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The Role of Banks in the Propagation of External Shocks to African Economies

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Abstract: **The paper examines the role played by banks in the propagation of external shocks to African economies. We employ a general equilibrium model of a small open economy to analyse how the banking sector propagates external shocks. The study uses a vector autoregression (VAR) analysis to assess the impact of exchange rate and foreign interest rate shocks on bank lending spreads and output fluctuations in African economies. We use quarterly time-series data for 5 selected African countries for the period 1990-2011. The findings show that foreign interest rate and exchange rate shocks significantly affect output fluctuations in Africa. The results, however, indicate that banks play limited role in the propagation of shocks to African economies.**

Keywords: **African economies, propagation, banking sector.**

1. INTRODUCTION

While studies have shown that external shocks influence economic fluctuations in African countries (see Kose and Riezman, 2001; Bleaney and Greenaway, 2001), little attention has been paid to the role played by the financial sector in the propagation and amplification of these external shocks. As documented in a number of studies, (see e. g, Edwards and Végh, 1997; Céspedes et al., 2005; Chue and Cook, 2008), external shocks that negatively impact bank balance sheets might hamper the bank lending channel and amplify the initial shocks. Agénor et al. (2008) find that positive foreign interest rate shocks increase domestic lending rate and lower output in Argentina.

Apart from intermediating foreign capital flows into the domestic economy, banks also borrow in foreign currency to finance domestic currency loans. This currency mismatch exposes banks to exchange rate volatility. Thus, exchange rate volatility directly impacts bank balance sheets and affect their financial intermediatory roles. De Bock and Demyanets (2012) provide evidence that exchange rate depreciation deteriorates bank balance sheet, lower employment and output in emerging market economies. Moreover, banks also incur short-term borrowing to finance domestic long term investment. This maturity mismatch predisposes banks to foreign interest rate shocks.

Despite the significant financial intermediatory role played by banks in the propagation of external shocks, there have been relatively few studies focussing on Africa. Study on banks in Africa has largely focused on its link to economic growth (see Atindéhou et al., 2005; Ibrahim, 2012). Other similar studies focus on the transmission of monetary policy shocks to the real economy by banks (see Lungu,2007). Notable exception are the works of Poghosyan and Hesse (2009) who focus on oil price and bank profitability in oil exporting countries. This study quantitatively examines the roles of banking sector in the propagation of external shocks to African economies.

This paper examines the roles played by banks in the propagation and magnification of external shocks in African economies. As in other developing countries, bank credit is an important source of finance in African countries. Hence, the impact of external shocks on banks is important for the domestic economy. Bank lending channel serves as the pivotal point through which exogenous shocks are transmitted to the domestic economy. In particular, we focus on the impact of exogenous change in exchange rate and foreign interest rate on bank lending channel. We extend the work of Agenor et al. (2008)

The rest of the paper is organised as follows. Section 2 reviews the literature on external shocks, financial intermediation and real economic activities. Section 3 considers the stylised facts. Section 4 presents and analyses the results. Section 5 draws the conclusion for the study.

2. REVIEW OF RELATED LITERATURE

Empirical studies have reported mixed results on the effects of external shocks on economic fluctuations in developing countries. For example, Mendoza (1993), Agénor et al. (1999), and Hernández (2011) report that external shocks have significant effects on macroeconomic fluctuations in developing and emerging economies. In contrast, Raddatz (2007) and Alve da Silva (2012) findings suggest that external shocks have limited impacts on the economies of developing and emerging countries. Evidence for Africa is also mixed. While Kose and Riezman (2001) and Collier (2007) find that external shocks have significant effect on African economy, Hoffmaister et al. (1997) and Sissoko and Dibooğlu (2006) report that external shocks have insignificant impact on African economy.

A related strand of literature has focused on the channel through which shocks are propagated and amplified in an ecoomy. In a framework developed by Bernanke and Gertler (1985), Bernanke et al. (1999), financial market frictions are identified as an important propagator and amplifier of nominal and real shocks to the economy. López et al. (2008) and Auel and Mendonça (2011) results indicate that financial frictions amplify and propagate shocks in emerging market economies. This is consistent with the findings by Von Heideken (2009), Lombardo and McAdam (2012), and Brzoza-Brzezina et al. (2013) for the US and the Euro area. In contrast, Hwang (2012) finds that financial frictions do not not magnify shocks in South Korea.

A number of authors have examined the role of financial frcitions in a small open economy vulnerable to external shocks. Specifically, studies have focused on the effects of external shocks on the firms' balance sheets that are vulnerable to exchange rate shocks. Krugman (1999) concludes that balance sheet effects strongly amplify the external shocks to the Asian countries. Céspedes et al. (2004) extend the financial accelerator model to an open economy and conclude that firms' balance sheet magnify external shocks to the economy. Elekdag et al. (2006), Tovar (2006) and Gertler et al. (2007) provide evidence for balance sheet effects in the amplification and propagation of Korean crises.

Given the fundamental roles of banks in emerging economies, a growing body of literature has focused on the roles of the banking sector in the propagation of external shocks to the economy. Edwards and Végh (1998) report that bank is important in the propagation of domestic and external shocks. Agénor et al. (2008) findings suggest that banks propagate and amplify foreign interest rate shocks in Argentina through changes in bank lending rate. On the other hand, Oviedo (2005) shows that banks mitigate the negative effect of foreign interest rates on the economy.

Apart from propagating foreign interest rate shocks, banks can also transmit trade and exchange rate shocks to the domestic economy. Choi and Cook (2004), and Auel and de Mendoça (2011) show that exchange rate volatility deteriorates bank balance sheet, constraint credit supply and reduce economic activity in emerging economies. Céspedes (2005) find that real exchange rate devaluations worsen bank balance sheets and have significant negative effect on output in developing countries. Blejer et al. (2002), and Beck et al. (2006),De Bock and Demyanets (2012) reveal that banks propagate terms of trade volatility in emerging economies.

Adverse external shocks might trigger banking crises and output losses in emerging market economies. For example, Eichengreen and Rose (1998) find that world interest rate shocks are responsible for banking crises in emerging market economies. Joyce and Nabar (2009) and Bordo et al. (2010) find that sudden stops are the cause of banking crises in emerging markets. and Duttagupta and Cashin (2011) identify currency crises and liability dollarization as determinants of banking crises in developing and emerging economies. Dell' Ariccia et al. (2008) findings suggest that banking crises have strong effects on the real sector of the economy through the lending channel.

2.1 Stylised Facts:

Because of their commodity export dependence, export concentration and high external debts, African economies are vulnerable to trade shocks and world financial shocks. Kose and Riezman (2001) find that trade shocks and foreign interest rate shocks significantly influence output variations in Africa. Frankel (2007) and Arezki et al. (2012) find significant relations between mineral prices and real exchange rate in South Africa. Ncube et al. (2012) find that US monetary policy shocks have significant effects on South Africa real and financial sectors. Table 1 shows the correlation between foreign interest rate, exchange rate and macroeconomic aggregates for selected African countries.

The correlation results for foreign interest rate and lending rate are mixed. While the association is positive in Kenya, South Africa and Uganda, it is negative in Malawi and Nigeria. A positive association suggests that lending rates increase

in response to rise in foreign interest rate. This is similar to the findings by Edwards and Végh (1997) and Agénor et al. (2008).The results also indicate negative association between foreign interest rate shocks and lending spread for all countries. This indicates that when foreign interest rate increases, the spread declines.

Also evident from Table 1 is the mixed correlation results between foreign interest rate and output. In four of the countries, there is significant negative association between foreign interest rate and output. This is related to the findings by Kose (2002) and Maćkowiak (2007) for emerging economies. The table also reveals significant negative relation between foreign interest rate and spread in three of the countries.

Table 1 also presents the correlation results between nominal exchange rate and macroeconomic variables. There is significantly negative correlation between nominal exchange rate and lending rate in four of the countries. This suggests that when exchange rate depreciates, the lending rate increases. This is in line with the findings by Edwards and Végh (1999). Except in Malawi, there is significant positive association between exchange rate depreciation and output in four countries. This indicates an expansionary effect of depreciation in African countries. This is contrary to the findings by Ahmed (2003) and Kandil et al. (2007) .

Table 1: Correlation for macroeconomic aggregates

Country	$\rho_{rf,lrate}$	$\rho_{rf,lspread}$	$\rho_{rf,output}$	$\rho_{s,lrate}$	$\rho_{s,lspread}$	$\rho_{s,output}$
Kenya	0.43 (4.47)	0.02 (0.16)	-0.67 (-8.27)	-0.31 (-2.99)	0.57 (6.46)	0.74 (10.06)
Malawi	-0.26 (-2.22)	-0.21 (-1.83)	0.50 (4.87)	0.50 (4.86)	0.30 (2.62)	-0.99 (-67.03)
Nigeria	-0.09 (-0.75)	0.07 (0.56)	-0.43 (-4.12)	-0.45 (-4.27)	-0.23 (-2.01)	0.76 (10.09)
South Africa	0.60 (6.34)	-0.34 (-3.00)	-0.68 (-7.69)	-0.59 (-6.11)	0.18 (1.51)	0.77 (10.01)
Uganda	0.15 (1.23)	-0.10 (-0.79)	-0.71 (-8.35)	-0.08 (-0.68)	-0.77 (-9.86)	0.94 (22.42)

ρ is the correlation coefficient. The t-statistics are in parenthesis. The spread is the difference between lending rate and deposit rate. Real GDP, real exchange rate, and real money supply are logged H-P filtered with smoothing parameters 1600.

3. THE MODEL

The role of bank lending channel in the propagation and amplification of monetary policy shocks has been identified in the literature (see Bernanke et al., 1991; Peek and Rosengreen, 2013). A related strand of literature has focused on the role played by banks in the propagation of external shocks to the domestic economy. For example, Edwards and Végh (1997) show how external shocks to the banking system affect output Agénor and Aizenman (1998) and Agénor et al. (2008) show that in a model where banks borrow from world capital market to finance domestic loan, external shocks effects are magnified through the bank lending spread.

In this study, we adopt the model developed by Edwards and Végh (1986) which incorporates the role played by the banking sector in the propagation of external shocks to domestic economies. In contrast to their model, our model economy does not operate under a pre-determined exchange rate. We also assume a small open economy monetary model integrated with the rest of the world. The economy faces a constant world interest rate. The economy produces a single tradable good with labour input. The domestic price of the good is P and purchasing power parity holds: $P_t = E_t P_t^*$ where E_t is the nominal exchange rate and P_t^* is the foreign-currency price of the good. Perfect capital mobility implies that $i_t = i_t^* + \varepsilon_t$ where $\varepsilon_t = \frac{\dot{E}}{E}$.

The model economy is made up of four agents: households, firms, banks, and government. The households consume and provide labour services. Households use demand deposits to carry out consumption (through deposit-in advance constraint). Firms must pay labour wage before production, hence they borrow from banks. The banks finance their lending activities with deposits from households and external financing. The government set the reserve requirement ratio.

3.1 Households:

The representative household' preference is given by:

$$\int_0^{\infty}[log(c_t) + log(m_t) + log(x_t)]exp(-\beta t)dt \quad (1)$$

where c_t denotes consumption, m_t denotes real balances, x_t is leisure, and β is the subjective discount rate. Labour supply is $1 - x_t$.

Households hold two assets: demand deposits, d_t, and an internationally-traded bond, b_t^h. The financial wealth of the household is: $\dot{a}_t^h = d_t + b_t^h$. The household's budget constraint is given by:

$$\dot{a}_t^h = ra_t^h + m_t + w_t(1 - x_t) + D_t^f + D_t^b + \tau_t - c_t - \left(i_t - i_i^d\right)d_t \quad (2)$$

where w_t is the real wage rate; D_t^f and D_t^b denote dividends from the firms and bank respectively; τ_t are lump-sum transfers from the government; i_t is nominal return on traded bonds (in terms of domestic currency); and i_i^d is nominal return on demand deposits. Eq.(2) implies that household's income consists of real returns on financial assets, ra_t^h, real balances, m_t, labour income, $w_t(1 - x_t)$, dividends from firms, D_t^f, dividends from banks, D_t^b, and transfers from the government. The expenditure consists of consumption, c_t, and the opportunity cost of holding demand deposits.

Household holds demand deposits to carry out consumption. The deposit-in-advance constraint is:

$$d_t = \gamma c_t \quad (3)$$

Integrating eq.(2), imposing the no-Ponzi game conditions, and incorporating Eq.(3), the household's intertemporal budget constraint is:

$$a_0^h + \int_0^{\gamma}\{w_t(1 - x_t) + m_t + D_t^f + D_t^b + \tau_t - c_t\left[1 + \gamma\left(i_t - i_i^d\right)\right]\}exp(-rt)dt \quad (4)$$

The household optimization problem involve choosing (c_t, m_t, x_t) to maximize Eq.(1) subject to Eq.(4) given its initial financial wealth, a_0^h, and the time paths of w_t, D_t^f, D_t^b, τ_t, i_t, and i_i^d. The first-order conditions are:

$$\frac{1}{c_t} = \lambda\left[1 + \gamma\left(i_t - i_i^d\right)\right], \quad (5)$$

$$\frac{1}{x_t} = \lambda w_t, \quad (6)$$

$$\frac{1}{m_t} = \lambda, \quad (7)$$

where λ is the time invariant multiplier associated with constraint, Eq.(4). Eq.(5) implies that at an optimum, the household equates the nmarginal utlity of consumption to the marginal utility of wealth multiplied by the effective price of the goods. Eq.(6) indicates that at an optimum, the marginal utility of leisure is equal to the marginal utility of wealth multiplied by the real wage. Eq.(7) states that the marginal utility of real balances is equal to the marginal utility of wealth.

3.2 The Firm:

The representative firm transforms one unit of labour to produce one unit of output, that is, operates under constant-returns-to-scale. The production function is:

$$y_t = l_t \quad (8)$$

The firm must use bank credit to pay the wage bill before output is sold. The firm faces a 'credit-in-advance' constraint. Formally,

$$z_t = \chi w_t l_t \quad (9)$$

where z_t is the realm stock of bank credit. The firm may also hold foreign bonds, b_t^f. The firm's real financial wealth is:

$$\dot{a}_t^f = b_t^f - z_t \quad (10)$$

The firm pays lending rate, i^l, for the bank credit. The firm flow constraint is given as:

$$\dot{a}_t^f = ra_t^f + y_t - w_t l_t - (i^l - i_t)z_t - D_t^f \quad (11)$$

where the term $(i^l - i_t)z_t$ represents the financial cost incurred by the firmfor using bank credit to pay wage bill. Integrating forward, imposing the no-Ponzi games condtion, and substituting Eqs. (8) and (9), the present discounted value of the firm's dividends can be written as:

$$\int_0 D_t^f exp(-rt)dt = a_0^f + \int_0 \{l_t - w_t l_t[1 + \chi(i_t^l - i_t)]\}exp(-rt)dt \quad (12)$$

The firm maximizes the present discounted value of dividends for given paths of w_t, i_t^l, and i_t, and a given initial stock of assets, a_0^f. The first-order condition is:

$$1 = w_t[1 + \chi(i^l - i_t)] \quad (13)$$

Eq.(13) indicates that at an optimum, the firm equates the marginal productivity of labour, unity, to the marginal cost of a unit of labour.

3.3 Banks:

Banks play an important role in the economy. They take deposits from households and lend to firms. Banks finance itself by taking deposits domestically and externally by issuing bonds in the international capital markets. The real assets of the banks are:

$$a_t^b = b_t^b + h_t + z_t - d_t \quad (14)$$

where b^b is internationally-traded bonds, z is credit to firms, h is high-powered money, and d is deposit.

Banking is costly in that banks need to use resources to produce credit and deposits. The banking cost consists of operational and non-operational costs. The banking cost function is:

$$q_t = \psi(z_t, d_t) \quad (15)$$

where $\psi(.) > 0, \psi_z(.) > 0, \psi_d(.) > 0, \psi_{zz}(.) > 0, \psi_{dd} > 0, \psi_{zd} < 0$

The bank flow constraint is

$$\dot{a}_t^b = ra_t^b + (i_t^l - i_t)z_t + (i_t - i_t^d)d_t - i_t h_t - \xi_t\psi(z_t, d_t) - D_t^b \quad (16)$$

where $\xi_t$is a shock to the banks' non-financial costs. The real return on lending to the firm is $(i_t^l - i_t)z_t$. This denotes the real return on bank credit in excess of the world interest rate. Banks can lend to the rest of the world at the rate i_t. The spread earned by banks by lending domestically is $i_t^l - i_t$. This is referred to as the lending spread.

The interest rate paid on deposits is $i_t^d - (\varepsilon_t + \pi_t^*) = r - (i_t - i_t^d)$. The term $(i_t - i_t^d)d_t$ implies the real gain to the bank from paying depositors less than the world real interest rate. The bank can borrow from the rest of the world by selling bonds at the rate i_t. Hence, $i_t - i_t^d$ is the spread earned by banks from borrowing domestically at a reduced cost. The term $i_t - i_t^d$ is the deposit spread. The term $i_t h_t$ is the opportunity cost of holding reserves.

Integrating forward Eq.(16) and imposing no-Ponzi games condition:

$$\int_0 D_t^b exp(-rt)dt = a_0^b + \int_0 [(i_t^l - i_t)z_t + (i_t - i_t^d)d_t - i_t h_t - \xi_t\psi(z_t, d_t)]exp(-rt)dt \quad (17)$$

The government imposes a reserve requirement ratio. ω_t. The required reserve constraint is

$$h_t = \omega_t d_t \quad (18)$$

The bank chooses $\{z_t, d_t, h_t\}$ that maximize the present discounted value of dividends subject to Eq.(18). The first-order conditions are:

$$i_t^l = i_t + \xi_t\psi_z\left(\frac{z_t}{d_t}, 1\right) \quad (19)$$

$$i_t^d = (1-\omega_t)i_t - \xi_t\psi_d\left(1, \frac{d_t}{z_t}\right) \quad (20)$$

Eq.(19) indicates that in the presence of costly banking, the lending rate i_t^l will always be greater than the cost of funds, i. Eq. (20) implies that the deposit rate, i^d, will always be below the cost of funds. Costly banking introduces a wedge between the lending rate and the deposit rate. The wedge between the lending rate and deposit rate $(i^l - i^d)$ is termed interest rate spread.

3.4 Government:

The government consists of the monetary and fiscal authorities. The monetary authority sets the paths of devaluation and fix the reserve requirement ratio. The fiscal authority receioves on net foreign assets, collects revenue, and gives transfers to households. The government flow constraint is

$$\dot{b}_t^g = rb_t^g + \dot{h}_t + (\varepsilon_t + \pi_t^*)h_t + \xi_t\psi(z_t, d_t) - \tau_t \quad (21)$$

The government lifetime constraint is

$$b_0^g + \int_0 \left[\dot{h}_t + (\varepsilon_t + \pi_t^*)h_t + \xi_t\psi(z_t, d_t) - \tau_t\right]exp(-rt)dt = 0 \quad (22)$$

3.5 Equilibrium Conditions:

$1 - x_t = l_t$

$i_t = i_t^* + \varepsilon_t$

Where $i_t^* = r + \pi_t^*$

$\dot{k}_t = rk_t + 1 - m_t - x_t - c_t$

where $k(= b^h + b^f + b^b + b^g)$

$\frac{1}{x_t} = \frac{\lambda}{1+\chi(i_t^l - i_t)}$

$\frac{x_t}{c_t} = [1 + \gamma(i_t - i_t^d)][1 + \chi(i_t^l - i_t)]$

4. DATA AND EMPIRICAL ANALYSIS

The goal of empirical analysis is to examine the role played by banks in the propagation of external shocks in African countries. Our data sample consists of quarterly data for five (5) African countries for the period 1990-2011. The selected countries are Kenya, Malawi, Nigeria, South Africa, and Uganda. Our choice of countries is guided by availability of consistent quarterly data. However, the data sample size differs from one country to another. We obtained our data from the IMF's International Financial Statistics (IFS).

To evaluate the extent to which shocks to the bankiong sector transmit to the other macroeconomic variables, we focus on four types of shocks: (i) shock to exchange rate; (ii) shock to foreign interest rate; (iii) shocks to domestic lending interest rate; and (iv)shocks to the spread between lending and deposit rate. The shocks to spread serve as shocks to the banking sector (ξ) in our model.

4.1 Granger causality:

To examine the causal relation between the shocks and macroeconomic variables, Granger causality tests were performed for the five countries. The results of Granger causality tests are summarized in Table 2. The results of the Granger causality tests are quite mixed. For the hypothesis that foreign interest rate Granger cause domestic lending rate, we cannot reject the hypothesis for only South Africa but for other countries, we can reject the hypothesis. The null hypothesis that foreign interest rate Granger cause spread cannot be rejected for Malawi and South Africa. But for other countries, it can be rejected.

In addition, the null hypothesis that foreign interest rate Granger cause output cannot be rejected for all the five countries. We find evidence of bi-causality for foreign interest rate and output in Kenya and South Africa. Moreover, the null hypothesis that lending rate Granger cause output can only be rejected in Uganda but in other countries, it cannot be rejected. The null hypothesis that spread Granger cause output cannot be rejected only in Uganda. Lastly, the null hypothesis that exchange rate Granger cause output and the reverse causality cannot be rejected in all the countries

Table 2: Granger causality

	Kenya	Malawi	Nigeria	S.Africa	Uganda
Null hypothesis	Prob.	Prob.	Prob.	Prob.	Prob.
Foreign interest rate does not cause lending rate	0.958	0.716	0.207	0.019	0.839
Lending rate does not cause foreign interest rate	0.067	0.81	0.124	0.517	0.160
Foreign interest rate does not cause spread	0.779	0.012	0.527	0.038	0.581
Spread does not cause foreign interest rate does not	0.418	0.431	0.124	0.298	0.219
Foreign interest rate does not cause output	0.0018	0.005	0.046	3.E-21	4.E-06
Output does not cause foreign interest rate	2.E-20	0.768	0.299	0.033	0.140
Lending rate does not cause output	0.051	0.001	0.003	9.E-08	0.135
Output does not cause lending rate	0.264	0.005	0.556	0.031	0.915
Spread does not cause output	0.257	0.904	0.370	0.207	0.022
Output does not cause spread	0.890	0.007	0.073	0.323	0.937
Nominal depreciation does not cause output	0.008	2.E-20	3.E-09	1.E-11	3.E-13
Output does not cause nominal depreciation	3.E-22	0.005	0.086	1.E-25	4.E-38

4.2 Vector autoregression analysis:

We use the vector autoregression analysis to examine the dynamics response of key variables to a series of exogenous shocks. We analyse the way in which foreign interest rate and nominal exchange rate shocks affect the domestic lending rate. Moreover, we analyse how foreign interest rate and nominal exchange rate, lending rate, and spread shocks affect output.

Fig.1 to 5 show the responses of lending rate and output to exogenous shocks. Except in Malawi and Nigeria, shocks to foreign interest rate are translated into higher domestic lending rates in other countries. Similarly in Kenya, Nigeria, and Uganda, shocks to exchange rate are translated into higher lending rate. But in Malawi and South Africa, it result in lower lending rate.

The results for output response to exogenous shocks are also mixed. In Kenya, all the shocks translate to lower output. In Malawi, only the spread shocks result in lower output. Other shocks lead to higher output in Malawi. In Nigeria, only foreign interest rate shocks result in higher output. In South Africa, exchange rate and lending shocks result in lower output. In Uganda, only exchange rate shocks translate to lower output.

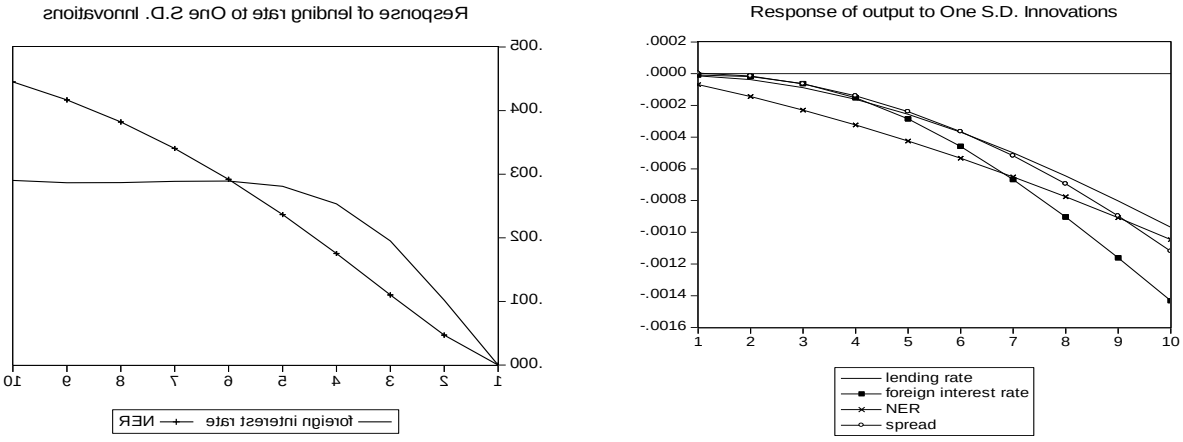

Fig.1. Impulse response for lending rate and output in Kenya

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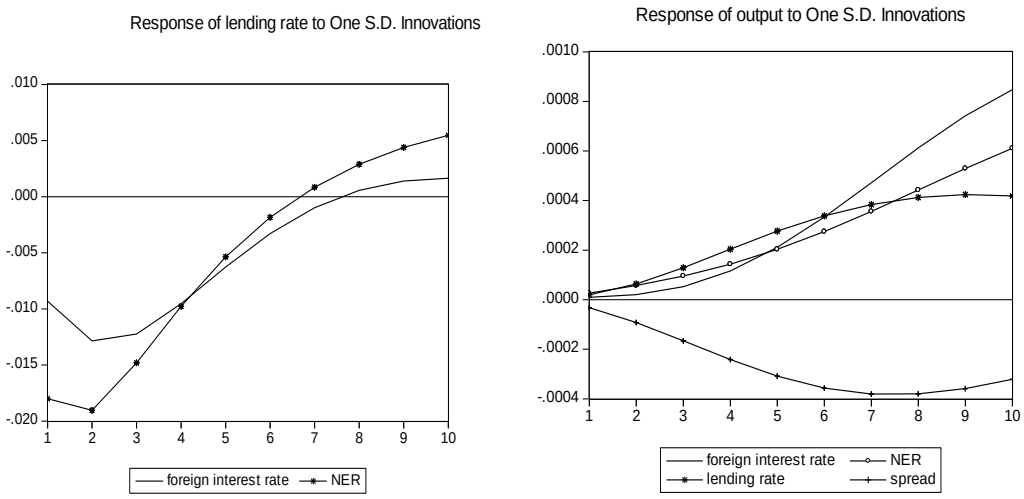

Fig.2. Impulse response for lending rate and output in Malawi

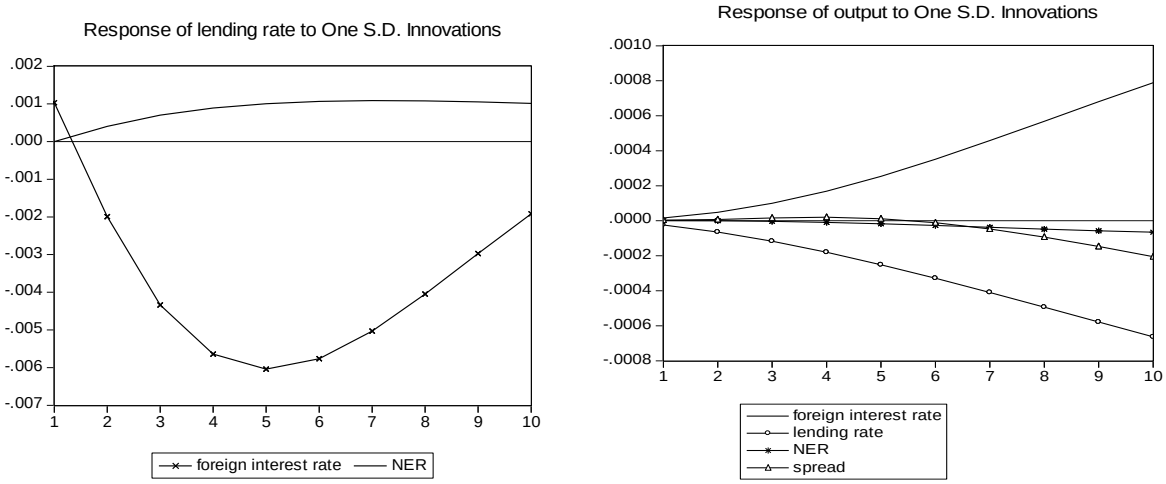

Fig.3. Impulse response for lending rate and output in Nigeria

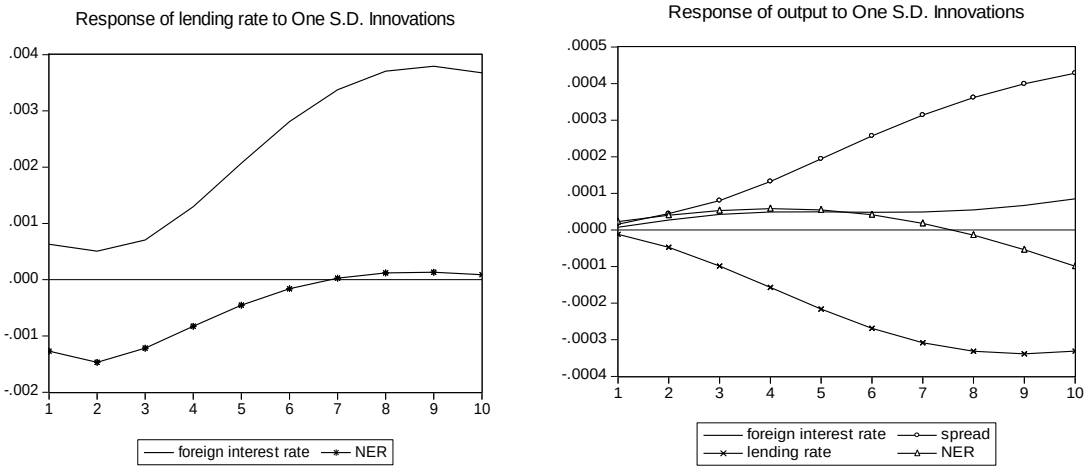

Fig.4. Impulse response for lending rate and output in South Africa

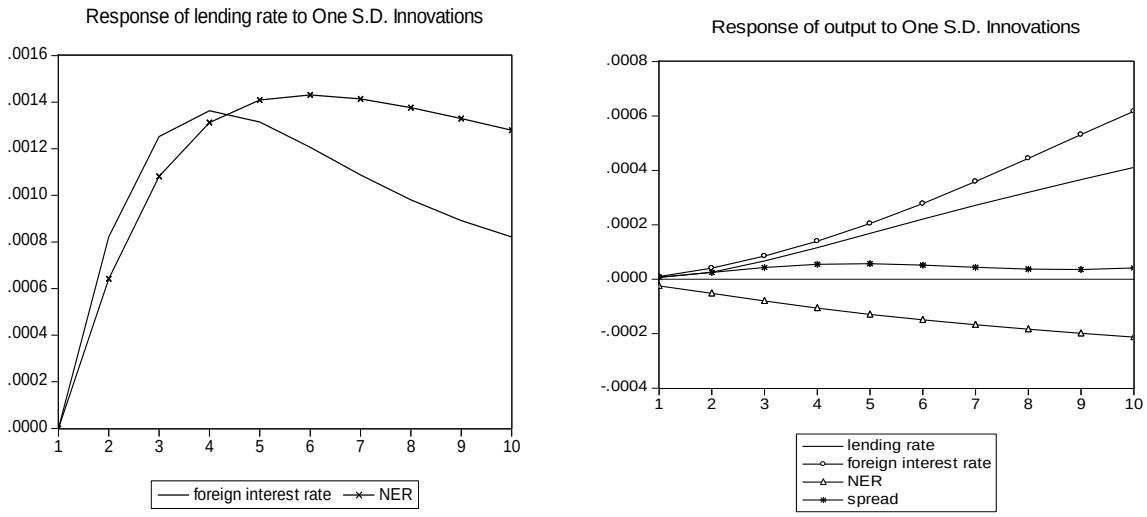

Fig.5. Impulse response for lending rate and output in Uganda

5. CONCLUSION

The study investigates the role played by banks in the propagation of external shocks in African countries. The evidence are quite mixed for African countries. Generally, the findings show that foreign interest rate and exchange rate shocks significantly affect output fluctuations in African countries. Foreign interest rate shocks also impact the spread in two countries and lending rate in South Africa. We find limited evidence that the banks propagate and amplify shocks to African economies. The implication of the findings is that African banks are not too exposed to external shocks.

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