Exchange Rate Pass-through and its Implications for Monetary Policy in Uganda

Jimmy Apaa Okello & Martin Brownbridge

Research Department & Economic Advisor to Governor

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Prepared by
Jimmy Apaa Okello & Martin Brownbridge
Research Department & Economic Advisor to Governor
Bank of Uganda
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ABSTRACT
This paper applies a VAR framework to analyze exchange rate pass-through to domestic inflation in Uganda. The results show that the pass-through indeed exists. Both nominal exchange rates depreciation and the increase in short-term interest rates have a significant and persistent impact on domestic consumer prices, but the impact of the nominal exchange rates shocks on prices are larger and faster than the monetary policy shock. The paper also finds that monetary policy seems to have little impact on real output. In terms of policy response, the paper argues that the existence of pass-through raises important policy questions for a central bank whose primary policy objective is to control inflation, but is also concerned with output stabilization. Because an exchange rate shock, which raises inflation, generates a potential conflict with the primary goal of the central bank.

JEL Classification: E31; F42; E52; F41
KEYWORDS: Exchange rate pass-through; Monetary Policy; Uganda; Reaction function

Correspondence Address: Research Department, Bank of Uganda, P.O. Box 7120, Kampala, Tel. 256 414 230791, Fax. 256 414 230791. Authors E-Mail addresses: japaa@bou.or.ug; Office of the Economic Advisor to Governor: mbrownbridge@bou.or.ug
1. INTRODUCTION

This paper provides an empirical analysis of exchange rate pass through to domestic prices in Uganda and discusses the implications of the findings for monetary and exchange rate policy, in particular the policy implications of exogenous shocks to the exchange rate for a central bank which aims to control inflation and stabilise output. As well as examining the magnitude of exchange rate pass through effects, the paper also analyses an issue which has potentially important implications for monetary and exchange rate policy; whether exchange rate changes affect domestic prices with different lags to monetary policy actions. We use a VAR framework to conduct the empirical analysis.

Most of the literature on inflation targeting emphasizes the need for exchange rate flexibility, to allow the central bank to focus its monetary policy on its domestic target, inflation. In advanced economies, the pass-through of exchange rate changes to domestic inflation is generally small, hence central banks can afford to ignore the exchange rate when setting policy interest rates, other than to the extent that they affect forecasts of future inflation. In developing economies and emerging markets, however, exchange rate pass through effects are often more important, hence central banks must pay more attention to the exchange rate when setting monetary policy.

Exchange rates are often volatile in small open economies which are subject to external shocks, such as terms of trade shocks. Moreover, the Ugandan economy, alongside several other economies in sub-Saharan Africa, which are termed “frontier markets”, has become more integrated with global financial markets and is attracting significant external investment into its financial markets from private portfolio investors, mainly because of the interest rate differentials with advanced economies.\(^1\) Portfolio capital flows, which are often very volatile, generate a further source of potential instability for the exchange rate. Portfolio capital flows to Uganda has in the recent past been substantial. Sales and purchases of foreign exchange from, and to, offshore portfolio investors accounted for nearly 20 percent of

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\(^1\) Frontier markets are identified on the basis of four criteria: has there been a takeoff in economic growth? is growth led by the private sector? has public policy embraced market led growth? and are there financial markets in which to invest? (Nellor, 2008). Christen (2011) characterises 12 economies in SSA as frontier market: Botswana, Cape Verde, Ghana, Kenya, Mauritius, Mozambique, Namibia, Nigeria, Seychelles, Tanzania, Uganda and Zambia.
all foreign exchange transactions carried out by commercial banks in Uganda in the first seven months of 2012.²

The paper empirically tests the following hypotheses:

i. First, shocks to the exchange rate are passed through to domestic inflation.

ii. Second, the exchange rate pass-through is rapid and affects inflation faster than monetary policy actions;

The key findings are that both nominal exchange rate depreciation and the increase in nominal short term interest rates have a significant and persistent impact on domestic consumer prices. The impact of the nominal exchange rates shocks are however larger and faster that a monetary policy shock. Monetary policy seems to have little impact on the real output.

The remainder of the paper is organized as follows. Section 2 discusses the concept of exchange rate pass-through and presents a simple model of pass through and the monetary policy transmission mechanism, designed to highlight the different lags involved. Section 3 discusses the methodology for testing the extent and speed of exchange rate pass-through comparing it with the impact of monetary policy shocks. Section 4 discusses the empirical results, while Section 5 discusses the implications for monetary and exchange rate policies, focusing in particular on a typical policy response to short term exchange shocks in frontier markets like Uganda.

### 2. EXCHANGE RATE PASS-THROUGH AND MONETARY POLICY TRANSMISSION

In open economies, the exchange rate can affect domestic inflation through several channels. The exchange rate directly affects the domestic prices of imported consumer goods; it also affects the production costs of domestically produced goods and services that use imports as inputs. The exchange rate also indirectly affects inflation through its impact on demand for net exports and thus aggregate demand. Finally the exchange rate may affect private sector expectations of future inflation and thereby affect private sector wage and price setting.

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² The denominator is sales and purchasers of foreign exchange to, and from, all agents, both domestic and foreign, other than other commercial banks in Uganda (it excludes purely interbank foreign exchange transactions).
behaviour. How strong exchange rate pass through effects are and how quickly they materialize, is an issue for empirical analysis. Exchange rate pass-through is likely to be stronger the more open the economy is. They are also likely to be stronger during periods when the output gap is positive (i.e. output is above potential) because domestic firms which use imports as inputs will have less incentive to absorb higher import costs in their profit margins. The first and second channels highlighted above are likely to be stronger when there are few domestically produced substitutes for imported goods. The expectations channel is likely to be stronger when monetary policy has not established anti-inflationary credibility.

Several of the channels noted above are likely to be more prominent in developing economies than in advanced economies. For example, developing economies are less diversified than advanced economies and are less likely to produce import substitutes. They are often more open to international trade, and their economies produce and consume a lower share of services than most advanced economies. Many developing economies have not yet established strong anti-inflationary credibility for their macroeconomic management. Consequently, it is likely that exchange rate pass through effects will be stronger in developing economies and emerging markets than in advanced economies (Calvo and Reinhart, 2000; Christensen, 2011; Ho and McCauley, 2003).

Not only are exchange rate pass through effects likely to be important in developing economies, their effects are likely to operate with shorter lags than those of monetary policy on inflation. This is because monetary policy mainly affects inflation through its impact on aggregate demand, with the changes in spending first being translated into changes in real output and only later fully into prices. In contrast, some of the exchange rate pass through effects can occur very quickly, although other effects associated with the exchange rate shocks may take more time to materialize. As discussed in the concluding section, this may have important policy implications.

2.1 The role of exchange rate in domestic inflation – the new Keynesian framework

In this section, we employ the standard new Keynesian framework which is widely used to model the monetary transmission mechanism in developed and emerging economies to
highlight the role of the exchange rate in domestic inflation and the lags involved relative to those of monetary policy. The framework consists of three equations; an aggregate demand equation to determine output in the short term; a Phillips curve equation, which determines inflation, and an exchange rate equation, plus a monetary policy reaction function.

In the aggregate demand equation, the output gap \( (y - y^*) \) is a function of the output gap in the previous period, plus the exchange rate change in the previous period \( (\Delta e_{t-1}) \), where a rise in \( e \) denotes a depreciation, and the domestic interest rate relative to a neutral rate of interest in the previous period \( (r_t - r^*) \), plus an error term which captures shocks to aggregate demand. We assume that the domestic interest rate short-term interest rate and is under the control of the central bank.

\[
y_t - y^* = \alpha (y_{t-1} - y^*) + \beta (r_{t-1} - r^*) + \gamma \Delta e_{t-1} + \epsilon_t
\]

The consumer price inflation equation is a Phillips curve with the addition of a term for the change in the exchange rate. Inflation is a function of past inflation and the output gap, with a lag of one period and the contemporaneous change in the exchange rate, plus an error term which captures shocks to inflation.

\[
\pi_t = \phi \pi_{t-1} + \delta (y_{t-1} - y^*) + \lambda \Delta e_t + \epsilon_t
\]

Finally, the change in the exchange rate is a function of the differential between domestic and foreign (\( r_{f_t} \)) interest rates, the change in the country risk premium and an error term which captures all shocks to the exchange rate. Ceteris paribus, an increase in the domestic interest rate leads to an appreciation of the exchange rate. All of the parameters in the three equations are assumed to be positive.

\[
\Delta e_t = -\eta (r_t - r_{f_t}) + \tau \Delta \rho_t + \epsilon_t
\]

This framework implies that a shock to the exchange rate directly affects inflation contemporaneously. In the following period the shock affects the output gap through its impact on aggregate demand and inflation because of its persistence from the previous period. In the next period (two periods after the shock), the exchange rate shock affects
inflation indirectly through the change in the output gap in the previous period and again through the impact of lagged inflation. Monetary policy affects inflation only after two periods. In the period following the change in the domestic interest rate, monetary policy affects the output gap through the aggregate demand channel which then affects inflation in the next period. However, if a forward looking inflation expectations term were included in equation 2, the response of inflation to monetary policy could be speeded up. Furthermore, monetary policy affects the exchange rate contemporaneously and hence this provides another channel through which monetary policy could have a faster impact on inflation, given that the exchange rate also affects inflation contemporaneously.

2.2 Central banks’ reaction to exchange rate shocks – the reaction function

Following Reyes (2003) and Ball and Reyes (2004b), we explain the importance of monetary authority’s response to exchange rate shocks. To do this, we start by describing the composition of the consumer price index:

\[ P = P_H \alpha + P_T (1-\alpha) \]  

(4)

where \( P \) is the consumer price index, \( H \) the non-traded sector, \( T \) the traded sector, and \( \alpha \) is a weight parameter, showing the contribution of each sector in the consumer price basket. From equation (4), we can derive an inflation equation for the economy:

\[ \pi = \alpha \pi_H + (1-\alpha) \pi_T \]

(5)

where \( \pi \) is the general inflation. Assuming relative purchasing power parity and constant world prices, and expressing the exchange rate depreciation as \( \Delta e \), we can rewrite equation (5) as:

\[ \pi = \alpha \pi_H + (1-\alpha) \Delta e \]

(6)

In equation (6), we show that exchange rate depreciation will have an effect on the general inflation and will vary depending on the contribution of traded and non-traded goods in the
consumer price basket. We can now look at the monetary policy authority response to exchange rate movements in terms of the Taylor-rule type model:

\[ i_t = \theta + \pi_t + \lambda(\pi_t - \pi^*) + \beta(y_t - y^*) \quad (7) \]

where \( i_t \) is the nominal interest rate, \( y_t \) is output, \( y^* \) is the equilibrium output level and \( \pi^* \) is the inflation target. The constant \( \theta \) can be understood as the equilibrium real interest rate. Equation (7) is a traditional Taylor-rule where the central bank reacts to deviations of inflation from the target and also to the output gap. Substituting (6) in (7), yields:

\[ i_t = \theta + \pi_t + \lambda[(\alpha \pi_{t-h} + (1 - \alpha)\Delta e_t) - \pi^*] + \beta(y_t - y^*) \quad (8) \]

In equation (8), it is clear according to Reyes (2003) and Ball and Reyes (2004b) that, although the central bank does not care about the exchange rate level, it must respond to its movements as it influences the overall inflation rate, and the attainment of the inflation targets. The term \((1-\alpha)\Delta e_t\) in equation (8) can be defined as the exchange rate pass-through effect. The greater this parameter, the more responsive is the central bank to the exchange rate movements.

3. VAR MODEL FOR UGANDA

We formulate two empirical models couched on Vector Autoregressive framework: a restricted VAR (Vector Error Correction Model) to assess the level or extent of exchange rates pass-through to domestic prices and a Structural VAR to estimate the impulse response functions.

3.1 Vector Error Correction Framework

We utilize a vector autoregressive (VAR) framework (Hendry and Doornik, 2001: 129) given that prices are likely to be non-stationary and cointegrated. We consider a VAR(p) model:

\[ x_t = \Phi_1 x_{t-1} + \Phi_2 x_{t-2} + \cdots + \Phi_p x_{t-p} + \Psi w_t + \varepsilon_t \quad (9) \]
where $\mathbf{x}_t$ is a $(m \times 1)$ vector of jointly determined $I(1)$ variables, $w_t$ is a $(q \times 1)$ vector of deterministic and or exogenous variables and each $\Phi(i = 1, \ldots, p)$ and $\Psi$ are $(m \times m)$ and $(m \times q)$ matrices of coefficients to be estimated by Johansen’s (1988) maximum likelihood procedure using a $(t = 1, \ldots, T)$ sample of data. $\epsilon_t$ is a $(m \times 1)$ vector of n.i.d. disturbances with zero mean and non-diagonal covariance matrix, $\Sigma$.

The error correction representation of (9) is given by:

$$
\Delta \mathbf{x}_t = \alpha \beta' \mathbf{x}_{t-p} + \sum_{i=1}^{p-1} \Gamma_i \Delta \mathbf{x}_{t-i} + \Psi w_t + \epsilon_t \quad (10)
$$

The focus is on the $(m \times r)$ matrix of co-integrating vectors, $\beta$, that quantify the ‘long-run’ (or equilibrium) relationships between the variables in the system and the $(m \times r)$ matrix of error correction coefficients, $\alpha$, the elements of which load deviations from equilibrium (i.e. $\beta' \mathbf{x}_{t-k}$) into $\Delta \mathbf{x}_t$, for correction. The $\Gamma_i$ coefficients in (10) estimate the short-run effect of shocks on $\Delta \mathbf{x}_t$, and thereby allow the short and long-run responses to differ.

### 3.2 Structural VAR set-up

The VAR model assumes that the Ugandan economy can be described by the following structural form:

$$
G(L)Y_t = C(L)X_t + \epsilon_t, \quad (11)
$$

where $G(L)$ is a $n \times n$ matrix polynomial in the lag operator; $C(L)$ is a $n \times k$ matrix polynomial in the lag operator; $Y_t$ is a $n \times 1$ vector of endogenous variables; and $X_t$ is a $k \times 1$ vector of exogenous (foreign) variables; $\epsilon_t$ is a $n \times 1$ vector of structural disturbances, with $\text{var}(\epsilon_t) = \Lambda$ is a diagonal matrix.

The reduced-form Structural VAR model is thus presented as:

$$
Y_t = A(L)Y_t + B(L)X_t + \mu_t, \quad (12)
$$
where \( A(L) \) and \( B(L) \) are matrices polynomial; \( \mu_t \) is a vector of reduced-form disturbances, with \( \text{var}(\mu_t) = \Sigma \).

Let \( F \) be the contemporaneous coefficient matrix in the structural form, and let \( H(L) \) be the coefficient matrix in \( G(L) \) with contemporaneous coefficient. That is,

\[
G(L) = F + H(L)
\]  

(13)

Therefore the structural and reduced form equations can be related by

\[
A(L) = -F^{-1}H(L) \quad \text{and} \quad B(L) = F^{-1}C(L).
\]  

(14)

The error terms are related:

\[
\mu_t = F^{-1}\varepsilon_t \text{or} \quad \varepsilon_t = F\mu_t, \text{which implies}
\]

\[
\Sigma = F^{-1}AF^{-1}'.
\]  

(15)

Consistent estimates of \( F \) and \( \Lambda \) are inferred by estimates of \( \Sigma \), which can be obtained by the maximum likelihood estimation. Since the right-hand side contains \( n \times (n + 1) \) free parameters to be estimated, while the left-hand side contains only \( n \times (n + 1)/2 \) parameters, we need \( n \times (n + 1)/2 \) restrictions to achieve identification. Normalization of the diagonal elements of \( F \) to be unity leaves \( n \times (n - 1)/2 \) additional restrictions, which should be motivated by economic theory.

The endogenous variables in the Structural VAR include real GDP (\( gdp \)), the world oil price (\( Oil \)), short-term interest rate (\( TB91R \)), the nominal effective exchange rate (\( NEER \)), and consumer price index (\( CPI \)):

\[
Y_t' = [oil_t \ gdp_t \ tb91r_t \ neer_t \ cpi_t]
\]  

(16)
The remainder of this section discusses identification schemes, which have been widely used for studies on the pass-through or monetary policy transmission mechanism.

### 3.2.1 The Recursive SVAR

This identification is the standard approach that imposes a recursive structure of the VAR, with the ordering of variables given in equation (16). It assumes that output ($gd$, $gdp$) has no immediate effects on oil prices ($oil$), short-term interest rate or monetary policy shock ($tb91r$) has no immediate effect on oil prices, nominal exchange rates ($neer$) have no immediate effect on short-term interest rate, and consumer prices ($cpi$) has no immediate effect on nominal exchange rates. Technically, this amounts to estimating the reduced form, then computing the Cholesky factorization of the reduced form VAR covariance matrix. In other words, the relation between the reduced-form errors and the structural disturbance is given by:

\[
\begin{bmatrix}
\varepsilon_t^{gd} \\
\varepsilon_t^{oil} \\
\varepsilon_t^{tb91r} \\
\varepsilon_t^{neer} \\
\varepsilon_t^{cpi}
\end{bmatrix} =
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\mu_t^{gd} \\
\mu_t^{oil} \\
\mu_t^{tb91r} \\
\mu_t^{neer} \\
\mu_t^{cpi}
\end{bmatrix}
\]

### 3.2.2 The Non-Recursive SVAR

The non-recursive identification relaxes the assumption of no contemporaneous relationships between the variables of interests. We modify Sims and Zha (1998) and Kim and Roubini (2000) non-recursive identification scheme as follows:

\[
\begin{bmatrix}
\varepsilon_t^{oil} \\
\varepsilon_t^{gd} \\
\varepsilon_t^{tb91r} \\
\varepsilon_t^{neer} \\
\varepsilon_t^{cpi}
\end{bmatrix} =
\begin{bmatrix}
1 & 0 & 0 & f_{14} & f_{15} \\
0 & 1 & f_{23} & 0 & f_{25} \\
0 & 0 & 1 & f_{34} & 0 \\
0 & 0 & f_{43} & 1 & f_{45} \\
0 & f_{52} & f_{53} & f_{54} & 1
\end{bmatrix}
\begin{bmatrix}
\mu_t^{oil} \\
\mu_t^{gd} \\
\mu_t^{tb91r} \\
\mu_t^{neer} \\
\mu_t^{cpi}
\end{bmatrix}
\]
The first equation represents the response of exchange rates, domestic consumer prices and international oil prices to an international oil price shock. The second equation represents the response of output to its own shocks, and the response of short-term interest rates and domestic consumer prices to shocks to the output. The third equation can be interpreted as the monetary policy reaction function, which responds contemporaneously to the nominal exchange rate shocks and its own innovations. The fourth equation suggests that the shocks to the nominal exchange rates affect interest rates and domestic consumer prices contemporaneously. The last equation can be interpreted as shocks to the domestic consumer prices affects output gap, short-term interest rates and exchange rates immediately.

One weakness with the Choleski procedure is that there is a different factorization for every ordering, implying that estimation results change considerably when the variable ordering is changed. The literature on exchange rate pass-through typically places consumer prices at the bottom of the VAR ordering, so that the price variable is contemporaneously affected by almost all other shocks [Kim and Roubini (2000)]. The VAR models are estimated in levels using quarterly data between 1999 and 2012. By estimating the VAR in levels, implicit cointegrating relationships are allowed in the data. All variables are seasonally-adjusted and expressed in natural logarithms. Standard information criteria are used to select the lag lengths of the SVAR, which turn out to be two (2). Figures 1a-e display the data used for the estimation of the VAR.

Figure 1a and b: natural logarithm of output gap and international oil prices
4. ESTIMATION RESULTS

4.1 Time series properties of the data

The series used are quarterly observations of real GDP, international oil prices, 91-day Treasury bill rates, consumer price index for Uganda, and nominal exchange rates. As an initial step, the data were tested for the order of integration. The ADF results are reported in Table 1 and it confirms that the series are non-stationary in levels and stationary in first differences, as visual inspection of the data suggests.
Table 1: Augmented Dickey–Fuller test statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Levels (lag)</th>
<th>Differences (lag)</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP</td>
<td>1.365346 (0)</td>
<td>-9.624779** (0)</td>
<td>Real GDP: I(1)</td>
</tr>
<tr>
<td>Oil price</td>
<td>2.424126 (0)</td>
<td>-5.358408** (0)</td>
<td>RBt: I(1)</td>
</tr>
<tr>
<td>91-day TB rate</td>
<td>-2.832331 (0)</td>
<td>-7.133747** (0)</td>
<td>RBt: I(1)</td>
</tr>
<tr>
<td>Nominal Exchange rate</td>
<td>-0.748948 (1)</td>
<td>-6.12698** (1)</td>
<td>RBt: I(1)</td>
</tr>
<tr>
<td>Consumer Price Index</td>
<td>1.215606 (10)</td>
<td>-4.708887** (10)</td>
<td>RBt: I(1)</td>
</tr>
</tbody>
</table>

* Significant at the 5 per cent level; ** significant at the 1 per cent level.

Lag length of the ADF regression was selected according to the Akaike Information Criterion and is reported in parentheses adjacent to test statistic; the Augmented Dickey–Fuller regression includes a constant and trend (and seasonal dummies for lamb) for the levels and a constant (and seasonal dummies for lamb) in differences; critical values derived by MacKinnon (1991).

4.2 Cointegration analysis

Using the data presented above, the levels representation of the VAR (equation (9)) was estimated for $p = 1, ..., 4$ unrestricted seasonal and intercepts restricted to the cointegration space. The Akaike Information Criterion selected a VAR(2) model, and diagnostic tests for residual autocorrelation, ARCH, and heteroscedasticity did not suggest departure from stated assumptions at the 5 per cent level using either vector or equation-based tests. Likewise, we fail to reject the null of normally distributed residuals (see Appendix). The cointegration analysis was conducted within the VECM (equation (10)). Cointegration results, reported in Tables 2a–c (see Appendix) suggest the presence of one equilibrium (stationary) relations among the variables.

The estimated long-run price equation ($t$-ratios are in parenthesis) is given by

$$LCPI = -0.25VEC + 0.49LNEER_t + 4.84GAP_t - 0.02RTB91_t + 0.49LCP1FOOD_t$$

(17)

$$(-4.07)$$  $$9.23$$  $$5.05$$  $$(-11.14)$$  $$9.02$$

All variables in the estimated log-run equation (17) including the coefficient of the error correction term are correctly signed and are statistically significant as the $t$-ratios indicate. The estimates are long-run elasticities; the estimates indicate that a one percent increase (depreciation) of the nominal exchange rate $ceteris paribus$ translates to 0.5 percent increase in domestic consumer prices. More so, a positive output gap (which is equivalent to overheating of the economy) and a higher domestic food prices cause the overall consumer...
prices to increase *ceteris paribus*. In addition, *ceteris paribus*, a one percent increase in the interest rate causes consumer prices to decline by 0.02 percent.

### 4.3 SVAR analysis

In this Section, we present the impulse response functions and accumulated impulse responses to trace the effects of a one-time shock to one of the innovations on current and future values of the endogenous variables. Figures 2a-d report the impulse response functions of the endogenous variables to one standard deviation innovation in the system, defined as an exogenous, unexpected, temporary rise in nominal exchange rate and nominal interest rates at $t=0$, together with a 95 percent confidence band. Since the impulses are standardized to one standard deviation of the residuals, the vertical axis in Figures 2a-d report approximate standard deviation change in domestic prices and output gap in response to a one standard deviation shock in the nominal exchange rates and interest rates.

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3 The 95 percent confidence band is obtained by bootstrapping with 500 replications, as described in Hall (1992).
The results are presented as follows:

- The effects of monetary policy and exchange rate shocks on output are similar; both affect output negatively. Surprisingly however, the impact of the nominal exchange rate depreciation on output is contrary to the standard view that depreciation should stimulate production in the traded goods sector and economic activity.

- Both monetary policy and nominal exchange rate shocks have a significant and persistent impact on domestic consumer prices. An unexpected and temporary rise in the short-term interest rate is followed by a decline in prices, with the effect peaking at between 4 and 5 quarters after the shock. On the other hand, an unexpected and
temporary rise in the nominal exchange rate (depreciation) is followed by an increase in domestic consumer prices, with the effect peaking at between 2 and 3 quarters. The impact of the exchange rate shock on domestic prices is larger and faster (only 2-3 quarters compared to 4-5 quarters) than that of a monetary policy shock.

In summary, both nominal exchange rate depreciation and the increase in nominal short-term interest rates have a significant and persistent (tendency of inflation to converge slowly to its long-run level following a shock) impact on domestic consumer prices, but the impact of the nominal exchange rates shocks on prices are larger and quicker than that of a monetary policy shock. The existence of inflation persistence in Uganda implies that prices and wages (or any other contract specified in nominal terms) could be adjusted only periodically.

The paper also finds that monetary policy seems to have little impact on real output; for a developing country like Uganda, this is not surprising given the structural weaknesses in the financial sector, which are likely to hamper the transmission mechanism of monetary policy. The structural weaknesses in the Ugandan financial sector include weak legal framework, poor governance, and insufficient infrastructure, which have contributed to high interest rate spreads, inadequate financial intermediation and heightened risks.

5. CONCLUSION AND POLICY IMPLICATIONS

The results reported above indicate that exchange rate shocks affect both inflation and output in Uganda and that the impact of an exchange rate shocks are larger and faster than that of a monetary policy shock. Given that frontier markets such as Uganda are vulnerable to exchange rate shocks, emanating in both the current and capital account of the BOP, what are the implications of these findings for a central bank whose primary policy objective is to control inflation but is also concerned with output stabilization? Our focus in this section is on an exchange rate shock (i.e. a depreciation), which raises inflation, because that entails a potential conflict with the primary policy goal of the central bank. A shock which appreciates the exchange rate is less problematic in terms of the inflation objective of the central bank, but it may cause other policy concerns, including concerns for the competitiveness of traded goods industries.
The policy implications of an external shock that depreciates the exchange rate depend on the nature of the shock. Because shocks to the exchange rate are likely to differ in terms of their impact on inflation and output depending on whether they originate in the current or capital account of the BOP and whether they are permanent or transitory, a uniform policy response to all exchange rate shocks is unlikely to be optimal. For this reason it is problematic to simply incorporate the exchange rate as a variable into the central bank’s monetary policy reaction function.

Faced with negative shock to the current account of the BOP (such as a fall in the external terms of trade), a real exchange rate depreciation is likely unavoidable to eventually restore external balance, unless the shock is only temporary (and can be financed). Consequently, the central bank may have little choice but to allow the exchange rate to depreciate and to trade this off against its inflation and output objectives; i.e. to accept a combination of temporary higher inflation and lower output as the price for maintaining external sustainability.

The implications are somewhat different when the exchange rate shock emanates from the capital account. As noted in the introduction, volatile portfolio capital flows are a major potential source of short term instability to the exchange rate. Portfolio capital shocks are more likely to be short term and reversible than most current account shocks, because they are often triggered by private sector expectations of short term movements in the exchange rate. Capital may flow out quickly if portfolio investors expect an exchange rate depreciation in the short term, which itself triggers the depreciation. Once the exchange rate has depreciated beyond the point where further depreciation is considered plausible by investors, capital will flow back in, partially or fully reversing the depreciation. Thus, the direct impact of a temporary exchange rate shock on prices should be transitory.

Faced with an exchange rate shock triggered by volatile capital flows, which is perceived by the central bank to be temporary, what are the policy options for the central bank? There are effectively three options: the first option is to effectively do nothing, on the grounds that the exchange rate shock and its direct impact on inflation is expected to be transitory; an approach which might be called “benign neglect of the exchange rate”. The drawback with such an approach is that the initial rise in inflation caused by higher traded goods prices may
trigger second round effects on wages and prices, leading to an increase in inflation expectations that become self fulfilling and erode the anti inflationary credibility of the central bank. As such higher inflation may persist after the original exchange rate shock has been reversed. Unless the central bank has already established very strong anti inflationary credibility, benign neglect of an exchange rate shock may be too risky a strategy for it to follow.

The second option is to tighten monetary policy by raising the policy interest rate to offset the impact of the exchange rate shock on domestic inflation. Higher interest rates will also serve to dampen the degree of exchange rate depreciation, provided that capital flows respond to interest rate differentials. Hence monetary policy will act on inflation through two channels, first by mitigating the exchange rate shock itself, and thus the degree of pass through of the shock to domestic prices, and second by putting downward pressure on aggregate demand. This approach is, however, problematic because of the differential lags reported above from the impulse response functions. If the exchange rate shock is transitory, it may have been reversed before monetary policy exerts its full impact on prices. As such, monetary policy may be restraining aggregate demand in a period when it is no longer necessary to do so to control inflation. As Eichengreen (2002) notes, because of the lags between policy interest rates and inflation, responding to transitory changes in the exchange rate by changing interest rates creates the risk of generating cyclical patterns of inflation and output. Monetary policy could become a source of instability, generating more volatile inflation and output.

The third option is to employ sterilized foreign exchange intervention to stabilize the exchange rate leaving monetary policy to focus on the inflation and output objectives. In the event of a depreciationary exchange rate shock, sterilized intervention would involve the central bank selling foreign exchange to the market while at the same time injecting domestic liquidity through open market operations to keep the monetary policy stance (e.g. the interest rate) unchanged. For economies that are open to capital flows, sterilized intervention has often been regarded as ineffective in stabilizing the exchange rate, because

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5 A much stronger version of this option would be to raise interest rates sufficiently to stabilise the exchange rate; to prevent depreciation of the exchange rate interest rates would have to be higher than would be necessary simply to offset the pass through effects of depreciation on inflation, given that the pass through is less than 100 percent. This would entail subordinating monetary policy entirely to the control of exchange rates, rather than domestic inflation, which is not compatible with an inflation targeting strategy.

6 In Uganda open market operations are mainly conducted through repurchase operations, to mop up liquidity, and reverse repurchase operations to inject liquidity.
the magnitude of capital flows involved would swamp the resources available to the central bank to intervene in the foreign exchange market unless it is also prepared to adjust the domestic interest rate to support its objective for the exchange rate.

However, capital mobility is far from perfect in most frontier markets, which allows some scope for central banks to conduct sterilized intervention. In effect, central banks in these economies have two policy instruments at their disposal – foreign exchange sales and purchases and the domestic interest rate – and can use these two instruments to target two independent variables – the exchange rate and inflation/output (Ostry et al, 2012). The smaller is the size of the domestic securities market and the less is the substitutability between domestic and foreign securities, the stronger are the portfolio balance effects on the exchange rate of sterilization and hence the more scope there is likely to be for sterilized intervention in the foreign exchange market. The domestic securities market is still relatively small in Uganda (the total stock of debt securities, public and private, is only 12 percent of GDP) and these securities are not likely to be perfect substitutes for foreign securities.

Sterilized intervention could be an attractive option to mitigate exchange rate depreciation caused by capital outflows which are thought to be temporary and are likely to be reversed. It would allow the central bank to avoid tightening monetary policy and thus avoid the potential negative and longer lasting impacts as discussed above. However, sterilized intervention would clearly only be possible on a temporary basis and where the central bank has a sufficiently large buffer of foreign exchange reserves from which to fund intervention. If the capital outflows prove to be more permanent, the central bank would have to quickly abandon the strategy or risk depleting its foreign reserves and possibly triggering a BOP crisis. Such a strategy would also be more feasible if it were operated in a symmetric manner, with the central bank accumulating foreign exchange reserves through sterilized intervention during periods of capital inflows and then using these reserves to support the exchange rate when capital flows out. The efficacy of intervention also requires that the central bank is able to analyse accurately and quickly the source of shocks to the exchange rate and to make an informed judgment as to whether the shocks are likely to be transitory or permanent, for which accurate up to date balance of payments data is clearly essential.
REFERENCES


APPENDIX

Table 2 a. Selected (0.05 level*) number of cointegrating relations by model

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<tr>
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Table 2 b. Unrestricted Cointegration Rank Test (Trace)

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<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
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Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 2 c. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

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Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Structural VAR Estimates

Date: 02/08/13   Time: 16:19
Sample (adjusted): 12/01/1999 12/01/2012
Included observations: 53 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 18 iterations

Structural VAR is just-identified

Model: \( A\varepsilon = Bu \) where \( E[u'u'] = I \)
Restriction Type: long-run text form
Long-run response pattern:

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Log likelihood 310.3004

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DIAGNOSTICS

VAR Residual Normality Tests
Orthogonalization: Estimated from Structural VAR
Null Hypothesis: residuals are multivariate normal
Date: 02/08/13   Time: 16:19
Sample: 9/01/1999 12/01/2012
Included observations: 53

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