Melick, 1999). On the other hand, the Bank of Japan is seen to intervene in response to deviations of the exchange rate from its implicit target level.

Generally, doubt has been cast on the efficacy of intervention. Intervention does not appear to affect fundamental economic determinants of the exchange rate. It also has weak long-run effects on the exchange rate (see Chaboud and LeBaron, 1999; Edison, 1993; Klein and Rosengren, 1991). In the short-term, central bank intervention is often associated with sharp price movements in currency markets. It is argued that intervention would only have lasting effects if it was accompanied by domestic policy changes (Schwartz, 2000).

7. Estimation procedure and empirical results

Model specification

Similar to Simatele (2004), GARCH (1,1) model is used to determine the impact of the weekly BoZ intervention on the volatility of the nominal spot kwacha/US dollar over the period April 1996-December 2010 as follows:

$$\Delta s_t = \alpha_0 + \sum_{i=1}^q \alpha_i \Delta s_{t-i} + \phi NIV_t + \varepsilon_t$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta h_{t-1} + \phi NIV_t + v_t \quad (4)$$

$$\varepsilon_t | I_{t-1} \sim (0, h_t)$$

where s_t is the logarithm of the kwacha/US dollar exchange rate such that Δs_t is returns in the kwacha/US dollar exchange rate; NIV_t is net intervention sales by the BoZ to the market; ε_t is residuals used to compute h_t ; h_t is conditional variance (volatility) of s_t derived from the GARCH (1,1) model; v_t is standardised residuals; I_{t-1} is the information set at time $t - 1$; and q is the lag length.

To ensure that the GARCH model is well-specified, $\alpha_0 > 0, \alpha_1 > 0$ and $\beta \geq 0$ must hold. The degree of volatility persistence is captured by $\alpha_1 + \beta$ such that the closer the sum is to 1, the more persistent the shocks are on volatility.

A GARCH(1,1) model specification as opposed to higher order GARCH specifications is chosen as it is parsimonious and, thus, avoids over-fitting the model and violation of non-negativity constraint. In addition, it sufficiently characterises the behaviour of the exchange rate, i.e., leptokurtic, asymmetry and volatility clustering (see Brooks, 2006). Further, the study models volatility of the kwacha/US dollar exchange rate using a GARCH (1,1) process based on the evidence of volatility clustering deduced from the descriptive statistics presented in Figure 2 and Table 2. Moreover, econometric models such as ARCH-type introduced by Engel (1982) and Bollerslev (1986) have been empirically useful in modelling temporal evolution of volatility.

The underlying theory suggests that, intervention in Equation 4 will reduce volatility if

the sign on is negative and increase volatility if the sign on is positive. This model does not distinguish between sterilized and unsterilized interventions similar to the approach taken by Aguilar and Nydahl (1998) and Baillie and Osterberg (1997). Further, the study does not explicitly test the channel through which intervention works, but simply if intervention affects the exchange rate.

Further, the probit test is conducted to determine whether the BoZ interventions are driven by volatility in the kwacha/US dollar. Ramana and Samiei (2000) argue that probit models provide a useful econometric technique for identifying triggers for intervention. Accordingly, intervention defined as D_t is a dummy variable that takes the value of one when intervention occurs and zero otherwise. D_t is said to respond linearly to variables such as the extent of the absolute change in the exchange rate during a specified period as below

$$D_t = \theta' x_t + u_t \quad (5)$$

where x_t is the set of exogenous variables that influence the response variable, u_t is an error term, and θ is the parameter to be estimated. In this study, D_t (denoted as IDUMMY) is created by modifying the intervention data series, such that D_t is assigned the value of one in weeks when intervention occurred and zero otherwise. A one lagged period value of D_t is included in the model as an explanatory variable to capture intervention clustering, i.e., whether intervention in one period is necessarily followed by another intervention in the following period.

Data sources

The intervention data series used in the empirical test are defined as net sales (sales less purchases) in millions of US dollars. Similar to Kamil (2008), actual values of intervention in US\$ million are used in this study despite the series being discontinuous.⁵ Since foreign exchange interventions are carried out in US dollars, the exchange rate studied is the nominal weekly average spot BoZ-mid kwacha/US dollar (K/US\$). Both the exchange rate and intervention data are obtained from the Bank of Zambia Statistics Fortnightly Bulletin (1996-2010).

Statistical properties of variables

Before empirical tests of equations 4 and 5 are conducted, various descriptive statistics for the exchange rate and intervention data series are examined, which provide insights into the characteristics of the data series under investigation. Table 2 reflects these descriptive statistics.

The presence of skewedness and kurtosis in the exchange rate and intervention data series are detected. Further, the Jarque-bera statistic confirms at 1% significance level that the two data series are not normally distributed. The kurtosis statistic reveals

the presence of leptokurtosis in the weekly change in the kwacha/US dollar exchange rate and intervention data series. Thus, evidence of leptokurtosis in the exchange rate suggests that there exists temporal clustering in the variance of the exchange rate where large changes are followed by large changes and small changes are followed by small changes and therefore warrant the use of a GARCH model. In addition, the presence of kurtosis in the data series indicates the likelihood that the market attributes to very large exchange rate movements in either direction in the near future. Finally, the BoZ was a net seller of foreign exchange over the sample period with an average intervention size of about US\$2.0 million per week.

Table 2: Weekly exchange rate and intervention statistics (1996-2010)

Statistic/Variable	S_t	ΔS_t	FXP_t	FXS_t	NI_t
Mean	3575.7	0.002	1.49	1.99	0.50
Maximum	5704.5	0.014	55.0	56.0	56.0
Minimum	1230.3	-0.167	0.00	0.00	-55.0
Standard deviation	1242.6	0.021	4.64	5.07	7.13
Skewedness	-0.59	-1.48	5.94	4.96	0.10
Kurtosis	2.13	17.04	49.66	38.48	22.12
Jarque-Bera	69.3	6599.9	74288.2	43477.5	11713.2
Probability	0.00	0.00	0.00	0.00	0.00
Sum			1149.6	1535.0	385.4

Source: Authors' Computations

Note:

- S_t = weekly average spot BoZ-mid kwacha/US dollar exchange rate (raw series)
- ΔS_t = change in natural logarithm of weekly average spot BoZ-mid kwacha/US dollar exchange rate
- FXP_t = weekly BoZ purchase intervention
- FXS_t = weekly BoZ sales intervention
- NI_t = weekly BoZ net intervention (-)

Empirical results

The results of the estimated Equation 4 are reported below:

$$\Delta S_t = 0.0004 + 0.285 \Delta S_{t-1} - 0.0000434 NI_t$$

(5.83)*** (9.71)*** (-1.91)*

$$h_t = 1.26e-06 + 0.295 + 0.645 h_{t-1} - 6.00e-06 NI_t$$

(2.45)** (6.81)*** (20.38)*** (-0.48)

$v_t Q = 7.3160[0.397]$; $= 1.2434[0.990]$; J-B = 19914.64[0.000]; ARCH LM = 0.0007[0.9796]; Log L = 2345.5; AIC = -6.087; SBC = -6.039

The lag length for $v_t Q$ and $v_t^2 Q$ is at 7 according to Tsay (2002), i.e., $k = \ln(T)$, where k is lag length and T is the number of observations. Bollerslev-Wooldridge robust standard errors and variance are used to take care of the non-normality property of the

data series and ensure consistent coefficient estimates are derived; z-statistics are reported in parenthesis, p-values in square brackets. ***, **, * refer to statistical significance at 1%, 5% and 10%, respectively.

The model is well-specified according to the diagnostic tests. The empirical results indicate persistence of volatility in the exchange rate series evidenced by the significance of the coefficient on the lagged value of the volatility term. While the results suggest that BoZ interventions tend to reduce volatility in the kwacha/US dollar exchange rate, its impact is, however, small and the coefficient is statistically insignificant. On the other hand, net sales of foreign exchange in the market tend to appreciate the kwacha/US dollar exchange rate, even though the statistical significance at 10% level indicates a relatively weak relationship. One possible explanation for the weak relationship could be attributed to the small average size of intervention of about US\$2.0 million relative to average market turnover of about US\$20.0 million over the sample period. A low correlation of 0.127 between the BoZ intervention and volatility in the kwacha/US dollar exchange rate further supports the weak impact of intervention on volatility.

The weak impact of intervention on the volatility of the exchange rate established in this study is not unique but in line with Chaboud and LeBaron (1999), Edison (1993), and Klein and Rosengren (1991). Bonsear-Neal (1996) argues that the effect of intervention on the volatility of the exchange rate depends on the extent to which it influences the fundamental causes of the latter, a possible argument in the Zambian case.

Finally, the probit test result reported below reinforces a weak relationship between volatility in the kwacha/US dollar exchange rate and the BoZ decision to intervene in the foreign exchange market.

$$IDUMMY_t = -0.493 + 0.917 IDUMMY_{t-1} + 11.622 h_t$$

(-7.23)*** (9.75)*** (0.47)

Log likelihood=-482.8.

z-statistics are in parenthesis.

Contrary to our results, Ramana and Samiei (2000) established that the decision by the Japanese authorities to intervene in the foreign exchange market was influenced by excessive movements in the yen/US dollar exchange rate consistent with the official pronouncement. The significance of the coefficient on the lagged value of the intervention dummy variable at 1% level confirms that intervention by the BoZ in the foreign exchange market in one period is likely to be followed by another intervention in the following period (i.e., interventions occur in clusters).

8. Conclusion and policy implications

The study analysed the impact of the BoZ foreign exchange intervention on the volatility of the kwacha/US dollar exchange rate over the period 1996-2010 using weekly data. The GARCH framework was employed in assessing the impact of intervention on the volatility of kwacha/US dollar exchange rate while the probit model analysed the extent to which volatility in the exchange rate is a factor in the intervention decision by the BoZ.

The empirical results reveal persistence of volatility in the exchange rate series and that, although interventions tend to reduce volatility in the exchange rate, its impact is weak. Further, evidence of BoZ's decision to intervene in the foreign exchange market on account of volatility in the kwacha/US dollar exchange rate appears weak.

Some important policy conclusions can be drawn from the empirical results obtained in this study. The empirical results reveal weak influence of intervention on the volatility of exchange rate. This could suggest that if the objective of the central bank is to reduce volatility of the exchange rate, intervention should not be taken as the sole policy instrument to achieve the desired results. Instead, the central bank would have to supplement intervention with other policy instruments. The choice of the instruments to use should be made in the context of their effectiveness to deal with volatility in the exchange rate. This, therefore, requires the central bank to identify the fundamental factors underlying volatility of the exchange rate so that appropriate instruments can be employed. This is an area for future research identified in this study. Moreover, Schwartz (2000) argues that domestic policy changes are required to re-enforce intervention in order to obtain desired results. Finally, a comprehensive re-examination of the foreign exchange intervention drivers is required.

Notes

1. The kwacha is the Zambian currency.
2. The foreign exchange in Zambia has traditionally been supplied by the copper mining sector (mostly by the now privatized ZCCM), which accounted for about 90% of total foreign exchange earnings. Up to 1984, all Zambian exporters surrendered foreign exchange earnings to the BoZ, which, in turn, allocated them to the market through an administrative arrangement. In 1984, non-copper exporters (i.e., non-traditional) were allowed to retain 50% of their export earnings. In 1992, non-traditional exporters were allowed 100% foreign exchange earnings retention. In April 1996, the ZCCM foreign exchange retention scheme was abolished. This meant that ZCCM could now trade foreign exchange directly in the inter-bank foreign exchange market. The retention scheme refers to the requirement by law at that time for ZCCM to surrender some of the total foreign exchange earnings to the BoZ and retain the rest for its own operational use.
3. All interventions undertaken by BoZ were pre-announced to the market and the market was informed of the change in the frequency of BoZ intervention.
4. Noise traders (chartists) are those traders whose demand for currencies or other assets is influenced by beliefs or sentiments that are not fully consistent with economic fundamentals. They base their expectations of future changes in the exchange rates on the behaviour of past values of the exchange rates.
5. Data gaps make the distribution of intervention to be concentrated around zero ("zero-inflated process") such that the relationship between intervention and its determinants is non-linear and the distribution of errors from regressions that include absolute intervention data may not be normal as per OLS assumption, especially in small samples.

References

- Aguilar, J. and S. Nydahl. 1998. "Central bank intervention and exchange rates: The case of Sweden". SverigesRiksbank, June.
- Baillie, R.T. and P.W. Osterberg. 1997. "Central bank intervention and risk in the forward market". *Journal of International Economics*, 43: 483-97.
- Baillie, R.T. and O.F. Humpage. 1992. "Post-Louvre intervention: Did target zones stabilize the dollar?" Working Paper No. 9203. Federal Reserve Bank of Cleveland.
- Bank of Zambia. Annual Reports. 1996-2010. Lusaka: Bank of Zambia.
- Bank of Zambia. Statistics Fortnightly Bulletins. 1996-2010. Lusaka: Bank of Zambia.*
- Bollerslev, T. 1986. "Generalized autoregressive conditional heteroskedasticity". *Journal of Econometrics*, 31: 307-27.
- Bonser-Neal, C. 1996. "Does central bank intervention stabilize foreign exchange rates?" Federal Reserve Bank of Kansas City, Economic Review, First Quarter.
- Bonser-Neal, C. and G. Tanner. 1996. "Central bank intervention and the volatility of foreign exchange rates: Evidence from the options market". *Journal of International Money and Finance*, 15, (6): 853-78.
- Brooks, C. 2006. *Introductory Econometrics for Finance*. Cambridge: Cambridge University Press.
- Catte, P., G. Galli, and S. Rebecchini. 1994. "Concerted interventions and the dollar: An analysis of daily data". In B.K. Peter, F. Papadia and F. Saccomanni, eds., *The International Monetary System*, pp. 201-39. Cambridge: Cambridge University Press.
- Chaboud, A. and B. LeBaron. 1999. "Foreign exchange market trading volume and federal reserve intervention". Federal Reserve System. Draft. July 14.
- Chipili, J.M. 1998. "A monetary approach to analyzing the floating exchange rate behaviour in Zambia, 1994-97". Master's Degree Dissertation, Department of Economics, University of Birmingham, United Kingdom.
- Chipili, J.M. 2010. "Macroeconomic effects of exchange rate volatility in Zambia". Department of Economics, University of Leicester, PhD Thesis.
- Dominguez, K. 1993. "Does central bank intervention increase the volatility of foreign exchange rates?". NBER Working Paper Series No.4532. National Bureau of Economic Research, Cambridge, MA.
- Dominguez, K. 1998. "Central bank intervention and exchange rate volatility". *Journal of International Money and Finance*, 18: 161-90.
- Dominguez, K. and J. Frankel. 1993. "Does foreign exchange intervention work?" Institute for International Economics, Washington, D.C.
- Edison, H.J. 1993. "The effectiveness of central bank intervention: A survey of literature after 1982". Special Papers on International Economics, 18, Princeton University.
- Engel, R. 1982. "Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation". *Econometrica*, 50: 987-1007.

- Galati, G. and W. Melick. 1999. "Perceived central bank intervention and market expectations: An empirical study of the yen/dollar exchange rate, 1993-96". BIS Working Paper No.77, October.
- Gosh, A. 1992. "Is it signalling? Exchange intervention and the dollar-deutschemark rate". *Journal of International Economics*, 32: 201-20.
- Humpage, O.F. 1988. "Intervention and the dollar's decline". Federal reserve Bank of Cleveland Economic Review, Quarter 2: 2-16.
- Hung, J.H. 1997. "Intervention strategies and exchange rate volatility: A noise-trading perspective". *Journal of International Money and Finance*, 12: 368-89.
- Kamil, H. 2008. "Is central bank intervention effective under inflation targeting regimes? The case of Colombia". IMF Working Paper No. WP/08/88. International Monetary Fund, Washington, D.C.
- Klein, W.M. and E.S. Rosengren. 1991. "Foreign exchange intervention as policy signal". New England Economic Review, May/June.
- Mungule, K.O. 2004. "The determinants of the real exchange rate in Zambia". AERC Research Paper No.146. African Economic Research Consortium, Nairobi.
- Mwenda, A. 1996. "Foreign exchange liberalisation in Zambia: Nature, performance and Prospects". Bank of Zambia International Conference on Economic Liberalization: Experiences and the Way Forward, Lusaka, 21-23 August.
- Neely, C. 2000. "The practice of central bank intervention: Looking under the hood". *Central Banking Quarterly Journal*, X1(2).
- Neil, B. and J.F. Fillion. 1999. "An intraday analysis of the effectiveness of foreign exchange intervention". Bank of Canada, Working Paper: 99-4, February.
- Obstfeld, M. 1989. "The effectiveness of foreign exchange intervention, NBER Working Paper Series No. 2796. National Bureau of Economic Research, Cambridge, MA.
- Ramana, R. and Samiei, H. 2000. "The yen-dollar rate: Have interventions mattered?" IMF Working Paper No. WP/00/95, June. International Monetary Fund, Washington, D.C.
- Rogoff, K. 1984. "On the effects of sterilized intervention: An analysis of weekly data". *Journal of Monetary Economics*, 14(2): 133-50.
- Simatele, M. 2004. "Financial sector reforms and monetary policy in Zambia". Department of Economics, Goteborg University, PhD Thesis.
- Schwartz, J.A. 2000. "The rise and fall of foreign exchange market intervention". *Journal of Business and Economic Statistics*, 7: 147-59.
- Tsay, R.S. 2002. *Analysis of Financial Time Series*. New York: John Wiley & Sons.

Other recent publications in the AERC Research Papers Series:

- Female Labour Force Participation in Ghana: The Effects of Education*, by Harry A. Sackey, Research Paper 150.
- The Integration of Nigeria's Rural and Urban Foodstuffs Market*, by Rosemary Okoh and P.C. Egbon, Research Paper 151.
- Determinants of Technical Efficiency Differentials amongst Small- and Medium-Scale Farmers in Uganda: A Case of Tobacco Growers*, by Marios Obwona, Research Paper 152.
- Land Conservation in Kenya: The Role of Property Rights*, by Jane Kabubo-Mariara, Research Paper 153.
- Technical Efficiency Differentials in Rice Production Technologies in Nigeria*, by Olorunfemi Ogundele, and Victor Okoruwa, Research Paper 154.
- The Determinants of Health Care Demand in Uganda: The Case Study of Lira District, Northern Uganda*, by Jonathan Odwee, Francis Okurut and Asaf Adebua, Research Paper 155.
- Incidence and Determinants of Child Labour in Nigeria: Implications for Poverty Alleviation*, by Benjamin C. Okpukpara and Ngozi Odurukwe, Research Paper 156.
- Female Participation in the Labour Market: The Case of the Informal Sector in Kenya*, by Rosemary Atieno, Research Paper 157.
- The Impact of Migrant Remittances on Household Welfare in Ghana*, by Peter Quartey, Research Paper 158.
- Food Production in Zambia: The Impact of Selected Structural Adjustments Policies*, by Muacinga C.H. Simatele, Research Paper 159.
- Poverty, Inequality and Welfare Effects of Trade Liberalization in Côte d'Ivoire: A Computable General Equilibrium Model Analysis*, by Bédia F. Aka, Research Paper 160.
- The Distribution of Expenditure Tax Burden before and after Tax Reform: The Case of Cameroon*, by Tabi Atemnkeng Johannes, Atabongawung Joseph Nju and Afeani Azia Theresia, Research Paper 161.
- Macroeconomic and Distributional Consequences of Energy Supply Shocks in Nigeria*, by Adeola F. Adenikinju and Niyi Falobi, Research Paper 162.
- Analysis of Factors Affecting the Technical Efficiency of Arabica Coffee Producers in Cameroon*, by Amadou Nchare, Research Paper 163.
- Fiscal Policy and Poverty Alleviation: Some Policy Options for Nigeria*, by Benneth O. Obi, Research Paper 164.
- FDI and Economic Growth: Evidence from Nigeria*, by Adeolu B. Ayanwale, Research Paper 165.
- An Econometric Analysis of Capital Flight from Nigeria: A Portfolio Approach*, by Akanni Lawanson, Research Paper 166.
- Extent and Determinants of Child Labour in Uganda*, by Tom Mwebaze, Research Paper 167.
- Oil Wealth and Economic Growth in Oil Exporting African Countries*, by Olomola Philip Akanni, Research Paper 168.
- Implications of Rainfall Shocks for Household Income and Consumption in Uganda*, by John Bosco Asiiimwe, Research Paper 169.
- Relative Price Variability and Inflation: Evidence from the Agricultural Sector in Nigeria*, by Obasi O. Ukoha, Research Paper 170.
- A Modelling of Ghana's Inflation: 1960–2003I*, by Mathew Kofi Ocran, Research Paper 171.
- The Determinants of School and Attainment in Ghana: A Gender Perspective*, by Harry A. Sackey, Research Paper 172.
- Private Returns to Education in Ghana: Implications for Investments in Schooling and Migration*, by Harry A. Sackey, Research Paper 173.
- Oil Wealth and Economic Growth in Oil Exporting African Countries*, by Olomola Philip Akanni, Research Paper 174.
- Private Investment Behaviour and Trade Policy Practice in Nigeria*, by Dipo T. Busari and Phillip C. Omoke, Research Paper 175.
- Determinants of the Capital Structure of Ghanaian Firms*, by Jochua Abor, Research Paper 176.
- Privatization and Enterprise Performance in Nigeria: Case Study of some Privatized Enterprises*, by Afeikhena Jerome, Research Paper 177.
- Sources of Technical Efficiency among Smallholder Maize Farmers in Southern Malawi*, by Ephraim W. Chirwa, Research Paper 178.
- Technical Efficiency of Farmers Growing Rice in Northern Ghana*, by Seidu Al-hassan, Research Paper 179.

- Empirical Analysis of Tariff Line-Level Trade, Tariff Revenue and Welfare Effects of Reciprocity under an Economic Partnership Agreement with the EU: Evidence from Malawi and Tanzania*, by Evioius K. Zgouu and Josaphat P. Kweka, Research Paper 180.
- Effect of Import Liberalization on Tariff Revenue in Ghana*, by William Gabriel Brafu-Insaidoo and Camara Kwasi Obeng, Research Paper 181.
- Distribution Impact of Public Spending in Cameroon: The Case of Health Care*, by Bernadette Dia Kamgnia, Research Paper 182.
- Social Welfare and Demand for Health Care in the Urban Areas of Côte d'Ivoire*, by Arsène Kouadio, Vincent Monsan and Mamadou Gbongue, Research Paper 183.
- Modelling the Inflation Process in Nigeria*, by Olusanya E. Olubusoye and Rasheed Oyaromade, Research Paper 184.
- Determinants of Expected Poverty Among Rural Households in Nigeria*, by O.A. Oni and S.A. Yusuf, Research Paper 185.
- Exchange Rate Volatility and Non-Traditional Exports Performance: Zambia, 1965–1999*, by Anthony Musonda, Research Paper 186.
- Macroeconomic Fluctuations in the West African Monetary Union: A Dynamic Structural Factor Model Approach*, by Romain Houssa, Research Paper 187.
- Price Reactions to Dividend Announcements on the Nigerian Stock Market*, by Olatundun Janet Adelegan, Research Paper 188.
- Does Corporate Leadership Matter? Evidence from Nigeria*, by Olatundun Janet Adelegan, Research Paper 189.
- Determinants of Child Labour and Schooling in the Native Cocoa Households of Côte d'Ivoire*, by Guy Blaise Nkamleu, Research Paper 190.
- Poverty and the Anthropometric Status of Children: A Comparative Analysis of Rural and Urban Household in Togo*, by Kodjo Abalo, Research Paper 191.
- Measuring Bank Efficiency in Developing Countries: The Case of the West African Economic and Monetary Union (WAEMU)*, by Sandrine Kablan, Research Paper 192.
- Economic Liberalization, Monetary and Money Demand in Rwanda: 1980–2005*, by Musoni J. Rutayisire, Research Paper 193.
- Determinants of Employment in the Formal and Informal Sectors of the Urban Areas of Kenya*, by Wambui R. Wamuthenya, Research Paper 194.
- An Empirical Analysis of the Determinants of Food Imports in Congo*, by Léonard Nkouka Safoulanitou and Mathias Marie Adrien Ndinga, Research Paper 195.
- Determinants of a Firm's Level of Exports: Evidence from Manufacturing Firms in Uganda*, by Aggrey Niringiye and Richard Tuyiragize, Research Paper 196.
- Supply Response, Risk and Institutional Change in Nigerian Agriculture*, by Joshua Olusegun Ajetomobi, Research Paper 197.
- Multidimensional Spatial Poverty Comparisons in Cameroon*, by Aloysius Mom Njong, Research Paper 198.
- Earnings and Employment Sector Choice in Kenya*, by Robert Kivuti Nyaga, Research Paper 199.
- Convergence and Economic Integration in Africa: the Case of the Franc Zone Countries*, by Latif A.G. Dramani, Research Paper 200.
- Analysis of Health Care Utilization in Côte d'Ivoire*, by Alimatou Cissé, Research Paper 201.
- Financial Sector Liberalization and Productivity Change in Uganda's Commercial Banking Sector*, by Kenneth Alpha Egesa, Research Paper 202.
- Competition and Performance in Uganda's Banking System*, by Adam Mugume, Research Paper 203.
- Parallel Market Exchange Premiums and Customs Revenue in Nigeria*, by Olumide S. Ayodele and Francis N. Obafemi, Research Paper 204.
- Fiscal Reforms and Income Inequality in Senegal and Burkina Faso: A Comparative Study*, by Mbaye Diene, Research Paper 205.
- Factors Influencing Technical Efficiencies among Selected Wheat Farmers in Uasin Gishu District, Kenya*, by James Njeru, Research Paper 206.
- Exact Configuration of Poverty, Inequality and Polarization Trends in the Distribution of Well-being in Cameroon*, by Francis Menjo Baye, Research Paper 207.
- Child Labour and Poverty Linkages: A Micro Analysis from Rural Malawian Data*, by Leviston S. Chiwaula, Research Paper 208.

- The Determinants of Private Investment in Benin: A Panel Data Analysis*, by Sosthène Ulrich Gnansounou, Research Paper 209.
- Contingent Valuation in Community-Based Project Planning: The Case of Lake Bamendjim Fishery Restocking in Cameroon*, by William M. Fonta, Hyacinth E. Ichoku and Emmanuel Nwosu, Research Paper 210.
- Multidimensional Poverty in Cameroon: Determinants and Spatial Distribution*, by Paul Ningaye, Laurent Ndjanyou and Guy Marcel Saakou, Research Paper 211.
- What Drives Private Saving in Nigeria*, by Tochukwu E. Nwachukwu and Peter Odigie, Research Paper 212.
- Board Independence and Firm Financial Performance: Evidence from Nigeria*, by Ahmadu U. Sanda, Tukur Garba and Aminu S. Mikailu, Research Paper 213.
- Quality and Demand for Health Care in Rural Uganda: Evidence from 2002/03 Household Survey*, by Darlison Kaija and Paul Okiira Okwi, Research Paper 214.
- Capital Flight and its Determinants in the Franc Zone*, by Ameth Saloum Ndiaye, Research Paper 215.
- The Efficacy of Foreign Exchange Market Intervention in Malawi*, by Kisukyabo Simwaka and Leslie Mkandawire, Research Paper 216.
- The Determinants of Child Schooling in Nigeria*, by Olanrewaju Olaniyan, Research Paper 217.
- Influence of the Fiscal System on Income Distribution in Regions and Small Areas: Microsimulated CGE Model for Côte d'Ivoire*, by Bédia F. Aka and Souleymane S. Diallo, Research Paper 218.
- Asset Price Developments in an Emerging Stock Market: The Case Study of Mauritius* by Sunil K. Bundoo, Research Paper 219.
- Intrahousehold Resources Allocation in Kenya* by Miriam Omolo, Research Paper 220.
- Volatility of Resources Inflows and Domestic Investment in Cameroon* by Sunday A. Khan, Research Paper 221.
- Efficiency Wage, Rent-Sharing Theories and Wage Determination in Manufacturing Sector in Nigeria* by Ben E. Aigbokhan, Research Paper 222.
- Government Wage Review Policy and Public-Private Sector Wage Differential in Nigeria* by Alarudeen Aminu, Research Paper 223.
- Rural Non-Farm Incomes and Poverty Reduction in Nigeria* by Awoyemi Taiwo Timothy, Research Paper 224.
- After Fifteen Year Use of the Human Development Index (HDI) of the United Nations Development Program (UNDP): What Shall We Know?* by Jean Claude Saha, Research Paper 225.
- Uncertainty and Investment Behavior in the Democratic Republic of Congo* by Xavier Bitemo Ndiwulu and Jean-Papy Manika Manzongani, Research Paper 226.
- An Analysis of Stock Market Anomalies and Momentum Strategies on the Stock Exchange of Mauritius* by Sunil K. Bundoo, Research Paper 227.
- The Effect of Price Stability On Real Sector Performance in Ghana* by Peter Quartey, Research Paper 228.
- The Impact of Property Land Rights on the Production of Paddy Rice in the Tillabéry, Niamey and Dosso Regions in Niger* by Maman Nafiou Malam Maman and Boubacar Soumana, Research Paper 229.
- An Econometric Analysis of the Monetary Policy Reaction Function in Nigeria* by Chukwuma Agu, Research Paper 230.
- Investment in Technology and Export Potential of Firms in Southwest Nigeria* by John Olatunji Adeoti, Research Paper 231.
- Analysis of Technical Efficiency Differentials among Maize Farmers in Nigeria* by Luke Oyesola Olarinde, Research Paper 232.
- Import Demand in Ghana: Structure, Behaviour and Stability* by Simon Kwadzogah Harvey and Kordzo Sedegah, Research Paper 233.
- Trade Liberalization Financing and Its Impact on Poverty and Income Distribution in Ghana* by Vijay K. Bhasin, Research Paper 234.
- An Empirical Evaluation of Trade Potential in Southern African Development Community* by Kisukyabo Simwaka, Research Paper 235.
- Government Capital Spending and Financing and Its Impact on Private Investment in Kenya: 1964-2006* by Samuel O. Oyieke, Research Paper 236.
- Determinants of Venture Capital in Africa: Cross Section Evidence* by Jonathan Adongo, Research Paper 237.
- Social Capital and Household Welfare in Cameroon: A Multidimensional Analysis* by Tabi Atemnkeng Johannes, Research Paper 238.
- Analysis of the Determinants of Foreign Direct Investment Flows to the West African and Economic Union Countries*, by Yélé Maweki Batana, Research Paper 239.
- Urban Youth Labour Supply and the Employment Policy in Côte d'Ivoire* by Clément Kouadio Kouakou, Research Paper 240.

- Managerial Characteristics, Corporate Governance and Corporate Performance: The Case of Nigerian Quoted Companies* by Adenikinju Olayinka, Research Paper 241.
- Effects of Deforestation on Household Time Allocation among Rural Agricultural Activities: Evidence from Western Uganda* by Paul Okiira Okwi and Tony Muhumuza, Research Paper 242.
- The Determinants of Inflation in Sudan* by Kabbashi M. Suliman, Research Paper 243.
- Monetary Policy Rules: Lessons Learned From ECOWAS Countries* by Alain Siri, Research Paper 244.
- Zimbabwe's Experience with Trade Liberalization* by Makochehanwa Albert, Hurungo T. James and Kambarami Prosper, Research Paper 245.
- Determinants in the Composition of Investment in Equipment and Structures in Uganda*, by Charles Augustine Abuka, Research Paper 246.
- Corruption at household level in Cameroon: Assessing Major Determinants* by Joseph-Pierre Timnou and Dorine K. Feunou, Research Paper 247.
- Growth, Income Distribution and Poverty: The Experience of Côte d'Ivoire From 1985 to 2002* by Kouadio Koffi Eric, Mamadou Gbongue and Ouattara Yaya, Research Paper 248.
- Does Bank Lending Channel Exist In Kenya? Bank Level Panel Data Analysis* by Moses Muse Sichei and Githinji Njenga, Research Paper 249.
- Governance and Economic Growth in Cameroon* by Fondo Sikod and John Nde Teke, Research Paper 250.
- Analyzing Multidimensional Poverty in Guinea: A Fuzzy Set Approach*, by Fatoumata Lamarana Diallo, Research Paper 251.
- The Effects of Monetary Policy on Prices in Malawi*, by Ronald Mangani, Research Paper 252.
- Total Factor Productivity of Agricultural Commodities in the Economic Community of West African States: 1961-2005* by Joshua Olusegun Ajetomobi, Research Paper 253.
- Public Spending and Poverty Reduction in Nigeria: A Benefit Incidence Analysis in Education and Health* by Uzochukwu Amakom, Research Paper 254.
- Supply Response of Rice Producers in Cameroon: Some Implications of Agricultural Trade on Rice Sub-sector Dynamics* by Ernest L. Molua and Regina L. Ekonde, Research Paper 255.
- Effects of Trade Liberalization and Exchange Rate Changes on Prices of Carbohydrate Staples in Nigeria* by A. I. Achike, M. Mkpado and C. J. Arene, Research Paper 256.
- Underpricing of Initial Public Offerings on African Stock Markets: Ghana and Nigeria* by Kofi A. Osei, Charles K.D. Adjasi and Eme U. Fiawoyife, Research Paper 257.
- Trade Policies and Poverty in Uganda: A Computable General Equilibrium Micro Simulation Analysis* by Milton Ayoki, Research Paper 258.
- Interest Rate Pass-through and Monetary Policy Regimes in South Africa* by Meshach Jesse Aziakpono and Magdalene Kasyoka Wilson, Research Paper 259.
- Vertical Integration and Farm Gate Prices in the Coffee Industry in Côte d'Ivoire* by Malan B. Benoit, Research Paper 260.
- Patterns and Trends of Spatial Income Inequality and Income Polarization in Cameroon* by Aloysius Mom Njong and Rosy Pascale Meyet Tchouapi, Research Paper 261.
- Private Sector Participation in the Provision of Quality Drinking Water in Urban Areas in Ghana: Are the People Willing to Pay?* By Francis Mensah Asenso-Boadi and Godwin K. Vondolia, Research Paper 262.
- Private Sector Incentives and Bank Risk Taking: A Test of Market Discipline Hypothesis in Deposit Money Banks in Nigeria* by Ezema Charles Chibundu, Research Paper 263.
- A Comparative Analysis of the Determinants of Seeking Prenatal Health Care in Urban and Rural Areas of Togo* by Ablamba Johnson, Alima Issifou and Etsri Homevoh, Research Paper 264.
- Predicting the Risk of Bank Deterioration: A Case Study of the Economic and Monetary Community of Central Africa* by Barthélemy Kouezo, Mesmin Koulet-Vickot and Benjamin Yamb, Research Paper 265.
- Analysis of Labour Market Participation in Senegal* by Abou Kane, Research Paper 266.
- What Influences Banks' Lending in Sub-Saharan Africa?* by Mohammed Amidu, Research Paper 267.