

## Currencies-Deposits Ratios and the Money Multipliers in African Countries

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### Abstract

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*This paper uses six different case scenarios to highlight the importance of high currencies-deposits ratios on the money multipliers in 54 African countries where the three major foreign currencies (US\$, £, and €) are easily accepted, exchanged, and deposited. In 26 African countries, the central banks mandate reserve requirements only on domestic demand deposits while central banks in 25 countries authorize reserve requirements on both domestic and foreign currency deposits. In contrast, central banks in Central African Republic, Djibouti, and Somalia have no reserve requirements. To highlight the impact of currencies-deposits ratios on the monetary system, this study provides the theoretical calculations of the money multipliers under six case scenarios. Generally, the standard model normally assumes no currency-deposit ratio and this explains why the computations in the first two case scenarios showed high money multipliers. Given that African countries are cash driven economies with easy access to US\$, £, and € through remittances and the high currencies-deposits ratios of the nonbank public, this study uses case scenarios three through five to illustrate that high currencies-deposits ratios remarkably decreased the power of the money multipliers, which would have negative impact on credit/liquidity growth. The calculated money multipliers in the sixth case scenario show that if the nonbank public decrease their currencies-deposits ratios due to financial intermediations outreach such that the residents in the underserved urban and rural communities gain access to financial intermediations, central banks in African countries can increase the power of the money multipliers if the main objective is to boost credit/liquidity growth.*

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**JEL Classification:** E51, E58, F36, G21, G28

### 1. Introduction

Since the late 1970s and early 1980s, African countries have experienced significant changes in their monetary systems. The most dramatic of these changes has been the widely accepted foreign currency holdings (FCUs) and deposits (FDDs) as manifested by the growing demand for foreign currencies such as the United States dollar (US\$), the British pounds (£), and the Euro (€) for transaction or precautionary and speculative purposes by the residents of African countries. According to El-Erian (1987), officially-sanctioned foreign currency deposits in developing countries occurred because of widespread currency substitutions.<sup>1</sup> In an environment of increasing desire to hold foreign currencies instead of domestic currencies, African governments embarked on promoting FDDs in the banking systems in order to gain more control over domestic liquidity, to encourage capital inflows, to provide a reliable source of foreign exchange, and to limit capital flight.

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<sup>1</sup> For the complete discussion of foreign currency deposits in developing and other developed countries, see El-Erian (1987) and Sussman (1992).

Due to persistent currency devaluations, many African households consider the holding of FCUs and FDDs as the necessary buffer against uncertainties with respect to the value of their domestic currencies and the returns on their asset-portfolio. As several studies pointed out, foreign currency holdings in dollars, pound sterling, and the euro could be in the form of cash, demand deposit, savings, and time deposits for transaction and asset purposes within the banking systems.

In the 1960s and early 1970s, it was virtually impossible for an African to accept the US\$ or £ or € as medium of exchange due to exchange rate laws and restrictions, but more importantly, no domestic merchants tagged his or her products in US\$ or £ or €. Today, it is a common practice for products to be tagged in any of these three major foreign currencies because these are widely accepted currencies over their domestic currencies. It is difficult to quantify the intensity of the desire to hold these currencies over the past three or more decades, however tourists who travel to many attractive destinations in African countries can confirm that local merchants prefer to accept foreign currencies rather than their domestic currencies. Today, nearly every African knows about foreign exchanges both at the official and black markets without any formal educational training in international economics. In view of this trend and given the fact that foreign currency deposits constitute a major share in total demand deposits within the banking systems, this study focuses on the money multipliers in all African countries. The central banks in some African countries require their banks to hold reserves on these foreign currency deposits while others do not. A common characteristic of these countries is the holding of foreign currencies due to the inflows of remittances from abroad regardless of the prevailing policy position.

Until recently, currency control laws prohibited the residents of some African countries from holding foreign currencies and assets. The events of the past three or four decades have shifted the emphasis on currency control laws. Now, African countries open their economies to free capital inflows; and international agencies such as Western Union, MoneyGram, DHL Express, and WorldRemit have made foreign currency holdings much easier through instantaneous or overnight remittances. This is one of the numerous policy shifts of the last three or four decades which suggests different dimensions with which to view the holdings of foreign currencies and deposits. So far, there are not many studies of reserve requirements on foreign currency deposits in African countries, especially the impact on the money supply processes and the money multipliers given the apparently high currencies-deposits ratios; therefore, this paper is an attempt to fill the gap.

This paper contributes to the literature by using theoretical models to show the effects of holding foreign currencies and deposits on the money supply and the money multipliers for 54 African countries. First, to the best of the author's knowledge, this is the first study to examine and/or compute the money multipliers for each African country under six case scenarios. Second, computing the money multipliers for each African country is important because country-specific analysis is much preferred to panel data analysis that some economists at the World Bank and International Monetary Fund [see Iossifiv and Khamis (2009) and Jerven (2015)] generally employ for African countries, more so in this case where reserve requirements on domestic and foreign currencies differ across countries. Third, this paper provides the theoretical underpinnings of the money multipliers for African countries where the widespread use of cash is most prevalent and much noticeable in this era of increasing remittances, which provided many African households with easy access and preference to hold US\$ and/or £ and/or € over their own domestic currencies.

The computed money multipliers in the first two case scenarios followed the traditional simplifying assumption of zero currency-deposit ratio with respect to both domestic and foreign currencies. Using the simple traditional model, the computed money multipliers are in double digits in 37 countries, except for Angola-3.33, Cape Verde-4.0, Comoros-4.0, Ethiopia- 6.67, Gambia-7.14, Liberia- 4.0, Libya- 5.0, Madagascar- 4.16, Nigeria- 4.44, Sao Tome and Principe- 6.25, Sierra Leone- 8.33, Sudan-5.6, South Sudan- 5.0, and Zimbabwe-3.33. Unfortunately, using the conventional model to compute money multipliers for African countries do not actually capture the fact that these are predominantly cash economies with very high currencies-deposits ratios. In other words, African households hold large ratios of both domestic and foreign currencies for transaction and precautionary purposes, despite financial innovations; therefore, incorporating the currencies-deposits ratios provides a more realistic analysis. Since the nonbank public holds very high ratios of both domestic and foreign currencies, this paper shows the impact on the money multipliers and money supply in case scenarios three through five under different currencies-deposits ratios. The computed results for the third case scenario showed that the high currencies-deposits ratios, by the nonbank public in African countries, remarkably decreased the impact of the money multipliers.

Essentially, these three case scenarios showcase the implicit challenges that African central banks face regarding credit/liquidity growth or management, predicting the money demand, and their ability to use contractionary monetary policy to achieve anti-inflation objective. The sixth case scenario is designed to illustrate that African central banks can increase the power of the money multipliers to boost credit/liquidity growth if they engage in policies to promote prudent financial intermediations by reaching out to the financially underserved urban and rural communities because this would reduce the high currencies-deposits ratios.

This paper is organized as follows. Section 2 provide a brief literature review of foreign currency holdings and deposits. Section 3 provides the general framework necessary to comprehend different aspects of foreign currency holdings and deposits. Section 4 provides the computed money multipliers under different scenarios based on the available data on reserve requirements and tests for the difference in the effectiveness of liquidity management between two groups of African countries. Section 5 is devoted to the concluding remarks and the monetary policy implications of this study.

## 2. Literature Review

Many studies have examined foreign currency holdings and deposits in the western industrialized and Latin American countries. Girton and Roper (1981), McKinnon (1982), Tanzi and Blejer (1982) provided the theoretical frameworks of currency substitutions and foreign currency holdings. Bordo and Choudhri (1982), Cuddington (1983), Ortiz (1983), Ramirez-Rojas (1985, 1986), Canto (1985), Fasano-Filho (1986), and Marquez (1987) provided the empirical tests. Studies such as Bennet *et al.* (1999), Boyd *et al.* (2001), Burnside *et al.* (2001), Kovanen (2002), De Nicolo *et al.* (2003) Ize and Yeyati (2003), Honohan and Shi (2003), Barth *et al.* (2004), and Broda and Yeyati (2006) have examined theoretically and/or empirically FDDs either in the context of “dollarization” and its effect on bank lending, monetary policies or the stability of the financial sectors in countries where there is no severe restriction on FDDs.

Studies by Tanzi and Blejer (1982), El-Erian (1987), and other researchers have shown that foreign currency deposits (FDDs) and foreign currency holdings (FCUs) in developing countries stem from the widespread currency substitutions, which was the response to foreign exchange restrictions and other external imbalances. The consensus among researchers of this phenomenon is that the large scale FCUs and the officially approved FDDs and the large scale growth in developing countries may have significantly altered the economic structure in terms of the ability of the governments to implement fiscal, monetary, and foreign exchange policies. To put this succinctly, FDDs and FCUs can be viewed as external macroeconomic shocks that affect money demand, household portfolio choice, the price level, and the entire banking systems. In a related study, Agénor and Khan (1996) utilized a model that incorporated forward-looking rational expectations for 10 developing countries and concluded that the foreign rate of interest and the expected depreciation of the parallel market exchange rate are important factors in the choice between holding domestic money or foreign currency deposits abroad.

In one of the recent studies, Kovanen (2002) provided a comprehensive analysis of the main features and policy implications of reserve requirements on foreign deposits in 44 countries in Sub-Saharan Africa (SSA). According to Kovanen (2002), central banks in 25 of these SSA countries require banks to hold reserves on both local and foreign currency deposits. In addition, he showed that the share of FCDs as percent total deposits was negligible in 17 countries and substantial in 26 countries. Within the latter group of countries, the share of FDDs as percent of total deposits was in double digits in 17 countries (Angola-65%, Burundi-12%, Democratic Republic of Congo-81%, Ghana-36%, Guinea-33.2%, Kenya-16%, Liberia-75.4%, Madagascar-19.3%, Malawi-17%, Mauritius-11.4%, Mozambique-52.8%, Rwanda-30%, Sao Tome and Principe-51.8%, Sierra Leone-28.1%, Tanzania-33.2%, Uganda-30.3%, and Zambia-45%). Kovanen concluded that a uniform ratio is preferable for monetary control purposes because it ensures the predictability of changes in the money multiplier, while using domestic currency as the reserve asset simplifies liquidity control.

In another related study, Kubo (2007) used cross-country data to analyze whether foreign currency deposits promote or deter financial development in low-income countries. More importantly, Kubo (2007) pointed out “that a higher proportion of FCD in total deposits is associated with growth in private credit only in inflationary circumstances (over 24 percent of the annual inflation rate). FCDs can lead to a decline in private credit below this threshold level of inflation.” Given the persistence of FCDs, Kubo (2007) argued that deregulating them in low-income countries may do more harm than good on financial development in the long term, notably after successful containment of inflation.

In Sanusi's (2010) examination of the money supply process in Ghana, he concluded that "the money multipliers have been subject to short-term fluctuations and long-term trend movement, but the *net* changes in money stock seems to be mainly driven by changes in monetary base," and that changes in both the net domestic assets which dominated prior to 1996 and net foreign assets since 2003 explain the changes in the monetary base of the Bank of Ghana. In a study of the money multiplier in Nepal during the fiscal year 2004/05 and 2014/15, Tiwari (2016) argued that reserve money is the best determinant of money supply, net foreign assets as the major determinant of reserve money, and time deposits to demand deposit ratio as the significant determinant of the money multiplier. In addition, Tiwari (2016) found the net foreign assets to be the better determinant than net domestic assets in Nepalese economy. But more importantly, she concluded that since Nepal Rastra Bank (central bank) does not control net foreign assets, this may pose some difficulties in controlling reserve money. These findings are not surprising due to the different characteristics of the financial and capital markets in many developing countries.

### 3. The Theoretical Framework

#### 3.1 Background Factors

The causes and economic implications of FCUs and FDDs in African countries have not been thoroughly analyzed. The absence of such analysis creates a vacuum with many questions unanswered. For example, what are the likely effects on domestic money demand, asset-portfolio composition, and the banking systems given the fact that the financial and capital markets in African countries are underdeveloped? Could FCUs and FDDs complicate the operation of the banking systems if central banks use reserve requirements as the tool of expansionary monetary policy instead of open-market operations when confronted with severe liquidity or credit crunch? These are critical questions in the context of African countries. This study fills another significant gap in the literature by answering these important questions.

Given the waves of FCUs and FDDs and the effects on African economies, it is important to highlight some of the underlying institutional and economic characteristics that contributed to the large scale FCUs and FDDs. During the 1980s and 1990s, African countries experienced grim economic outlooks as real GDP and per capita income (real per capita GDP) grew at anemic rates, and in some years, the growth rates were actually negative. Generally, African countries depend heavily on the exports of agricultural products for their foreign exchange earnings with which they pay for the imports of goods and services, particularly, the capital imports for the manufacturing sector. The excess demand for imports given the insufficient foreign exchange earnings from the exports of agricultural products during the 1970s and the 1980s contributed to the deficits in current account balances. The poor economic performances, the massive importation of goods and services, the balance of payments problems, and the growing external debts led some of these countries to adopt very restrictive economic stabilization programs, especially with respect to foreign exchange policies with the objective of conserving the foreign exchange earnings which declined very sharply due to the depressed world market.<sup>2</sup> Furthermore, the depressed state of the world market affected export earnings from oil and other primary commodities thus many countries experienced decreases in their external reserves. As external reserves decreased, foreign exchange was rationed, and large scale FCUs emerged which served those who could not obtain foreign exchange authorization through the official channels. Arguably, the emergence of large scale parallel markets was in response to the insufficient foreign exchange earnings. In the parallel markets, foreign currencies exchanged for domestic currencies at rates much higher than the official rates. In addition, the countries operated under the fixed exchange rate policies, which encouraged overvaluation of their domestic currencies, affected international trade, and other foreign transactions in an environment of underdeveloped financial capital markets with profound capital and international trade restrictions.

There are several economic implications of FCUs and FDDs that warrant critical analysis. For the remainder of this section, the focus is on some major channels such as the demand for money, asset-choice or portfolio composition, domestic inflation rates, the banking systems, and the money multipliers, through which the effects of FCUs and FDDs are transmitted to African economies.

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<sup>2</sup> For the literature on currency transferability and developments in African countries, the reader is advised to see Pick's *Currency Yearbook*, various issues.

### 3.2. The Demand for Money

Theoretically, the demand for money depends on income and the market interest rate. In many developing countries, interest rates are not market determined or are sometimes negative due to control laws.<sup>3</sup> In economies with widespread FCUs and FDDs, the alternative assets include foreign currency in the hands of the residents and foreign currency denominated deposits. The issue for discussion is the impact of FCUs and FDDs on the domestic money demand. As explained earlier, the residents now hold both domestic and foreign currencies for transaction or precautionary purposes because the purchasing power of foreign currencies increase with recurring devaluations of domestic currencies, thus making the holding of foreign currencies much more desirable. In other words, the higher the purchasing power (or the appreciation of foreign currency) of foreign currencies when the domestic currencies are devalued, the greater the incentive for residents to replace their holdings of domestic currencies with foreign currencies.

One can sum up the explanation thus far within the framework of economic theory, which suggests that money demand ( $M^D$ ) is a function of income ( $Y$ ) and interest rate ( $r$ ), which is normally expressed as:

$$M^D = f(Y, r) \quad (1)$$

and that  $\frac{\partial M^D}{\partial Y} > 0$  and  $\frac{\partial M^D}{\partial r} < 0$ . Generally,  $\frac{\partial M^D}{\partial Y} > 0$  captures the conventional transaction and precautionary motives as to why people demand for money, and  $\frac{\partial M^D}{\partial r} < 0$  captures the Keynesian speculative motive. Applying this standard money demand theory to African countries, one needs to consider foreign currency inflows, therefore, the money demand equation is rewritten as:

$$M^D = f[(Y, r); FCU(REM), FDD(REM)] \quad (2)$$

where  $FCU$  and  $FDD$  are the total foreign currency holdings and deposits, and  $REM$  is the level of remittances from abroad. Over the past three and a half decades, nearly every African household has access to foreign currencies because they receive remittances from relatives who live in the United States and other European countries; therefore, the expectation is that  $\frac{\partial M^D}{\partial FCU} \frac{\partial FCU}{\partial REM} > 0$  and  $\frac{\partial M^D}{\partial FDD} \frac{\partial FDD}{\partial REM} > 0$  as remittances increase.

Since the total money demand can be in the form of domestic currencies ( $DCUs$ ), foreign currencies ( $FCUs$ ), domestic demand deposits ( $DDD$ s), and foreign currency-denominated deposits ( $FDD$ s) in local commercial banks; therefore, equation (2) is rewritten as:

$$M^D = h[DCU(Y), DDD(r), FCU(REM), FDD(REM)] \quad (3)$$

and rearranging in linear form as:

$$M^D = DCU(Y) + FCU(REM) + DDD(r) + FDD(REM) \quad (4)$$

where  $DCU(Y)$  and  $FCU(REM)$  are the holdings of domestic and foreign currencies for transaction and/or precautionary purposes,  $DDD(r)$  is the domestic currency-denominated deposits, while  $FDD(REM)$  is the foreign currency-denominated deposits in African countries where such deposits are permissible. The  $FCU(REM)$  holdings are exchanged whenever these foreign currencies appreciate in values, in both the official and parallel markets.

To normalize the money demand expressed in equation (4), it is assumed that each component is a proportion ( $\lambda$ ) of total money demand, which sums to unity, that is:

$$M^D = \lambda_1 DCU + \lambda_2 FCU(REM) + \lambda_3 DDD + \lambda_4 FDD(REM) \quad (5)$$

and that  $\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 = 1$ . Today, one can assume that African households prefer to hold a larger proportion of their  $M^D$  in foreign currencies either due to the devaluations of their domestic currencies or that foreign currencies are more prevalent when compared to the 1960s and 1970s. The preference for foreign currencies over their domestic currencies implies that  $(\lambda_2 + \lambda_4) > (\lambda_1 + \lambda_3)$ .

<sup>3</sup> Basically, the market interest rate is the opportunity cost of holding money relative to the return on alternative assets.

For those countries that prohibited or restricted  $FDD(REM)$ , one can safely assume that  $\lambda_4$  is highly negligible or close zero; however,  $\lambda_2 > (\lambda_1 + \lambda_3)$  because foreign currency holdings still exist due to the remittances from relatives abroad. These foreign currencies are held in cash at home (warehousing of foreign currencies) and are later exchanged through the local Bureau de Change or parallel markets whenever these currencies appreciate significantly relative to their domestic currencies.

### 3.3. Asset or Portfolio Allocation

Generally, the financial and capital markets perform the important role of channeling funds from lenders-savers to borrowers-spenders thereby resulting in higher economic efficiency. In addition, the activities in financial markets have direct effects not only on the behavior of corporations, but also in showing the direction of the economy as a whole. To understand how  $FCUs$  and  $FDDs$  influence the composition of assets in the financial and capital markets in African countries, let us assume that in the past three years every African family was confronted with two choices of assets:

1. buy a one-year of their government securities, say in August of 2019 for 10,000.00 in their domestic currency to be redeemed for 11,000.00 in August of 2020, and
2. hold either US\$1,000 or £1,000.00 or €1,000.00 in currencies or in foreign currency-denominated deposits with one of the commercial banks.

For simplicity, let us assume that the 2019-2020 official foreign exchange rate was such that US\$1.00 or £1.00 or €1.00 was expected to appreciate by 15% to 20% during the same period. Alternatively, one can also assume that these economies experienced severe external shocks and that the International Monetary Fund and/or World Bank experts advised the governments to devalue their domestic currencies in order to maintain their competitiveness and improve their terms of trade.<sup>4</sup>

With expected devaluations, the holding of US\$, £, and € denominated deposits became much more preferable to many African households, thus it was prudent for them to shift their portfolio from short-term and long-term government securities or corporate bonds to these foreign-currencies-denominated deposits; therefore, this led to the growth of foreign currency deposits. It is logical to conclude that the recurring devaluations of their domestic currencies, which occurred from time to time encouraged asset substitutions. This assertion is supported by the Egyptian experience during the 1980s, and according to El-Erian (1987),  $FDDs$  in Egypt grew from 25 percent of broad money in 1980 to 40 percent in 1985 and much higher thereafter.<sup>5</sup>

It should be noted that the explanation above is also applicable to the capital markets where long term instruments such as the corporate stocks, corporate bonds, and government securities are bought and sold. In either case, the end result is that residents will give up domestic financial assets for foreign currency denominated deposits. As a matter of fact, this could have more adverse impact on the capital markets because of the characteristics (illiquidity, riskiness and/or uncertainty) of the instruments of the capital markets. Since these  $FDDs$  are highly liquid – part of M1 – therefore those residents who are risk averse and those with preference for highly liquid or nearly liquid assets will prefer to choose  $FDDs$  over short-term and long-term domestic financial assets. Another important question that can be raised relates to the effects of  $FCUs$  and  $FDDs$  on the ability of corporations and the governments to raise funds in the financial and capital markets since these are two of the markets where they raise the required operating funds. Obviously, the growth of  $FCUs$  and  $FDDs$  affects the ability of corporations to raise needed funds in both markets if the residents show preference for more of foreign currency denominated assets in their portfolio. Similarly, the growth of  $FCUs$  and  $FDDs$  will affect the ability of the governments to finance and implement their ambitious development programs if government securities are no longer attractive assets to residents despite the safety usually identified with such securities.

According to the theory of portfolio allocation, a saver's or an investor's asset allocation ( $AA$ ) depends on wealth ( $W$ ), expected returns on assets ( $ER$ ), risk or variability associated with asset return values ( $RV$ ), liquidity of assets ( $LA$ ), and the costs of acquiring information ( $IC$ ).

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<sup>4</sup> Generally, most developing countries, especially those in the African continent, are always advised to adjust or devalue their foreign exchange rates whenever they experience external imbalances.

<sup>5</sup> El-Erian (1987) cited Egypt and Sudan among several developing countries where foreign currency deposits have emerged.

In the African case, one can assume that the asset-choice of a typical household and/or an investor is composed of *DDD*, *FDD(REM)*, savings and time deposits, life insurance reserves, and bonds (*B*). The expectation is that African households' or investors' asset allocation will depend on *W(REM)*, *ER*, *RV*, *LA*, and *IC*. Given the country-specific characteristics of the financial systems in African countries, it is reasonable to conclude that their domestic bonds are acquired with high information costs, illiquidity, risky, and decrease in value due to expected devaluations (*ED*), therefore, a typical African household prefers to hold highly liquid *FCUs* and/or *FDDs* as alternatives to government securities and corporate bonds. Algebraically, the determinants of asset allocation, in African countries, can be expressed as:

$$AA = f[W(REM), ER, RV, LA, IC, ED] \quad (6).$$

In addition,  $\frac{\partial AA}{\partial W} \frac{\partial W}{\partial REM} > 0$ ,  $\frac{\partial AA}{\partial ER} > 0$ ,  $\frac{\partial AA}{\partial RV} < 0$ ,  $\frac{\partial AA}{\partial LA} > 0$ ,  $\frac{\partial AA}{\partial IC} < 0$ ,  $\frac{\partial AA}{\partial ED} < 0$ . From equation (6), one can hypothesize that remittances have contributed positively to household wealth in many African countries over the past three decades as manifested by the increase in *FDDs*, which they now hold as substitutes for government securities and corporate bonds due to expected devaluations.

As expected currency devaluations decrease asset allocation with respect to government securities and corporate bonds ( $\frac{\partial AA}{\partial B} < 0$ ), the result has been a remarkable increase in *FDDs* as substitute assets ( $\frac{\partial AA}{\partial FDD} > 0$ ).

Nevertheless, the net effect has been an increase in total asset allocation because  $\frac{\partial AA}{\partial FDD} > 0$  is much greater than

$\frac{\partial AA}{\partial B} < 0$ . Based on this logical reasoning, one can therefore conclude that the existence of foreign currency holdings, where *FDDs* prevailed, no doubt affected asset allocation positively in many African countries. Given the observed easy inflows of foreign currencies into African countries over the past three decades, it is important to analyze theoretically the effects of *FCUs* and *FDDs* on domestic inflation rates in these countries.

### 3.4. Domestic Inflation Rates

According to Tanzi and Blejer (1982), when a country goes through a period of inflation which is higher than its trading partners, the country is advised: (a) to adjust its exchange rate to reflect the domestic and foreign inflation differential, and (b) to allow domestic real interest rate to be positive in order to induce savings and efficient resource allocation.<sup>6</sup> The persistent inflation rates in many African countries during the last three or more decades has attracted the attention of economists, policymakers, and international agencies such as the International Monetary Fund and the World Bank. Several hypotheses have been advanced to explain the inflationary pressures in African countries. In a study of the Ghanaian experience, Chhiber and Shafik (1992) disputed the conclusion that large official devaluations contributed to the surge in inflation rate in Ghana.<sup>7</sup>

As the African experience shows, when countries adjust their foreign exchange rates to reflect the difference between domestic and foreign inflation, indirectly, they encourage currency substitution and large scale parallel markets, which affect domestic money demand negatively. The net effect of a decrease in the demand for domestic currencies and the increase in the demand for foreign currencies is an increase in the income velocity of money. The higher the income velocity of money, the higher the acceleration of domestic inflation. For example, inflation rates were moderate in some of these countries before their adjustments in foreign exchange rates. Since then, prices have skyrocketed because of the increase in the prices of imports; therefore, the conclusion that foreign exchange rate adjustments influenced currency substitution which contributed to the inflation rates that spiraled out of control in many in African countries.

<sup>6</sup> See Tanzi and Blejer (1982) for detailed discussion of some major issues with respect to inflation, interest rate policy, and currency substitution in developing countries.

<sup>7</sup> See Chhiber and Shafik (1992) for detailed discussion on the relationship between devaluation, the parallel markets, and the rising inflation in Ghana. This is also holds true for other African countries not covered in their study.

To show the effects of *FCUs* and *FDDs* on inflation rates requires the use of the conventional quantity theory of money, which states that the quantity of money (*M*) multiplied by the velocity (*V*) must equal nominal GDP (*PY*). This is expressed as:

$$MV = Py \tag{7}$$

and that

$$M = PyV^{-1} \tag{8}$$

Since money market equilibrium condition requires money demand ( $M^D$ ) to be equal to money supply ( $M^S$ ), which is equal to nominal money balances (*M*), that is,  $M^D = M^S = M$ ; therefore, *M* in equation (8) is replaced with *FCU(REM)* and *FDD(REM)* from equation (4) to get:

$$FCU(REM) + FDD(REM) = PyV^{-1} \tag{9}$$

Taking the time derivative of equation (9) yields:

$$\dot{f}cu|_{rem > 0} + \dot{f}dd|_{rem > 0} = \dot{p} + \dot{y} - \dot{v} \tag{10}$$

Equation (10) states that the growth rates of *FCUs* and *FDDs*, fueled by the growth of remittances, equal the growth rates of prices and real output minus the growth rate of velocity of money. For African countries, it is reasonable to assume the growth rates of real output and velocity to be zero, thus equation (10) is rewritten as:

$$\dot{f}cu|_{rem > 0} + \dot{f}dd|_{rem > 0} = \dot{p} \tag{11}$$

Equation (11) shows that the growth rates of *FCUs* and *FDDs* fueled by the growth in remittances can explain the rising inflation rates in African countries because there has not been any noticeable growth in real output in some of these countries over the past several decades. One can conclude therefore that the growth rates of nominal GDP ( $\dot{p} + \dot{y}$ ) observed in the past couple of decades can be explained by inflation rates ( $\dot{p}$ ) due to the inflows of foreign currencies and foreign currency-denominated demand deposits held and/or hoarded by residents in African countries. This is consistent with Airaudo’s (2014) finding for a small open economy.

### 3.5. The Banking Systems in African Countries

When African countries operated under the fixed exchange rate regimes during the 1960s and 1970s, they had no issue with foreign currency deposits because their foreign exchange control laws prohibited the holding of such deposits. Today, large scale *FCUs* and *FDDs* thrust the banking systems into an unfamiliar territory where some central banks require reserve requirements on both domestic and foreign currency deposits and others still maintain the traditional standard. To comprehend this analysis within the banking systems in Africa, it is assumed that the balance sheet of a typical bank is as depicted in Table 1. In addition, the money stock (*M*) is assumed to consist of four types of assets: domestic (*DCU*) and foreign (*FCU*) currencies in the hands of the public for which the public has complete control but different from the vault cash (*C*) held by banks, domestic currency-denominated deposits (*DDD*s), and foreign currency-denominated deposits (*FDD*s).

**Table 1: The Balance Sheet of a Typical African Bank**

Assets	Liabilities
Vault Cash ( <i>C</i> ): Domestic Currencies ( <i>DC</i> ) and Foreign Currencies ( <i>FC</i> )	Domestic currency-denominated demand deposits ( <i>DDD</i> s)
Reserves ( <i>RR</i> )	Foreign currency-denominated deposits ( <i>FDD</i> s)
Loans ( <i>L</i> )	Borrowed reserves ( <i>BR</i> )
Physical assets ( <i>PA</i> )	Net worth ( <i>NW</i> )

**Source:** Table created by the author for ease in exposition.

In order to capture the money supply and monetary policy implications of *FCUs* and *FDDs*, the money stock is expressed as:

$$M = DCU + FCU + DDD + FDD \tag{12}$$



and that

$$TDD = DDD + FDD \quad (13)$$

where  $TDD$  is the total demand deposits in these banks; and  $\frac{DDD}{TDD}$  and  $\frac{FDD}{TDD}$  are the shares of domestic and foreign currency deposit in total demand deposits. Substituting equation (13) into (12) yields:

$$M = DCU + FCU + TDD \quad (14).$$

Similarly, the ratio of domestic currencies to domestic currency-denominated demand deposits as well as the ratio of foreign currencies to foreign-currency denominated demand deposits are also under the control of the nonbank public and these ratios can be expressed:

$$\frac{DCU}{DDD} = cdr \quad \text{or} \quad DCU = cdrDDD \quad (15)$$

and

$$\frac{FCU}{FDD} = cfr \quad \text{or} \quad FCU = cfrFDD \quad (16).$$

Substituting equations (15) and (16) into equation (14) and rearranging yields:

$$M = (cdr + cfr + 1) TDD \quad (17).$$

Monetary theorists suggest that in any banking system, the stock of high-powered money<sup>8</sup> ( $H$ ) is the sum of domestic currency ( $DCU$ ) in circulation in the hands of nonbank public and banks' total reserves ( $TR$ ). For African countries, it is important to consider the existence and persistence of foreign currency holdings ( $FCUs$ ) and foreign currency-denominated deposits ( $FDDs$ ); therefore, the justification for incorporating  $FCUs$  into the high-powered money ( $H$ ). That is:

$$H = DCU + FCU + TR \quad (18)$$

and that

$$H = DCU + FCU + RR + ER \quad (19)$$

where  $TR$  consists required reserves ( $RR$ ) and excess reserves ( $ER$ ). Equations (18) and (19) show that the central banks can control the high-powered money through direct open market purchases or sales to the public or the banks, which will lead to changes in domestic ( $\Delta DCU$ ) and foreign currency ( $\Delta FCU$ ) holdings of the public and the banks' total reserves ( $\Delta TR$ ) via  $DDD$ s and  $FDD$ s.

Since some banks are required to hold a fraction of their  $DDD$ s and  $FDD$ s as required reserve, therefore, the reserves-to-deposits ratios can be expressed as:

$$\frac{TR}{DDD} = rrd \quad \text{or} \quad TR = rrdDDD; \quad \text{and} \quad \frac{TR}{FDD} = rrf \quad \text{or} \quad rrfFDD \quad (20)$$

and since banks may hold excess reserves, their excess reserves-to-deposits ratios are expressed as:

$$\frac{ER}{DDD} = erd \quad \text{or} \quad ER = erdDDD; \quad \text{and} \quad \frac{ER}{FDD} = erf \quad \text{or} \quad erfFDD \quad (21)$$

where  $rrd$  and  $rrf$  are the required reserve ratios that banks must hold against  $DDD$ s and  $FDD$ s in some African countries. Equation (21) presumes that banks hold fractions ( $erd$  and  $erf$ ) of their  $DDD$ s and  $FDD$ s as excess reserves. Substituting  $DCU = cdrDDD$  from equation (15),  $FCU = cfrFDD$  from equation (16), and  $TR = rrdDDD$  and  $rrfFDD$  from equations (20) as well as  $erdDDD$  and  $erfFDD$  from (21) into equation (19) yields:

$$H = (cdr + rrd + erd)DDD + (cfr + rrf + erf)FDD \quad (22).$$

<sup>8</sup> High-powered money is known as the necessary monetary base, which is the sum of domestic currency ( $DCU$ ) in circulation and bank reserves ( $TR$ ).

Since  $TDD$  is the sum of  $DDD$ s and  $FDD$  in equation (13); therefore, equation (22) is rewritten as:

$$H = (cdr + cfr + rrd + rrf + erd + erf)TDD \quad (23).$$

According to Kovanen (2002, Table 2, p. 7), some central banks in African countries require banks to hold the same reserve ratio on both the local currency-denominated deposits and foreign currency-denominated deposits, thus  $rrd$  and  $rrf$  are equal (that is,  $rrd + rrf = 2rrd$ ) and therefore equation (23) is rewritten as:

$$H = (cdr + cfr + 2rrd + erd + erf)TDD \quad (24).$$

To derive the money multiplier processes in African countries,  $M$  given in equation (17) is divided by  $H$  given in equation (23) to get:

$$\frac{M}{H} = \frac{cdr + cfr + 1}{cdr + cfr + rrd + rrf + erd + erf} \quad (25).$$

The right hand side of equation (25) is the money multiplier for African countries where  $rrd$  and  $rrf$  are not the same according to the central banks' reserve requirements. Multiplying both sides of equation (25) by  $H$  yields the money supply equation, which can be expressed as:

$$M|_{rrd \neq rrf} = \left( \frac{cdr + cfr + 1}{cdr + cfr + rrd + rrf + erd + erf} \right) H \quad (26).$$

Equation (26) shows the money creation processes in African countries where  $rrd$  and  $rrf$  are not the same; and for 26 African countries where  $rrf$  is zero or not applicable, equation (26) becomes:

$$M|_{rrf = 0} = \left( \frac{cdr + cfr + 1}{cdr + cfr + rrd + erd + erf} \right) H \quad (27).$$

For 25 African countries, *except* for Liberia, where  $rrd$  and  $rrf$  are equal (that is,  $rrd = rrf$ ; therefore,  $rrd + rrf = 2rrd$ ), and equation (26) becomes:

$$M|_{rrd = rrf} = \left( \frac{cdr + cfr + 1}{cdr + cfr + 2rrd + erd + erf} \right) H \quad (28).$$

From these money supply equations, it is plausible to conclude that there are no clear patterns with respect to the money multipliers in African countries because not all countries require the holding of reserve balances on foreign-currency deposits. This is consistent and supportive of Kovanen's (2002) conclusion that "the use of local currency as the only eligible reserve asset to meet the mandatory reserve requirements on foreign-currency deposits complicates banks' liquidity management in countries suffering from large economic imbalances or exchange rate volatility." To see the monetary policy implications of the theoretical model, the next section is devoted to the computation of the money multipliers for African countries for which there are available data on reserve requirements. The main objective is to highlight the impact of the public's holdings and/or hoardings of domestic and foreign currencies, and what the implicit consequences are regarding the money supply processes and banks' credit/liquidity management in African countries.

#### 4. Theoretical Calculations of Money Multipliers in African Countries

Since the focus of this paper is on the impact of the currencies-deposits ratios on the money multipliers in African countries, equation (25)<sup>9</sup> is utilized to compute the money multipliers.

<sup>9</sup> For simplicity, it is assumed that these banks do not hold excess reserves on  $DDD$ s and  $FDD$ s ( $erd = erf = 0$ ) because loans created through excess reserves on both deposits provide rent-seeking avenues for those who are involved in the loan processes. For more on rent-seeking activities in African banking systems – see Owoye (2017).

Given that African countries are more cash driven developing economies, computing the money multipliers in a simple and more realistic “African model”<sup>10</sup> will enhance a better understanding of the money supply and credit/liquidity management processes. To comprehend the results of these calculations, let us consider six different case scenarios (CS) to illustrate different currencies-deposits ratios in CS3 through CS6:

- CS1:** Commercial banks hold the required reserves only on domestic deposits, which means  $rrd > 0$ , and the conventional assumption is that the currency-deposit ratio is zero and that there are no foreign currency holdings and deposits thus  $FCUs = FDDs = 0$ ; therefore,  $cdr = cfr = rrf = 0$ .
- CS2:** Given the prevalence of  $FCUs$  and  $FDDs$  in past three or more decades, some central banks required their commercial banks to hold reserves on both  $DDD$  and  $FDDs$ , that is  $rrd > 0$  and  $rrf > 0$  and that  $rrd$  and  $rrf$  may or may not be equal, and  $cdr = cfr = rrf = 0$  holds as in CS1.
- CS3:** Between the 1960s and 1980s, many African households hold/hoard 100 percent of the US\$, £, and € remittances they received from relatives abroad, which they converted into domestic currencies when needed for transaction and precautionary purposes. It is also assumed that they also hold about 50 percent of domestic currencies; therefore,  $cfr = 1.00$  and  $cdr = 0.50$ .
- CS4:** As the acceptance of foreign currencies became a normal policy positions in many African countries, it is assumed that currencies-deposits ratios decreased to  $cfr = 0.75$  and  $cdr = 0.15$ .
- CS5:** As global financial innovations finally reached many African countries, access to modern financial tools further decreased currencies-deposits ratios such that  $cfr = 0.60$  and  $cdr = 0.10$ .
- CS6:** To illustrate the importance of financial reforms and how any system-wide comprehensive financial intermediations aimed at reducing currencies-deposits ratios could enhance credit/liquidity within the banking systems even if the reserve requirements on both deposits remain unchanged, it is assumed that  $cfr = 0.10$  and  $cdr = 0.05$

For clarity, it is important to point out that CS1 and CS2 are consistent with the traditional model, which economists use to calculate the simple money multiplier. The computed money multipliers reported in Tables 2 and 3 for CS1 and CS2 are based on the data, with respect to reserve requirements on domestic and foreign deposits, obtained from various sources including Kovanen (2002, p. 7), Gray (2011, pp. 54-55), and Central Bank News. It is worth noting that the results for CS2 reported in Table 3 show that the computed money multipliers decreased by a predictable 50 percent in 24 of 25 African countries in Group B. For these countries, the central banks required the same reserve requirements on both domestic ( $DDD$ s) and foreign currency demand deposits ( $FDD$ s). Liberia is the only country in Group B with different reserve ratio on both deposits, and the money multipliers decreased by 41.75 percent.

Unfortunately, the results in both CS1 and CS2 do not fully capture the true money multipliers in cash driven African economies where the currencies-deposits ratios have been very high over the past three of four decades due to the increased inflows of remittances (US\$, £, and €) to these economies. To capture what could be a better illustration of money multipliers in African countries, it is important to consider different currencies-deposits ratios given in CS3 through CS5 in conjunction with the legally required reserve ratios that yielded the computed money multipliers reported for CS1 and CS2. The computed money multipliers reported for CS3 show a remarkable decrease in the power of the money multipliers when households hold their entire foreign currencies and half domestic currencies ( $cfr = 1.00$ ,  $cdr = 0.50$ ). Interpretatively, when African households hoard foreign currencies a 100 percent in anticipation of domestic currency devaluations, the money multipliers decreased remarkably in all African countries.

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<sup>10</sup> See Jerven (2015) in order to appreciate/understand why using easily comprehensible models for African countries are better because policy recommendations based on highly sophisticated econometric models have not helped.

**Table 2: Computed Money Multipliers for 26 African Countries in Group A  
with  $rrd > 0$  and  $rrf = 0$**

Country	Reserve Ratios (%)		Money Multipliers						
	Domestic	Foreign n	CS1	CS2	CS3	CS4	CS5	CS6	
1	Algeria	8.0*	-----	12.5	-----	<b>1.58</b>	<b>1.93</b>	<b>2.18</b>	<b>5.00</b>
2	Angola	19.0	-----	5.26	-----	<b>1.49</b>	<b>1.74</b>	<b>1.91</b>	<b>3.38</b>
3	Botswana	5.0	-----	20.00	-----	<b>1.61</b>	<b>2.00</b>	<b>2.27</b>	<b>5.75</b>
4	Burundi†	3.0*	-----	33.33	-----	<b>1.63</b>	<b>2.04</b>	<b>2.33</b>	<b>6.39</b>
5	Cameroon	5.88	-----	17.0	-----	<b>1.60</b>	<b>2.02</b>	<b>2.30</b>	<b>5.51</b>
6	Chad	3.88	-----	25.77	-----	<b>1.62</b>	<b>1.97</b>	<b>2.08</b>	<b>6.09</b>
7	Comoros	25.0*	-----	4.0	-----	<b>1.43</b>	<b>1.65</b>	<b>1.79</b>	<b>2.88</b>
8	Congo, Democratic Republic†	2.0	-----	50.0	-----	<b>1.64</b>	<b>2.09</b>	<b>2.36</b>	<b>6.76</b>
9	Congo, Republic of	5.88	-----	17.0	-----	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.51</b>
10	Egypt	14.0	-----	7.14	-----	<b>1.52</b>	<b>1.83</b>	<b>2.02</b>	<b>3.97</b>
11	Equatorial Guinea	5.88	-----	17.0	-----	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.51</b>
12	Ethiopia	15.0*	-----	6.67	-----	<b>1.52</b>	<b>1.81</b>	<b>2.00</b>	<b>3.83</b>
13	Gabon	5.88	-----	17.0	-----	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.51</b>
14	Gambia	15.00	-----	6.67	-----	<b>1.52</b>	<b>1.81</b>	<b>2.00</b>	<b>3.83</b>
15	Kenya	5.25	-----	19.05	-----	<b>1.61</b>	<b>1.99</b>	<b>2.26</b>	<b>5.68</b>
16	Lesotho†	3.0	-----	33.33	-----	<b>1.63</b>	<b>2.04</b>	<b>2.33</b>	<b>6.39</b>
17	Libya	20.0	-----	5.0	-----	<b>1.43</b>	<b>1.73</b>	<b>1.89</b>	<b>3.29</b>
18	Malawi	5.0	-----	20.0	-----	<b>1.61</b>	<b>2.00</b>	<b>2.27</b>	<b>5.75</b>
19	Mauritania	7.0*	-----	14.29	-----	<b>1.59</b>	<b>1.96</b>	<b>2.21</b>	<b>5.23</b>
20	Morocco	5.0	-----	20.0	-----	<b>1.61</b>	<b>2.00</b>	<b>2.27</b>	<b>5.75</b>
21	Seychelles	10.0*	-----	10.0	-----	<b>1.56</b>	<b>1.90</b>	<b>2.13</b>	<b>4.60</b>
22	Sierra Leone		-----	8.33	-----	<b>1.54</b>	<b>1.86</b>	<b>2.07</b>	<b>4.26</b>
23	South Sudan	12.0*	-----	5.0	-----	<b>1.43</b>	<b>1.73</b>	<b>1.89</b>	<b>3.29</b>
24	Sudan	20.0	-----	5.6	-----	<b>1.49</b>	<b>1.76</b>	<b>1.93</b>	<b>3.48</b>
25	Tunisia†	1.0	-----	100.0	-----	<b>1.60</b>	<b>2.09</b>	<b>2.39</b>	<b>7.19</b>
26	Zimbabwe	30.0	-----	3.33	-----	<b>1.39</b>	<b>1.58</b>	<b>1.70</b>	<b>2.56</b>

**Source:** Data on reserve ratios on *DDD*s and *FDD*s from: Kovanen (2002, p. 7), Gray (2011, pp. 54-55), and the Central Bank News at <http://www.centralbanknews.info/p/reserve-ratios.html>. † = countries with reserve ratio equal or less than the 3 percent required ratio in the United States, and \* indicates data on reserve requirement levels reported by Gray (2011) based on IMF survey of central banks.

**Table 3: Computed Money Multipliers for 25 African Countries in Group B with  $rrd > 0$  and  $rrf > 0$**

Country	Reserve Ratios (%)		Money Multipliers					
	Domestic	Foreign n	CS1	CS2	CS3	CS4	CS5	CS6
1. Benin†	3.0	3.0	33.33	16.67	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.48</b>
2. Burkina Faso†	3.0	3.0	33.33	16.67	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.48</b>
3. Cape Verde	15.0	15.0	6.67	3.33	<b>1.39</b>	<b>1.58</b>	<b>1.70</b>	<b>2.56</b>
4. Côte d'Ivoire	5.0	5.0	20.0	10.0	<b>1.56</b>	<b>1.90</b>	<b>2.13</b>	<b>4.60</b>
5. Eritrea	10.0*	10.0	10.0	5.0	<b>1.47</b>	<b>1.73</b>	<b>1.89</b>	<b>3.29</b>
6. Ghana	10.0	10.0	10.0	5.0	<b>1.47</b>	<b>1.73</b>	<b>1.89</b>	<b>3.29</b>
7. Guinea	5.5	5.5	18.18	9.09	<b>1.55</b>	<b>1.88</b>	<b>2.09</b>	<b>4.42</b>
8. Guinea Bissau†	3.0	3.0	33.33	16.67	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.48</b>
9. Liberia	25.0*	18.0	4.0	2.33	<b>1.28</b>	<b>1.43</b>	<b>1.50</b>	<b>1.98</b>
10. Madagascar	24.0	24.0	4.16	2.08	<b>1.26</b>	<b>1.38</b>	<b>1.44</b>	<b>1.82</b>
11. Mali†	3.0	3.0	33.33	16.67	<b>1.60</b>	<b>1.98</b>	<b>2.24</b>	<b>5.48</b>
12. Mauritius	9.0	9.0	11.11	5.55	<b>1.49</b>	<b>1.76</b>	<b>1.93</b>	<b>3.49</b>
13. Mozambique	14.0	14.0	7.14	3.57	<b>1.40</b>	<b>1.61</b>	<b>1.73</b>	<b>2.67</b>
14. Namibia†	1.0	1.0	100.0	50.0	<b>1.64</b>	<b>2.06</b>	<b>2.36</b>	<b>6.76</b>
15. Niger	5.0	5.0	20.0	10.0	<b>1.56</b>	<b>1.90</b>	<b>2.13</b>	<b>4.60</b>
16. Nigeria	22.5	22.5	4.44	2.22	<b>1.28</b>	<b>1.41</b>	<b>1.48</b>	<b>1.92</b>
17. Rwanda	5.0*	5.0	20.0	10.0	<b>1.56</b>	<b>1.90</b>	<b>2.13</b>	<b>4.60</b>
18. Sao Tome and Principe	16.0*	16.0	6.25	3.13	<b>1.37</b>	<b>1.56</b>	<b>1.67</b>	<b>2.45</b>
19. Senegal	9.0	9.0	11.11	5.55	<b>1.49</b>	<b>1.78</b>	<b>1.93</b>	<b>3.49</b>
20. South Africa†	2.5*	2.5	40.0	20.0	<b>1.61</b>	<b>2.00</b>	<b>2.27</b>	<b>5.75</b>
21. Swaziland†	2.5*	2.5	40.0	20.0	<b>1.61</b>	<b>2.00</b>	<b>2.27</b>	<b>5.75</b>
22. Tanzania	7.0	7.0	14.29	7.14	<b>1.52</b>	<b>1.83</b>	<b>2.02</b>	<b>3.97</b>
23. Togo†	1.5	1.5	66.66	33.3	<b>1.63</b>	<b>2.04</b>	<b>2.33</b>	<b>6.39</b>
24. Uganda	9.5*	9.5	10.53	5.26	<b>1.49</b>	<b>1.74</b>	<b>1.91</b>	<b>3.38</b>
25. Zambia	5.0	5.0	20.00	10.00	<b>1.56</b>	<b>1.90</b>	<b>2.13</b>	<b>4.60</b>

**Source:** Data on reserve ratios on *DDDs* and *FDDs* from: Kovanen (2002, p. 7), Gray (2011, pp. 54-55), and the Central Bank News at <http://www.centralbanknews.info/p/reserve-ratios.html>. † = countries with reserve ratio equal or less than the 3 percent required ratio in the United States, and \* indicates data on reserve requirement levels reported by Gray (2011) based on IMF survey of central banks.

**Table 4 Computed Money Multipliers for 3 African Countries Group C with  $rrd = rrf = 0$ ,  $cdr$  and  $cfr > 0$**

Country	Reserve Ratios (%)		Money Multipliers					
	Domestic c	Foreign n	CS1	CS2	CS3	CS4	CS5	CS6
1. Central African Republic‡	0.0	0.0	∞	∞	<b>1.67</b>	<b>2.11</b>	<b>2.43</b>	<b>7.67</b>
2. Djibouti‡	<i>TBI</i>	0.0	∞	∞	<b>1.67</b>	<b>2.11</b>	<b>2.43</b>	<b>7.67</b>
3. Somalia‡	0.0	0.0	∞	∞	<b>1.67</b>	<b>2.11</b>	<b>2.43</b>	<b>7.67</b>

**Note:** *TBI* means reserve requirement is yet to be introduced in Djibouti. ‡ = the three African countries with no required reserve ratio similar to Australia, Canada, New Zealand Sweden, and the United Kingdom.

Based on the computed money multipliers reported for CS3–CS5, one can easily conclude that high *cdr* and *cfr* ratios reduce the power of the money multipliers in African countries.

Finally, the computed money multipliers reported for CS6 show the remarkable increase in the power of the money multipliers if the financial systems in African countries embark on financial reforms with wide-ranging financial intermediations in order to minimize the currency holdings of African households in urban and rural areas. For example, if due to the easy access to financial institutions in the urban and rural communities,  $cfr = 0.10$  and  $cdr = 0.05$ , this would enhance efficient money supply control or credit/liquidity management within the banking systems.

Furthermore, the required reserve ratios reported in Table 2 along with the computations of the money multipliers show 26 African countries in Group A where central banks mandate require reserves only on *DDDs*. In contrast, Table 3 shows 25 African countries in Group B where central banks authorize required reserves on both *DDDs* and *FDDs*. According to monetary theorists, the reserve ratio is the most powerful monetary policy tool with which the central banks can influence credit growth. Central banks decrease (increase) the reserve ratio as way to increase (decrease) the money multipliers in order to increase (decrease) the growth of credit/liquidity within the banking systems; therefore, one can consider the reserve requirements on both *DDDs* and *FDDs* in 25 African countries in Group B as a form of credit/liquidity tightening. The issue for empirical analysis is whether or not there is a difference in the power of the money multipliers for the 26 African countries in Group A where the legal reserve requirements are only on *DDDs*, and those in Group B where banks hold reserves on both deposits.

Finally, Table 4 shows three African countries in Group C where central banks do not require reserve ratios on deposits similar to advanced countries such as Australia, Canada, New Zealand, Sweden, and the United Kingdom. The infinite ( $\infty$ ) money multipliers reported for both CS1 and CS2 should not be construed that the central banks or commercial banks in these three African countries can create money without constraints. There are other constraints such as capital requirements that could impact the growth in liquidity, and as shown by the calculated results in CS3-CS5, high currencies-deposits ratios would also impact the money multipliers.

Furthermore, from the data on required reserve ratios and the money multipliers reported in Tables 2 and 3 it is difficult to ascertain the difference in credit/liquidity growth between those African countries in Group A relative to those in Group B. However, one can conclude that the money multipliers are indicative of the extent to which credit/liquidity grows among countries in both groups. In other words, lowering the reserve ratios would increase the power of the money multipliers thus fostering credit/liquidity growth; therefore, it is possible to expect better credit/liquidity growth in one group relative to the other. To verify or refute this expectation regarding credit/liquidity growth between both groups, it is important to test the null ( $H_0$ ) and research ( $H_R$ ) hypotheses as:

$$H_0 : \overline{MM}_A \geq \overline{MM}_B : \text{Credit/liquidity growth as indicated by the magnitude of the money multipliers among the countries in Group A is not greater or better than the countries in Group B}$$

$$H_R : \overline{MM}_A < \overline{MM}_B : \text{Credit/liquidity growth as indicated by the magnitude of the money multipliers among the countries in Group A is less than the countries in Group B.}$$

where  $\overline{MM}_A$  and  $\overline{MM}_B$  are the average money multipliers (*MM*) for African countries in Group A and Group B, respectively.

The results reported in Table 5 based on the statistical tests of the differences between means for both groups of countries show that one cannot reject the null hypothesis because the estimated *t*-value of 1.56 is less than the critical value at the marginal significance level given as  $\alpha = 0.01$ . This means that there is no statistically significant difference between the 26 countries in Group A where the reserve requirements on *DDDs* alone could be considered as credit or liquidity enhancing or growth relative to those 25 countries in Group B where reserve requirements on both *DDDs* and *FDDs* could be considered as credit or liquidity tightening.

**Table 5: Tests of  $H_0 : \overline{MM}_A \geq \overline{MM}_B$  versus  $H_A : \overline{MM}_A < \overline{MM}_B$** 

Group A				Group B			
$N_A$	$\overline{MM}_A$	$S_A^2$	$S_A$	$N_B$	$\overline{MM}_B$	$S_B^2$	$S_B$
26	18.59	397.12	19.92	25	11.57	120.65	10.98
Difference in $\overline{MM} = 7.02$ and $t_{\text{-value}} = 1.57$ , $\alpha = 0.01$							

$$df = 49 (N_A + N_B - 2).$$

In addition to the null and research hypotheses given above, and given the higher *cdr* and *cfr* ratios considered in computing the money multipliers reported in CS3 through CS5, analysts and policymakers can also speculate whether or not credit/liquidity tightening would be more effective among the countries in Group B relative to those countries in Group A. Verifying this speculation requires testing  $H_0$  and  $H_R$  as:

$H_0 : \overline{MM}_A \leq \overline{MM}_B$ : Given the high ratios of *cdr* and *cfr*, credit/liquidity tightening as indicated by the magnitude of the money multipliers among the countries in Group B is not greater or more effective than the countries in Group A.

$H_R : \overline{MM}_A > \overline{MM}_B$ : Given the high ratios of *cdr* and *cfr*, credit/liquidity tightening as indicated by the magnitude of the money multipliers among the countries in Group B is greater or more effective than the countries in Group A.

**Table 6: Tests of  $H_0 : \overline{MM}_A \leq \overline{MM}_B$  versus  $H_A : \overline{MM}_A > \overline{MM}_B$** 

Group A				Group B			
$N_A$	$\overline{MM}_A$	$S_A^2$	$S_A$	$N_B$	$\overline{MM}_B$	$S_B^2$	$S_B$
26	1.56	0.005	0.07	25	1.50	0.013	0.11
Difference in $\overline{MM} = 0.05$ and $t_{\text{-value}} = 1.93$ , $\alpha = 0.01$							

$$df = 49 (N_A + N_B - 2).$$

Based on the estimated results reported in Table 6, one cannot reject the null hypothesis because the estimated *t*-value is less than the critical value at the marginal significance level given as  $\alpha = 0.01$ . Once again, one can conclude that there is no statistically significant difference in credit tightening among the countries in Group B relative to those countries in Group A when both groups have high ratios of *cdr* and *cfr*. Interpretatively, one can conclude from the calculated money multipliers based on the six case scenarios that mandating reserve requirements only on domestic deposits to achieve credit/liquidity growth or on both domestic and foreign currency deposits to achieve credit/liquidity tightening does not matter if *cdr* and *cfr* remain very high in African countries due to ineffective and inefficient financial intermediations.

## 5. Concluding Remarks and Credit/Liquidity Control Implications

This study examined the impact of currencies-deposits ratios and the reserve requirements on both domestic and foreign currency deposits in 54 African countries where in a group of 26 countries, central banks required reserve ratios only on domestic demand deposits while in another group of 25 countries, the central banks required uniform reserve ratio on both domestic and foreign currency deposits, *except* Liberia. In contrast, central banks in Central African Republic, Djibouti, and Somalia have no reserve requirements. The background analysis shows that *FCUs* and *FDDs* emerged in African countries due to external macroeconomic imbalances which worsened in the late 1970s and 1980s. Furthermore, to lay the groundwork for better understanding of the African case, this paper explained the four channels through which *FCUs* and *FDDs* continued to exert influence on financial intermediation and monetary policies in African countries.

In doing so, this paper utilized theoretical models to answer some pertinent research questions in order to highlight the complications with respect to the operations of the banking systems and the money supply processes by considering *FCUs* as a component of high-powered money in the money supply processes in African countries.

The derivations of the money supply equations and money multipliers focused precisely on how *FCUs*, *FDDs*, and high currencies-deposits ratios could impact the money multipliers in African countries thus the computations of the money multipliers under six different case scenarios. The calculated money multipliers reported in the first case scenario confirmed the conventional money multiplier method. The second case scenario shows that there are 25 (Group B) of the 54 African countries where central banks required uniform reserve requirements on both *DDD*s and *FDD*s. Among the 25 African countries in Group B, only Liberia required different reserve ratio on *DDD*s and *FDD*s. Incorporating the reserve requirements on *FDD*s into the computations of the money multipliers, the computations showed that holding reserves on both *DDD*s and *FDD*s reduced the power of the money multipliers for the countries in Group B by 50 percent, *except* in Liberia. In addition, case scenarios CS3 through CS5 show that high *cdr* and *cfr* ratios reduced the power of the money multipliers in all African countries, regardless of whether reserve requirements are only on *DDD*s or both deposits. The three scenarios (CS3-CS5) suggest that for African countries where the financial markets are underdeveloped, which may explain why *cdr* and *cfr* are very high, reducing the reserve ratios (*rrd* and *rrf*) on both deposits to zero would not change the challenges of liquidity growth or management that African central banks face. As the results in Table 4 illustrate, African countries such as the Central African Republic, Djibouti, and Somalia that have zero required reserve ratios would still have issue with liquidity growth if we consider the high currencies-deposits ratios. The sixth case scenario (CS6) shows that if the financial systems in African countries embark on prudent financial markets reforms with wide-ranging financial intermediations that would enable African households to gain free and secure access to various financial intermediaries or institutions in urban and rural areas, this would lower the *cdr* and *cfr* ratios, thus strengthening the power of the money multipliers. More importantly, prudent financial markets reforms or intermediations would curtail the current habits of holding/hoarding foreign currencies. Over the past three or four decades, foreign currencies are easily remitted to African countries thus the increase in foreign currency holdings/hoardings due to domestic currency devaluations. More importantly, the ease with which these foreign currencies such as the US\$, £, and € can be converted into domestic currencies in the parallel exchange markets has led to inflation rates spiraling out of control in many African countries.

Finally, the breakdown of African countries into three groups enabled us to confirm that there is no statistically significant difference between these groups with respect to liquidity management either through credit growth in those countries in Group A where reserve requirements are only on domestic demand deposits in comparison to those countries in Group B where required reserve ratios on both *DDD*s and *FDD*s could be perceived as credit tightening. Based on the results of the two null hypotheses, it is safe to conclude that effective or efficient credit/liquidity growth or management would require complete financial intermediations to minimize the holdings or hoardings of domestic and foreign currencies by the nonbank public, especially by those underserved urban and rural communities in African countries.

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