



# Macroeconomic and market microstructure modelling of Ugandan exchange rate



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## ABSTRACT

This paper empirically investigates the usefulness of a hybrid model consisting of macroeconomic fundamentals and market microstructure variables in examining the dynamics of the Uganda shilling/US dollar foreign exchange rates. We employ macroeconomic fundamentals that are guided by the monetary model of exchange rates and market microstructure related frictions represented by order flow and bid–ask spreads to track long-run and short-run movements in exchange rates, respectively. Utilising the ARDL framework, we estimate the model using monthly data spanning the period January 1995 to March 2013. We find that our hybrid model is robust to alternative model specifications and provides an adequate framework to explain the dynamics of the Uganda shilling/US dollar foreign exchange rates.

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## 1. Introduction

In recent times, the globalisation phenomenon coupled with the global financial crisis (GFC) has renewed interest in investigating foreign exchange market dynamics. Although the earlier presumption was that Sub-Saharan Africa would be less affected by the GFC, the rapid depreciation of currencies of African countries and decline in stock prices during this time (African Development Bank, 2009; Ltaifa et al., 2009) has engendered the need to investigate the likely impact of domestic and foreign shocks on exchange rate movements. Following the GFC, the African continent has suffered severely as second round effects of the crisis began to emerge mainly through the decline in Africa's exports, foreign aid, private capital inflows and remittances (African Development Bank, 2010). Clearly, the resultant slowdown in growth and macroeconomic instability is likely to constrain financial integration, economic growth and progress towards achieving the Millennium Development Goals of the African continent.

The difficulty in predicting exchange rates is well documented in the literature as macroeconomic forecast models tend to underperform a random walk model. In their seminal article, Meese and Rogoff (1983) show that macroeconomic fundamentals, including money supply, interest rates, real income and the current account balance contain no useful information for forecasting exchange rates over the short to medium term horizon. Since then empirical evidence of the impact of macroeconomic fundamentals on exchange rates has been mixed (Cheung et al., 2005; Engel et al., 2007; Frankel and Rose, 1995) with the general conclusion being that exchange rate dynamics cannot be exclusively accounted for by macroeconomic fundamentals. A recent

development is the hybrid model, which incorporates macroeconomic fundamentals and market microstructure variables for modelling exchange rates (Evans, 2011; Evans and Lyons, 2002). The hybrid approach has gained credibility because of its ability to explain a significant proportion of exchange rate movements and its continued superior performance in both in-sample and out-of-sample tests compared to traditional models (Evans and Lyons, 2002; Rime et al., 2010).

The objective of this paper is to develop a hybrid model that captures exchange rate dynamics in Uganda over the floating exchange rate regime. This paper makes three main contributions to the literature. First, few studies have examined the hybrid model within a developing country context. In this study we develop a hybrid model and apply it to a developing country, in this case Uganda. Second, while our approach is similar to that of Chinn and Moore (2011), we extend their model in several important directions. First, we incorporate additional market microstructure variables based on sound economic theory to adequately capture exchange rate dynamics, namely, bid–ask spread in addition to order flow. Second, we include variables capturing central bank intervention and stock of foreign exchange reserves to account for Uganda's managed float foreign exchange regime. Lastly, given that previous studies indicate that the information content of order flow originates from dealer transactions with customers, we employ aggregate order flow from the end user segment of the Ugandan foreign exchange market and not interdealer order flow, thus capturing the economy wide demand for foreign exchange. In this way, we extend earlier studies on the Ugandan foreign exchange market of Opolot and Anguyo (2007) and Egesa (2009) by considering a wide array of market microstructure and macroeconomic fundamentals and using high frequency data covering a longer time span to explain exchange rate dynamics in Uganda.

The rest of this paper is organised as follows. Section 2 provides an overview of foreign exchange rate policy reform in Uganda. Section 3

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reviews the literature on foreign exchange determination. Section 4 describes the ARDL model and the sources and description of data. Section 5 reports and discusses the empirical results. Section 6 concludes with some policy recommendations.

## 2. Evolution of exchange rate policy in Uganda

In 1966, the Uganda government established the Bank of Uganda (BOU) as the central bank with the mandate of maintaining external reserves in order to safeguard the international value of the Uganda shilling. This responsibility was further underscored by the Bank of Uganda Act (Government of Uganda, 2000) and the Foreign Exchange Act (Government of Uganda, 2004) which appointed BOU as the Government's agent to manage the foreign exchange rate and foreign currency transactions. Since its inception, the Uganda foreign exchange market has undergone significant transformation. The focus of BOU has been to eliminate price distortions and this was largely achieved through increased reliance on market mechanisms to guide resource allocation (Atingi-Ego and Sebudde, 2004; Kasekende et al., 2004). The adoption of a flexible exchange regime was expected to ensure a uniform market determined exchange rate for achieving efficient resource allocation (Kasekende and Ssemogerere, 1994).

Prior to 1980, the Uganda shilling was pegged to various currencies including the US dollar, pound and SDR (Atingi-Ego and Sebudde, 2004). These pegs were used to provide a nominal anchor for controlling inflation and promoting export competitiveness. Despite this, the deterioration in the economy in the latter half of the 1970s led to a chronic shortage of foreign exchange and the emergence of a parallel unofficial foreign exchange market with an overvalued Uganda currency. The overvalued foreign exchange rate imposed an implicit tax on exports and subsidized imports (Kasekende and Ssemogerere, 1994; Whitworth and Williamson, 2010). In an attempt to restore macroeconomic stability and exchange rate competitiveness, Ugandan authorities adopted various exchange rate regimes over the period 1980 to 1990 including an independent float, a dual exchange rate regime, auction system, adjustable independent peg and a discretionary crawl (Atingi-Ego and Sebudde, 2004). In July 1990, a significant step towards the adoption of a market based foreign exchange rate occurred when the parallel market was legalised and exporters were allowed to retain all foreign exchange receipts from such exports (Atingi-Ego and Sebudde, 2004; Byaruhanga et al., 2010). Private demand for foreign exchange was to be channelled through the bureaux which dealt in spot transactions at freely determined rates. The bureaux market grew rapidly and by June 1993 the number of bureaux operating stood at 80 of which 25 were bank-owned and 55 private-owned.<sup>1</sup> The emergence of the bureaux helped in narrowing the premium between the official exchange rate and the bureau rate (Byaruhanga et al., 2010; Kasekende and Ssemogerere, 1994; Whitworth and Williamson, 2010).

Since the adoption of a flexible exchange rate regime in 1993, the Uganda shilling/US dollar exchange rate has been characterised by persistent depreciation. Between 1993 and 2012, the nominal Uganda shilling per US dollar exchange rate (UGX/USD) depreciated by 109.48%, an average depreciation of 4.38% per year (Bank of Uganda, 2013). The liberalization of capital and current account did see a marginal appreciation of the local currency during the period 1994 to 1996, largely the result of improvements in terms of trade (Byaruhanga et al., 2010). However, thereafter, the local currency experienced strong depreciation pressure over the period 1997 and 2000 which coincided with the unwinding of the coffee boom and removal of controls on the capital account (Byaruhanga et al., 2010). The rate of depreciation of the local currency slowed down over the period 2001 to 2002 and by 2008 the local currency was stable and registering a slight appreciation over the period 2003 to 2008 (Bank of Uganda,

2013). The appreciation pressures during this period were partly caused by an increase in private transfers, exports of goods and services and private capital inflows in addition to large donor inflows (Byaruhanga et al., 2010; Kasekende, 2001). The increased capital flows were indicative of the increased confidence in the performance and management of the Ugandan economy during this period, a payoff for consistent adherence to prudent macroeconomic policies. Nonetheless, the exchange rate appreciation caused some concerns for exporters especially producers of primary commodities who raised concerns about possible loss of competitiveness owing to the strengthening of the local currency against the US dollar.

Recently, there has been growing concern over strong depreciation pressures since the onset of the GFC and its implication for macroeconomic stability (Bank of Uganda, 2011; Tumusiime-Mutebile, 2012b). The outcome of this debate on the policy front has been a focus on the likely role of monetary policy in keeping appreciation or depreciation pressures at bay (Mugume, 2011). This notwithstanding, the exchange rate is market determined and the Bank of Uganda only intervenes to smooth out wide fluctuations, but does not defend any particular level of the exchange rate. Thus an understanding of exchange rate dynamics in Uganda is crucial. Indeed gains in growth and poverty reduction over the period are in part due to the liberalization of the foreign exchange market (Byaruhanga et al., 2010).

## 3. Exchange rate determination: an overview

Traditional approaches to exchange rate determination rely on macroeconomic fundamentals to account for exchange rate dynamics. Despite their contribution to policy discourse, macroeconomic fundamental models have been criticised in the econometric literature as failing to fully account for exchange rate behaviour, particularly short run dynamics (Cheung et al., 2005; Kim et al., 2010; Meese and Rogoff, 1983). However, macroeconomic fundamental models are found to provide valuable insight into the drivers of exchange rate in the long run and this provides useful guidance for policy makers and other stakeholders (Cerra and Saxena, 2010; Frankel and Rose, 1995; Rapach and Wohar, 2002).

Although the monetary model of exchange rate determination and its variants remain popular in modelling foreign exchange rates (see Hopper (1997); Sarno and Taylor (2002); Morley (2007); MacDonald (2007)), the poor performance of this model in out-of-sample forecast has prompted researchers to seek out alternative models to account for exchange rate dynamics. The two new approaches that emerged rely on micro foundations to explain exchange rate dynamics, namely, the New Open Economy Macroeconomics (NOEM) approach (Bergin, 2003; Lane, 2001) and the Market Microstructure (MM) approach (Evans, 2011; Lyons, 2001). Despite these developments, the NOEM and MM models have not been employed in the developing countries' context because they require high frequency micro data on the behaviour of individuals and firms (Evans, 2011; Hairault and Sopraseduth, 2004; Sarno and Taylor, 2002) which are often not available for developing countries.

In recent times, a new approach, the hybrid model, emerged which incorporates both macroeconomic fundamentals and market microstructure variables to explain exchange rate dynamics. The hybrid model has gained credibility because of its ability to explain a significant proportion of exchange rate dynamics and its continued superior performance in both in-sample and out-of-sample tests (Evans and Lyons, 2002; Rime et al., 2010). The hybrid model, unlike the traditional monetary model, is capable of accounting for the key drivers, such as expectations, which influence exchange rate dynamics in the short to medium term (Evans, 2011; Evans and Lyons, 2002; Rime et al., 2010). As well, the hybrid model is capable of explaining a significant portion of exchange rate dynamics of various currencies, time periods and forecast horizons (Evans, 2011).

<sup>1</sup> Bank of Uganda 1993 communication Archives.

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