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What Ails Bank Deposit Mobilization and Credit Creation in Kenya?

Benjamin Ongwae Maturu[1]

March 2021

Abstract

We estimate a proposed core financial intermediation model built upon an extended classical quantity theory using Bayesian econometric techniques. The findings suggest that the persistent deceleration in bank deposits, bank credit and domestic final output during the most of the second half of the decade ending in Dec. 2019 is due to a downward spiral (or a vicious circle) of bank deposits, bank credit and domestic final output caused by a reversal of hitherto accommodative economic and financial policies meant to revitalise the economy following the 2007 post-election disturbances and to check adverse contagion effects from the global economic and financial crises. With accommodative economic and financial policies including relaxed compliance with provisioning for non-performing bank loans, the gross non-performing bank loans accumulated to unprecedented levels thereby adversely affecting effective demand for and supply of bank credit in the private sector. This situation was aggravated by tightening monetary policy stance using the central bank rate amid tighter requirements for compliance with provisioning for non-performing loans.

1 The author can be reached through email: maturubo@gmail.com. **Disclaimer:** The views expressed in this paper are solely those of the authors and do not in any way reflect the views of their respective institutions of affiliation.

1.0 Introduction

Bank deposit mobilisation and credit creation, which combine into core financial intermediation, are procyclical, and there is potential for the occurrence of virtuous or vicious circles of core financial intermediation and economic growth. It is within this context that the observed persistent deceleration in core financial intermediation amid a persistent deceleration in economic growth from May 2014 through Dec. 2019 raises legitimate economic policy concerns, and it is worth empirical investigation.

Recent studies show that empirical investigations have been carried out for countries with near similar concerns and experiences with core financial intermediation and economic growth. See, for instance, Finger and Hesse (2009), Guo and Stepanyan (2011), and Rosenberg and Tirpak (2008). Guo and Stepanyan provide important stylised facts about bank lending. For instance, during the pre-crisis period, namely, 2002Q1-2008Q3 growth in bank credit across the panel of emerging market economies averaged 24 percent per annum with a peak, and through values of 59 percent per annum and 6 percent per annum During the post-crisis period 2009Q1-2010Q2, it averaged 8 percent per annum with peak and through growth rates of 32 percent per annum and -3 percent per annum

The post-crisis period 2009Q1-2010Q2 estimates of the average growth rates of bank credit by groups of emerging markets are 4 percent per annum for EU emerging markets, 10 percent per annum for other European emerging markets, 5 percent for the Middle East and Africa, 14 percent per annum for Asia emerging markets, and 10 percent per annum for Central America emerging markets. In its best performed period Aug. 2012 – Feb. 2016, growth in real bank lending in Kenya averaged 10 percent per annum compared 6 percent per annum for real economic growth in Jun. 2013 – Aug. 2017. Bank lending decreased by 2.6 percent per annum in Dec. 2012 and by 5.4 percent per annum in Apr. 2017.

Considering the paucity of empirical evidence on the determination of bank deposit mobilisation and credit creation in Kenya, we investigate the determination of core financial intermediation and economic growth in Kenya to shed light on choosing

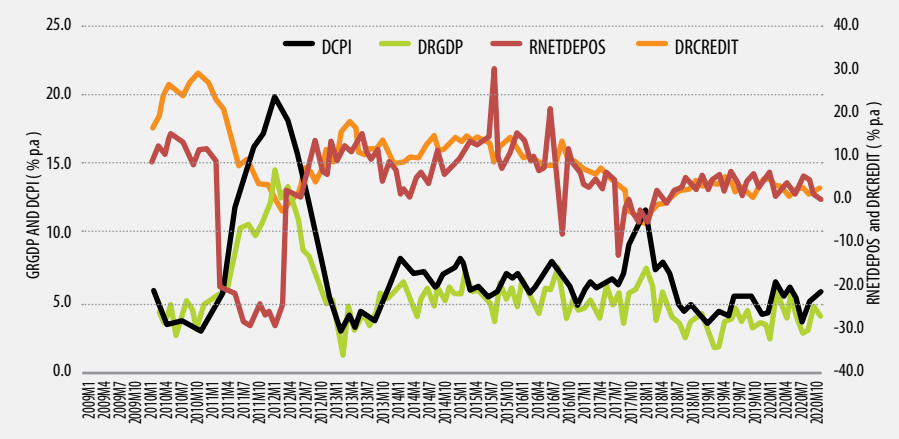
appropriate economic and financial policies. We have organised the remainder of this study as follows. Upon providing some background information about the macroeconomic environment in Kenya and the performance of Kenya's banking industry in the subsequent section, we provide a review of the literature in Section 3 and then discuss the methodology in Section 4. We present and discuss the empirical results in Section 5, upon which we conclude with lessons learnt in Section 6.

2.0 Background to Kenya's Economy

2.1 Economic Growth and Inflation

Available data, which we have plotted in Figure 1, show that real economic growth averaged 5.63 percent per annum in Feb.2010 - Dec.2019 and attained minimum and maximum levels of 1.33 percent per annum and 14.52 percent per annum in Nov. 2012 and Nov. 2012. In contrast, the rate of inflation averaged 7.11 percent per annum, with minimum and maximum levels of 3.17 percent per annum and 19.72 percent per annum being attained in Nov. 2011 and Oct. 2010. The real economic growth accelerated in Nov. 2011-May 2017, from 1.33 percent per annum to 7.6 percent per annum amid an acceleration in the rate of inflation from 3.25 percent per annum to 11.7 percent per annum. .

Figure 1: Month-on-Month Real Economic Growth and CPI Inflation Rates (Q4-2010-Q4-2016)



Source: Plotted by the author using data published by the Central Bank of Kenya (CBK) and the Kenya National Bureau of Statistics (KNBS).

Notes: DCPI is the month-on-month percentage change in the consumer price index where Feb. 2009=100; DRGDP is the month-on-month percentage increase in the real gross domestic product; RNETDEPOS is the month-on-month percentage increase in the banking industry's real net deposits, i.e., total nominal bank deposits minus the period disbursement of bank credit scaled down by the period value of the CPI.

2.1.1 Core Financial Intermediation

In comparison, when the real economic growth and the rate of inflation accelerated in Nov. 2012-May 2017, real bank deposits net of changes in bank credit accelerated from 11 percent per annum in Nov. 2012 to 29 percent per annum in Feb. 2015 and, thereafter, to 20 annum in Dec. 2015. Similarly, real bank credit accelerated from a low of minus 3 percent per annum in Dec. 2011 to 18 percent per annum in Dec. 2012 and then to 13 percent per annum in Feb. 2016. Unprecedently, it decelerated by 6 per cent per annum in May 2017.

As the growth in core real bank deposits and credit stalled in May 2017-Dec. 2019, real economic growth and the CPI rate of inflation stalled too where the rate of inflation fell within the, usually, desired policy range of 5 per cent per annum with a percentage point band. In contrast, the average rate of real economic growth of 5.63 percent per annum is a far cry from the policy desired 10 percent per annum in the Vision 2030.

Considering that corresponding peaks and throughs generally precede peaks and throughs in the time path of real economic growth in the growth rate of real bank credit, we infer that real bank credit is a leading indicator and therefore predicts real economic growth and the CPI rate of inflation. Considering also that the rate of inflation rides higher than the real economic growth, domestic residents must have suffered tremendous loss in real disposable incomes. This must have made it harder for them to repay existing bank loans and to get approval for new loans; having suffered a loss of creditworthiness. In the circumstances, private sector residents would very much have liked to borrow but could not for their lack of capacity to repay loans; they lacked effective demand for bank credit.

It is not surprising, that the rate of accumulation of gross non-performing loans surged during the study period and that upon introduction of capped interest rates under the Banking (Amendment) Act 2016, there was a tremendous increase in the number of applications for bank loans that could not match the number of approved loan applications.

2.1.2 Non-Performing Loans

We have plotted the banking industry's gross non-performing ratio in Figure 2, where the GNPLS ratio is the GNPLS expressed as a proportion of the total bank credit in the economy. We consider only GNPLS of banks that are not under statutory management. We find that the GNPLS ratio falls into three episodes: a steady decline from 6.38 percent in Jan.2009 to 2.78 percent in Dec. 2012 followed by a slow growth to 3.6 percent in Oct. 2015 upon which it grew strongly to 9.16 percent in Aug. 2018. It plateaued thereafter; averaging 9 percent through 2019 where it attained a value of 8.68 percent per annum in Dec. 2019. Indeed, the GNPLS ratio will be much larger at each data point if we scaled GNPLS down by the total bank credit in the private sector only. The point is clear, though; reduced disposable incomes must have precipitated an increase \in non-performing loans as the private sector residents' capacity to repay existing loans decreased.

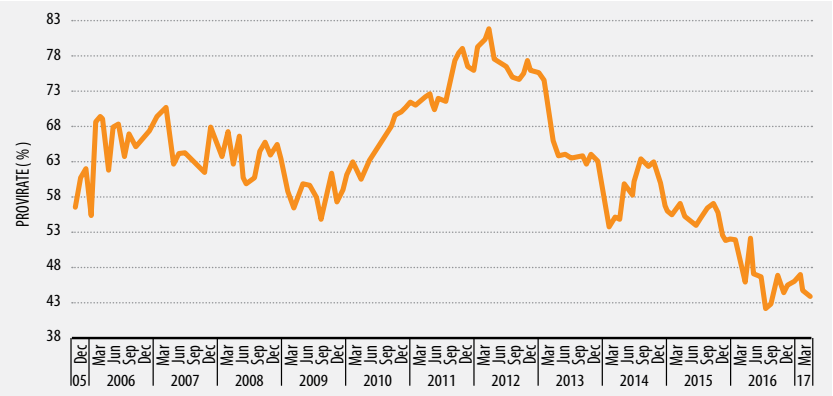
Figure 2: Gross Non-Performing Loans (Jan. 2009-Dec. 2019)

Source: Plotted by the author using data published by the Central Bank of Kenya. **Notes:** GNPLS is the gross non-performing loans expressed in KShs Billion, and TCREDIT is the total outstanding bank credit in the economy in KShs billions.

2.1.3 Provisioning

We have plotted the provisioning rate, which is the amount of provisioning for the non-performing loans expressed as a proportion of the GNPS, in Figure 3. Clearly, the provisioning rate by the banking industry, which steadily declined from 70.73 percent in May 2007 to Sep. 2009, possibly consistent with easing macroprudential policy to stimulate the economy following the post-election violence and to check

Figure 3: Provisioning Rate (Dec. 2005-Mar. 2017



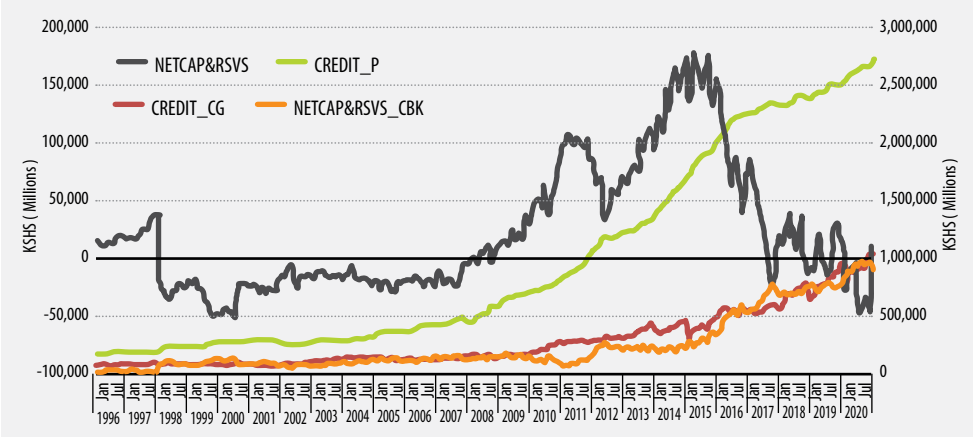
Source: Plotted by the author using data published by the Central Bank of Kenya. **Notes**: The provisioning rate is the proportion of the period provisioning expressed as a proportion of the period gross non-performing loans.

contagion effects from the global financial and economic crises of 2008/09, rose relatively fast to 81.56 percent in Apr. 2012 upon which it experienced significant reversal and plummeted to 44.25 percent in Mar. 2017. More specifically, macroprudential policy on provisioning was relatively tight, GNPLS as a proportion of total bank credit declined from 4.94 percent in Jan. 2009 to the sample period low of 2.81 percent in Dec. 2012. Consistently, the provisioning rate rose appreciably from 54.97 percent to 81.56 percent over the period Jan. 2009-Dec. 2012. Upon relaxation of enforcement of provisioning requirements where the provisioning rate declined from 81.56 percent in Dec. 2012 to 44.86 percent in Feb. 2017, the GNPLS ratio, which is the GNPLS expressed as a proportion of total bank credit in the economy, rose from 2.81 percent to 6.12 percent and thereafter to 9.16 percent in Aug. 2018.

2.1.4 Risk-Adjusted Capital

Apart from bank deposits, insurance services and labour, bank capital is a critical input in credit creation. It is useful, therefore, examining the trend of the banking industry capital during the sample period bearing in mind the adverse implications of net non-performing loans on the capital. Correcting the banking industry's capital, which we express in terms of the banking industry's capital and reserves, for the net non-performing loans, we obtain the risk-adjusted core capital. The risk-adjusted capital plotted in Figure 4 shows a drastic decrease in the banking industry's capital and reserves since Oct. 2015 which is a great contrast to the long period of a general increase in bank capital and reserves in Jul 2007-Sep 2015 and

Figure 4: Banks' Net Capital and Reserves and Credit, (Jan. 1996-Jan. 2020)



Source: Plotted by the author using data published by the Central Bank of Kenya. **Notes:** NETCAP&RSVS is read on the left axis, and NETCAP&RSVS_CBK, CREDIT_P and CREDIT_CG on the right axis; Banks' include non-bank financial institutions, and we have included NETCAP&RSVS_CBK for comparison with NETCAP&RSVS

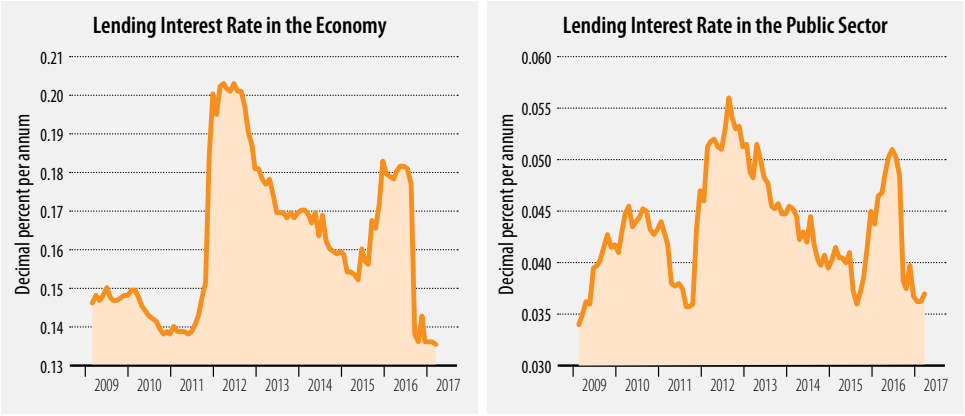
the ensuing decline in bank lending in the private sector, see CREDIT_P in the post-Oct. 2015 period is vividly clear, and one cannot help attributing the decline to the erosion of the banking industry's core capital by the net non-performing loans and that GNPLS are the critical factor that precipitated the near sudden stop in bank lending in Oct. 2015.

That the Central Bank's capital and reserves were not spared either as they also slowed down in growth to grow in tandem with the capital and reserves of the banking industry. That suggests that the banking industry and the Central Bank were experiencing a shared shock. Possibly, the Central Bank was spending resources, i.e. assets to promote stability in the banking industry. It is also possible that the banking industry and the Central Bank, which have significant net foreign assets, would have been incurring foreign exchange rate capital losses. We consider this point shortly, herein.

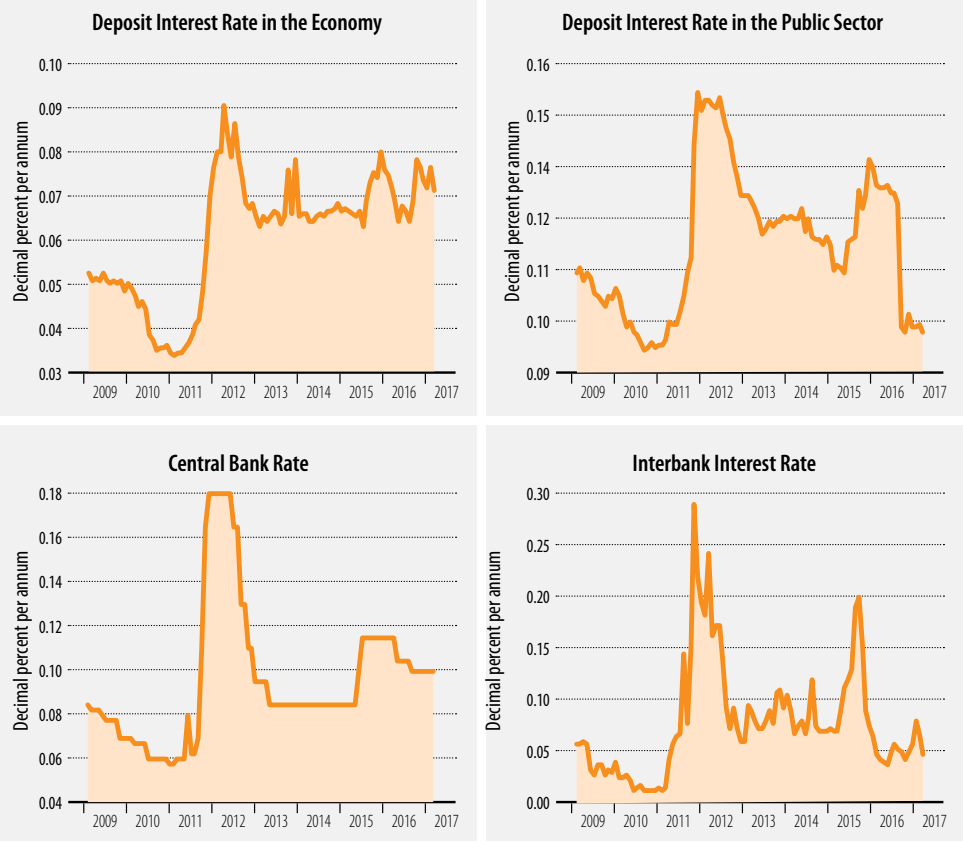
2.1.5 Monetary Policy Environment

We have plotted Figure 5 to show the dynamics in monetary policy during the study period and its implications for money and credit markets. We have assumed that monetary policy is adequately captured by the central bank rate, which is the monetary policy rate plotted in the left-foreground panel.

Figure 5: Monthly Time Paths of Selected Net Nominal Interest Rates (Feb. 2009 – Mar. 2017)



Source: CBK



Source: CBK

The time paths of the money and credit market interest rates closely track the central bank rate with implications for core financial intermediation and real economic growth. Thus, monetary policy matter for money and credit market interest rates as well as core financial intermediation and the real economy.

To stimulate the economy following the post-2007 violence which disrupted economic activities and to check adverse contagion effects from the global financial and economic crises of 2008/09 which, with the help of hindsight, transmitted with long lags to developing countries and persisted in most advance countries, the authorities eased economic and financial policies. This is evident from the steady decline in the central bank rate to a low of 5.75 percent

per annum in Jan. 2011 upon which it increased drastically to 18 percent per annum in May 2012 at which level it was retained through Apr. 2015 upon which it was reduced to 8.5 percent per annum in Jun. 2013 before being increased to 11.5 percent per annum in Jul. 2015. It stayed at this level through, for instance, Nov. 2016.

Monetary policy easing through Jan. 2011 coincided with an unprecedented expansion in bank deposit mobilisation and bank lending followed within approximately a year by correspondingly rapid real economic expansion amid high rates of inflation as shown in Figure 2. As monetary policy stance was tightened leading to a central bank rate of 18 percent per annum in May 2012, growth in real bank deposits and real bank credit in the economy rapidly slowed down almost as equally as it expanded previously when monetary policy was eased. And as would be expected based on previous experience with monetary policy actions, monetary policy easing from a central bank policy rate of 18 percent per annum in May 2012 to 8.5 percent per annum in Jun. 2013 was accompanied with a steady recovery in real basic bank deposits and bank lending accompanied by real economic recovery amid a steady rise in inflation for as long as the monetary easing was maintained.

There is reason to believe, therefore that monetary tightening from 8.5 percent per annum in Apr. 2015 to in 11.5 percent per annum in Jul. 2015 must-have one of the factors which precipitated an unprecedented slowdown in real bank deposit mobilisation and lending in Oct. 2015. Introduction of the Banking (Amendment) Bill 2015 must have compounded the problem through the expectations among banks which could not tell if Bill, when and if it were enacted into law, would take effect retroactively and therefore for the avoidance of the risk associated with the implementation of the anticipated Act chose to refrain from lending as there before. Indeed, the bank deposit mobilisation and lending worsened upon enactment of the Banking (Amendment) Act 2016 that the Act had to be repealed in Nov. 2019. There has been some recovery bank lending since then but not to rates of expansion experienced before Oct. 2015.

3.0 Literature Review

3.1 Theoretical Literature

Recent studies on bank deposits and credit are based on the theories of demand for and supply of money as encapsulated in the conventional LM-Curve; the locus of points representing equilibrium money stock. It is implicitly assumed in the studies that bank deposits and bank credit are forms of money.

The general specification of the benchmark model for an open economy,

$$LM=f\left(\overset{+ve}{P}, \overset{+ve}{y}, \overset{-ve}{i}, \overset{+ve}{S}; \Phi\right) \quad \text{..... (L1)}$$

Where,

LM is the nominal equilibrium stock of money in the economy;

P is the general equilibrium level of prices in the economy;

y is the equilibrium output in the economy which captures demand for money;

i is the equilibrium interest rate, which is the cost of money, in the economy which captures money supply conditions;[2]

s is the equilibrium nominal foreign exchange rate, expressed as the domestic currency price of foreign exchange, in the economy which captures currency substitution and dollarisation effects on domestic money; and

Φ is the optimal vector of parameters loading the effects of p, y, i and s onto ; and

$\overset{+ve}{\cdot}$ is the qualitative effect of the associated determinant of LM and therefore, for instance, $\overset{+ve}{y}$ shows that LM increases with the real output y.

2 Within the context of analysing the determination of bank deposits, the bank deposit interest rate (which is a return on the deposits), applies.

In the particular case of a closed economy, or for an economy in which the effect of s is statistically insignificant, the 3rd element of Φ is null i.e., $\Phi_3=0$.

Perhaps one of the most notable money demand function nested in the LM-curve is the Cagan (1956). The author assumes that during periods of hyperinflation, which is an average rate of monetary price inflation of goods of at least 50 percent per month, expected future inflation dominates the effect of all other determinants of demand for money including output. The author, therefore, abstracts from output effects and considers the role of expected future inflation which is incorporated into the analysis using the Fisher Parity equation where the nominal interest rate comprises of the real component and the expected future inflation. See application of the Cagan (1956) model to testing rational and adaptive expectations by Metin and Muslu (1999) to Turkey.

Concerned that monetary policy may not be independent when the floating foreign exchange regime prevails, a strand of studies on demand for money advocate for consideration of foreign monetary variables such as the foreign exchange rate and foreign interest rates in determination of demand for domestic money during periods of floating foreign exchange regimes. The studies include Miles (1978), Hamburger (1977), Bordo and Choudhri (1982), Bahmani-Oskooee (1991) Arango and Nadiri (1981) and Hueng (1997). A criticism of Hueng levels against Hamburger, and Bordo and Choudhri is that these studies' money demand functions are lacking theoretical foundations. Studies by Miles (1978), and Bordo and Choudhri (1982) are the exception. Miles derives a money demand function from a constant elasticity of substitution production functions of money services. Bordo and Choudhri derive theirs from the money in the utility function.

One can, however, arrive at the same theoretical model using extended forms of either the classical quantity theory or the Cambridge transactions equation. According to the Cambridge cash balance theory advanced by, for instance, Pigou (1917) and Marshall (1890), a fraction of the stock of money, which must be equal to the nominal value of output in equilibrium; where is the price level, and is the real output, is used as a store of value. The demand for money as a store of value is therefore provided by (L2).

$$M_d=kPy \quad \text{..... (L2)}$$

When money stock M satisfies the demand for money M_d and supply of money M_S, and the equilibrium condition is provided by (**L3**).

$$M_d=M_S=M \quad \text{..... (L3)}$$

Using (L3) in (L2) and with some re-organisation, the equilibrium money stock augmented with the income velocity of circulation of money $(1/k)$ is provided by (L4).

$$M(1/k)=Py \quad \text{..... (L4)}$$

Under the classical quantity theory of demand for money, however, see for instance Fischer (1911), money is simply a medium of exchange where the effective supply and demand for money, i.e., the equilibrium money stock $\mathbf{MV}$ is provided by (L5) where $\mathbf{V}$ is the income velocity of circulation of money.

$$MV=Py \quad \text{..... (L5)}$$

Since (**L4**) and (**L5**) are observationally equivalent, the classical quantity theory and the Cambridge transactions equation coincide conditional on (**L6**).

$$V=1/k \quad \text{..... (L6)}$$

As we show shortly herein, the classical quantity theory approach results in endogenously determined real and nominal foreign exchange rates unlike in the LM-Curve model where the nominal foreign exchange rate is incorporated into the analysis of the determination of bank credit in an ad hoc manner.

3.2 Empirical Literature

In their empirical examination of the demand for commercial bank deposits in Lebanon, Finger and Hesse (2009) estimate, for instance, a benchmark model analogous to a standard money demand function where the determinants are real economic activity, prices, and interest rates using quarterly data covering the period 1993-2008. They find that domestic and external factors matter for the demand for the deposits. The vector error correction model (VECM) results show that deposit demand elasticities to the coincident indicator, Lebanon-foreign interest rate differentials, prices and advanced economies' industrial production are: 0.419, 0.035, 0,702 and 3.34. The adjustment speed coefficient is estimated at -0.198, and the adjusted coefficient of determination is 59 percent.

Guo and Stepanyan (2011) examine the determination of private bank credit in emerging economies across the continents during the 2001-2010 decade. Using a VECM approach, they find that supply and demand factors matter. Specifically, stronger economic growth increases credit growth, high inflation increases nominal credit growth but slows down growth in real credit, domestic and external loose monetary conditions lead to higher growth in credit and improvement in the health of the banking sector expressed in terms of the non-performing loans ratio leads to higher growth in credit. They also find that domestic and foreign funding (i.e., domestic, and foreign currency deposits) promotes the growth of credit. For instance, the empirical results of the benchmark model for the period 2002Q1-2007Q4 show that all the coefficients are correctly signed and statistically significant at conventional significance levels. The private sector credit elasticities to growth in domestic currency-denominated deposits, growth in foreign currency denominated deposits, inflation, lagged gross domestic product, lagged deposit rate, and change in Fed Funds rate is 0.439, 0551, 0.485, 1.121. -0.38, and 0.369. The adjusted coefficient of determination is estimated at 47.5 percent.

Concerned that growth in private credit comprising both domestic and foreign currency denominated credit and expressed in domestic currency for the ease of aggregation may reflect nominal foreign exchange rate depreciation, as opined by Rosenberg and Tirpak (2008). In this paper, while controlling for the exchange rate, they find that the private credit increase with nominal foreign exchange rate depreciation where the applicable elasticity is 0.133.

Rosenberg and Tirpak (2008) investigate the determinants of private sector foreign currency borrowing among ten new member states of the European Union. Using quarterly data for the period 1999-2007 they find that a higher domestic-foreign interest rate differential increases the demand for foreign currency-denominated credit where for domestic banks only the elasticity is 0.00113 and for domestic banks inclusive of cross border borrowing is 0.00179. The foreign exchange restriction index (lagged) is also statistically significant with the following elasticities: -0.02467 for domestic banks only and -0.01377 for domestic banks inclusive of cross border borrowing. An economy's openness is generally insignificant while non-financial sector borrowing from abroad is significant with elasticities 0.17037 and 0.07032.

Considering the relevance of empirical analyses of demand for money to the analysis of demand for bank deposits and bank credit, which are components of money, we include empirical evidence of demand for money. For instance, Hamburger (1977) finds that the foreign interest rate does not provide additional information to the domestic interest rate in predicting demand for domestic. Arango and Nadiri (1981) arrive at the same verdict regarding the role of the level of the foreign exchange rate in demand for real cash balance in Canada, Germany, the United Kingdom, and the USA.

Hueng (1997) attributes the lack of statistical significance of foreign interest rates and foreign exchange rates to Hamburger (1977), and Arango and Nadiri (1981) having used data drawn from fixed foreign exchange regimes. He supports his explanation using the results derived by Bahmani-Oskooee)1991) using data drawn from the floating foreign exchange regime covering 1973-1987 to show that the foreign exchange rate is statistically significant. Hueng's study findings based on using quarterly Canadian data for the floating foreign exchange regime period 1973:2-1991:1 and a micro-theoretic log-linear real money demand function with net domestic and foreign interest rates show that, in addition to the traditional factors, namely, real income and the domestic nominal interest rate, the foreign interest rate and the real foreign exchange rate are statistically significant in driving demand for real domestic money. The estimated elasticities of the demand to real income, domestic interest rate, foreign interest rate and real exchange rate are, in their order: 3.432, -0.191, 0.212. and -0.89. He explains that the decreasing effect on demand for real domestic money deriving from a real foreign exchange rate depreciation is due to decreased demand for domestic bonds by foreign investors and in so doing, therefore, shows that

the foreign exchange rate exerts a dollarisation effect on demand for domestic money.

There is a lack of recent studies on bank deposit mobilisation and credit creation within Kenya's context. The available evidence on financial intermediation focuses on the pricing of bank deposits and bank credit in an indirect way where the determination of the effective bank profit margins (or lending-deposit interest rates) is studied. Some of the recent studies include Nyamongo, Ndirangu and Kariuki (2016), Kiptui (2014), and Were and Wambua (2013). These studies are useful to the extent that they help one infer that while highly effective bank profit margins motivate banks to lend more, the margins discourage deposit mobilisation and limit access to bank credit when the deposit interest rates are too low and bank lending interest rates too high.

3.2.1 Knowledge Gaps

Certainly, recent empirical evidence on core financial intermediation and economic growth is wanting, and we attempt to bridge the gap in this study. Unlike the recent empirical studies which use panel data analysis, we address the paucity of empirical evidence within the Kenyan context by carrying out a country-specific investigation of core financial intermediation. For richer results, considering the procyclicality of core financial intermediation, it is useful extending the analysis to include an economic growth model in which bank financial intermediation plays a role thereby explicitly modelling reverse causality between bank credit and economic growth instead of having to control for it as implemented in Guo and Stepanyan (2011). This way, we emphasise that core financial intermediation is not an end in itself but an important necessary condition for sustained rapid economic growth which is, in turn, a necessary condition for sustained high levels of human welfare for domestic residents.

Unlike the panel data analyses which use very narrow post-crisis windows for each country, our country-specific study uses a relatively long sample period Feb. 2010 – Mar. 2017 for model estimation and Apr. 2017 – Dec. 2019 for analysis of out-of-sample model performance. Similarly, unlike past studies also, our analysis is based on an extended classical quantity theory in which economic growth, real and nominal foreign exchange rates are endogenously determined. We also tackle bank deposit mobilisation and credit creation in together as core financial intermediation thereby incorporating feedback effects between the two.

4.0 The Core Financial Intermediation Model

4.1 The Estimable Model

It can be shown that based on an extended classical quantity theory, there exists a general equilibrium core financial intermediation model provided by (1) – (19).

$$bd=a_0+a_1p_{ac}+a_2y_{dis}+a_3creditp\{1\}+a_4cob+e_{bd},\ \forall e_{bd} \sim N(\mu_{bd},\sigma^2_{bd}),a_1<>0,a_2,a_3>0,\text{and } a_4<0 \quad \ldots\ldots (1)$$

$$cob=b_0+b_1depo+b_2creditp+b_3bd+e_{cob},\forall e_{cob}\sim N(\mu_{cob},\sigma^2_{cob}), b_1,b_3<0;b_2>0 \quad \ldots\ldots (2)$$

$$creditp=c_0+c_1y_{dis}+c_2bd+c_3gnpls+c_4s+c_5lendp+e_{creditp},\ \forall e_{creditp}\sim N(\mu_{creditp},\sigma^2_{creditp}),c_1>0,c_2<>0,c_3,c_5<0;\ c_4>0 \quad \ldots\ldots (3)$$

$$creditg=d_0+d_1p_{ac}+d_2y_{dis}+d_3gnpls+d_4lendg+e_{creditg},\forall e_{creditg} \sim N(\mu_{creditg},\sigma^2_{creditg}\text{^2}),d_1,d_2,d_3>0\ ;\ d_4<0 \quad \ldots\ldots (4)$$

$$depo=h_0+h_1cbr\{1\}+e_{depo},\forall e_{depo}\sim N(\mu_{depo},\sigma^2_{depo}\ );\ 0<h_1<1 \quad \ldots\ldots (5)$$

$$endp=k_0+k_1cbr+k_2lendg+e_{lendp},\forall e_{lendp}\sim N(\mu_{lendp},\sigma_{lendp}\text{^2}\ ); k_1,k_2>0 \quad \ldots\ldots (6)$$

$$lendg=l_0+l_1lendp+e_{lendg},\ \forall e_{lendg}\sim N(\mu_{lendg},\sigma^2_{lendg}\ );\ l_1>0 \quad \ldots\ldots (7)$$

$$gnpls=n_0+n_1gnpls1+n_2prov+e_{gnpls},\ \forall e_{gnpls}\sim N(\mu_{gnpls},\sigma^2_{gnpls}\ ),\ 0<n_1<1;\ n_2<0 \quad \ldots\ldots (8)$$

$$y=e_0+e_1rcredit+e_y,\ \forall e_y\sim N(\mu_y,\sigma^2_y)\ ;\ e_1>0 \quad \ldots\ldots (9)$$

$$s=pa_0+pa_1s_1+e_s,\ \forall e_s\sim N(\mu_s,\sigma^2_s\ )\ ;\ 0<pa_1<1 \quad \ldots\ldots (10)$$

$$prov=p_0+p_1\,prov_1+e_{prov},\ \forall e_{prov}\sim N(\mu_{prov},\sigma^2_{prov})\ ;\ 0<p_1<1 \quad (11)$$

$$dirtax=q_0+q_1 dirtax_1+e_{dirtax},\ \forall e_{dirtax}\sim N(\mu_{dirtax},\sigma^2_{dirtax})\ ;\ 0<q_1<1 \quad (12)$$

$$cbr=wu_0+wu_1 cbr_1+e_{cbr},\ \forall e_{cbr}\sim N(\mu_{cbr},\sigma^2_{cbr})\ ;\ 0<wu_1<1 \quad (13)$$

$$p_a\,c=\beta_0+\beta_1 p_a\,c_1+e_{pac},\ \forall e_{pac}\sim N(\mu_{pac},\sigma^2_{pac})\ ;\ 0<\beta<1 \quad (14)$$

$$y_{dis}=(1\text{-}dirtax)p_{ac}(y) \quad (15)$$

$$rcredit=(creditp+creditg)/p_{ac} \quad (16)$$

$$tcredit=tcreditp+tcreditg \quad (17)$$

$$tcreditp=(1+lendp)creditp \quad (18)$$

$$tcreditg=(1+lendg)creditg \quad (19)$$

4.2 Data

We use monthly time series data for the following variables to estimate the model.

bd is the nominal basic bank deposits (KShs billion);

y is the final domestic output expressed in terms of the gross domestic product at constant Feb. 2009 market prices (KShs billion);

p_{ac} is the price of the final domestic output, which is the gross domestic product deflator (Feb. 2009=100);

y_{dis} is the real disposable income at constant Feb. 2009 market prices (KShs billion);

creditp is the nominal principal amount of commercial bank credit to the private sector (KShs billion);

tcreditp is the nominal commercial bank credit, inclusive of accrued interest, in the private sector (KShs billion);

tcreditg is the nominal commercial bank credit, inclusive of accrued interest, in the public sector (KShs billion);

creditg is the nominal principal amount of commercial bank credit to the public sector (KShs billion);

rcredit is the real bank credit, inclusive of accrued

interest in the economy (KShs billion);

cob is the nominal currency (notes and coins) circulating outsides banks (KShs billion);

gnpls is the gross non-performing loans, a proxy for the credit repayment default risk, (KShs billion);

dirtax is the net effective government taxation rate on the domestic output proxied by pay as you earn PAYE expressed as a fraction of the gross domestic product (decimal percent);

prov is the provisioning by banks for the non-performing loans, which is a proxy for macroprudential policy, (KShs billion);

lendp is the nominal bank lending interest rate in the private sector (percent per annum);

lendg is the net nominal net bank lending interest rate in the public sector (percent per annum);

depo is the net nominal bank deposit interest rate in the economy (percent per annum);

cbr is the net nominal central bank interest rate, which is the monetary policy interest rate, (percent per annum);

s is the domestic currency price of foreign exchange (KShs);

$\mathbf{e_z}$, for all **z**, is the disturbance error term in the z^{th} equation where $\mathbf{e_z}$ is assumed to be normally distributed with mean μ_z and constant variance σ_z^2; and;

$a_i, \forall_i = 0,1,2,3,4,$ for instance, are parameters in equation (1) to be estimated.

To estimate the model, we use monthly time series data covering the period Mar. 2009 to Mar. 2017. We, however, have data for the period Apr. 2017 to Dec. 2019 for the evaluation of the model's out-of-sample predictive power. We obtain the data from the Central Bank of Kenya (CBK) and the Kenya National Bureau of Statistics (KNBS) websites. The gross domestic product data is available at the quarterly frequency. It can be shown that using the classical quantity theory under certain simplifying assumptions; we interpolate the quarterly gross domestic product and the gross domestic product deflator into monthly series. When the interpolated monthly data is reworked backwards to obtain quarterly data and compared with corresponding published data, we obtain strong positive correlation coefficients, thereby indicating that the interpolated data is useful in the empirical analysis.

Using monthly time series data is appropriate because the resulting empirical model is potentially useful as a tool of economic and policy analysis using high-frequency data. This is, for instance, consistent with the Central Bank of Kenya's Monetary Policy Committee (MPC) regular decision-making process where, among other considerations, it reviews the appropriateness of the prevailing monetary policy stance expressed in terms of the central bank rate. We have chosen the study sample of Feb. 2009 to Dec. 2019 because consistent data on the final domestic good and its price is available. The gross domestic

product and the gross domestic product deflator with the same base, namely, Feb. 2009=100, is available.

4.3 Model Estimation Techniques

To conserve degrees of freedom in the estimation of the model, we use Bayesian econometric techniques. Using linear least squares, we estimate each of the behavioural equations to obtain preliminary results for specifying the prior joint density function of the parameters and to reduce the size of the model by dropping redundant explanatory variables. The final estimation of the reduced model involves two steps. In the first step, we solve the input model for its state-space representation. We then estimate the state-space model using the BFGS method within the context of the maximum likelihood estimator. We execute the 2 steps Bayesian econometric techniques in version 10 of the Regression Analysis of Time Series (RATS) computer software.

5.0 Empirical Results

Upon application of the general-to-specific approach to estimating the core financial intermediation model using linear least squares with heteroscedasticity-consistent (Eicker-White) standard errors, we obtained the results provided in Table 1 panels (a) through (d). Using the parsimonious linear regression results in Table 1, we specified the prior joint density function and proceeded to re-estimate the parsimonious core financial intermediation model in two steps.

Firstly, we solve the model into its state-space representation with a linear linearisation of the non-linear definitional identities in the model using the DSGE instruction in the RATS computer software. We then estimated the state-space model using the Simplex method as the primary method and BFGS as the final method under the dynamic linear model (DLM) instruction. We obtained 3 sets of comparative results provided in Table 2, where the preferred results are the Model 1 ones because they bear the largest log-likelihood value, and all model equation standard errors are positive definite. For practical purposes, also, the results presented in Table 1 are obtained using input data in levels.

Once subjected to the DSGE instruction with the linear linearisation option, the model variables are transformed into their deviations from steady-state. Any forecast results based on the estimated linearised state-space model are deviations from steady-state and must be reworked backwards to obtain the original variables' original data units by adding back the steady-state values to forecasts.

In contrast to the parsimonious linear regression results provided in Table 2, the results provided in Table 1 consider the simultaneous equations nature of the core financial intermediation model. We attribute discrepancies between the results in Table 1 and those under Model 1 in Table 2 to differentials in consideration of reverse causality effects among the simultaneous equations in the estimated model. The effects are not accounted for in the parsimonious linear regression results while they are in Model 1. For instance, in Table 1 panel (a), the a_0

coefficient under the linear regression results is 9.184 while it is 8.927 is the result under Model 1.

Since the BFGS algorithm is a simultaneous equations estimator, we obtain a log-likelihood value for the model. For the ease of visualisation of and reference to the preferred empirical results, which are the Model 1 results in Table 2, we present the results in equation form as provided by (1) to (19) where {1} is the one-period lag operator on the attaching variable.

$$bd = -8.927-2.942p_{ac}+3.272y_{dis}+6.191creditp\{1\}+0.551cob \quad (1)$$

$$cob = -0.436y_{dis}+1.48depo+1.024creditp\{1\}-0.381bd \quad (2)$$

$$creditp=-10.203+2.555y_{dis}+0.246bd-0.121gnpls+0.305s-3.598lendp \quad (3)$$

$$creditg=-18.675-3.098p_{ac}+0.341y_{dis}+0.221gnpls+11.304lendg \quad (4)$$

$$depo = 0.013+0.354cbr\{1\} \quad (5)$$

$$lendp = 0.008+0.347cbr+1.259lendg \quad (6)$$

$$lendg =0.011+0.118lendp \quad (7)$$

$$gnpls = -0.115+0.9gnpls\{1\}+0.211prov \quad (8)$$

$$y = 2.032+0.663rcredit \quad (9)$$

$$s = 0.01+0.149s\{1\} \quad (10)$$

$$prov = 0.005+0.921prov\{1\} \quad (11)$$

$$dirtax = -0.356+0.58dirtax\{1\} \quad (12)$$

$$cbr = 0.106+0.822cbr\{1\} \quad (13)$$

$$p_{ac} = 0.011+0.997p_{ac}\{1\} \quad (14)$$

$$y_{dis} = (1-dirtax)p_{ac}(y) \quad (15)$$

$rcredit = (creditp+creditg)/p_{ac}$ .....(16)

$tcredit = tcreditp+tcreditg$ ..... (17)

$tcreditp=(1+lendp/100)creditp$ ..... (18)

$tcreditg=(1+lendg/100)creditg$ ..... (19)

Table 1 (A): Determination of Nominal Basic Bank Deposits (BD)

	General results				Parsimonious results			
Variable	**Coeff**	**Std Error**	**T-Stat**	**Signif**	**Coeff**	**Std Error**	**T-Stat**	**Signif**
Constant	-8.794	3.397	-2.589	0.010	-9.184	3.725	-2.465	0.014
LP_{AC}	-1.579	0.806	-1.958	0.050	-1.800	0.825	-2.182	0.029
LY_{DIS}	3.220	1.111	2.898	0.004	3.316	1.190	2.786	0.005
LR_{DEPO}	-1.434	1.2948	-1.107	0.268				
LS	-0.210	0.246	-0.856	0.392				
LCREDITP{1}	0.534	0.153	3.492	0.001	0.559	0.154	3.623	0.000
LCOB	-0.437	0.124	-3.537	0.000	-0.491	0.1091	-4.500	0.0000
Diagnostic test results								
Cantered R^2	0.926				0.925			
Standard error	0.040				0.040			
Log-likelihood	240.683				239.414			
Observations	131				131			
Degrees of freedom	124				126			

Table 1(B): Determination of Private Sector Nominal Bank Credit (CREDITP)

	General results				Parsimonious results			
Variable	**Coeff**	**Std Error**	**T-Stat**	**Signif**	**Coeff**	**Std Error**	**T-Stat**	**Signif**
Constant	-9.264	1.857	-4.988	0.000	-10.648	0.211	-50.52	0.000
LP_{AC}	0.371	0.495	0.748	0.454				
LY_{DIS}	2.201	0.640	3.439	0.001	2.677	0.083	32.175	0.000
LBD	0.278	0.062	4.462	0.000	0.252	0.648	5.166	0.000
LGNPLS	-0.139	0.023	-6.167	0.000	-0.129	0.021	-6.248	0.000

General results					Parsimonious results			
Variable	Coeff	Std Error	T-Stat	Signif	Coeff	Std Error	T-Stat	Signif
LS	0.312	0.061	5.075	0.000	0.307	0.063	4.857	0.000
LR_{LENDP}	-3.316	0.334	-9.938	0.000	-3.242	0.2991	-10.839	0.000
Diagnostic test results								
Cantered R^2	0.994				0.994			
Standard error	0.014				0.014			
Log-likelihood	283.892				283.420			
Observations	98				98			
Degrees of freedom	91				92			

Table 1(C): Determination of Public Sector Nominal Bank Credit (CREDITG)

General results					Parsimonious results			
Variable	Coeff	Std Error	T-Stat	Signif	Coeff	Std Error	T-Stat	Signif
Constant	-18.183	5.525	-3.291	0.001	-21.342	4.362	-4.892	0.000
LP_{AC}	-2.953	1.433	-2.061	0.039	-3.726	1.148	-3.246	0.001
LY_{DIS}	5.437	1.917	2.837	0.005	6.630	1.442	4.599	0.000
LBD	0.211	0.241	0.877	0.381				
LGNPLS	0.140	0.086	1.626	0.104	0.212	0.046	4.659	0.000
LS	0.140	0.219	0.639	0.523				
LR_{LENDG}	11.092	2.453	4.522	0.000	11.000	2.398	4.587	0.000
Diagnostic test results								
Cantered R^2	0.938				0.937			
Standard error	0.044				0.044			
Log-likelihood	171.202				170.316			
Observations	98				98			
Degrees of freedom	91				93			

Table 1(D): Determination of Nominal Currency Outside Banks (COB)

	General results				Parsimonious results			
Variable	Coeff	Std Error	T-Stat	Signif	Coeff	Std Error	T-Stat	Signif
Constant	-0.748	2.391	-0.313	0.755				
LP_{AC}	-0.448	0.468	-0.956	0.339				
LY_{DIS}	0.479	0.746	0.642	0.521	0.164	0.025	6.581	0.000
LR_{DEPO}	2.073	0.695	2.981	0.003	1.658	0.451	3.680	0.000
LS	-0.040	0.079	-0.509	0.611				
LCREDITP	0.684	0.109	6.255	0.000	0.597	0.021	29.037	0.000
LBD	-0.139	0.040	-3.431	0.000	-0.144	0.0471	-3.060	0.002
Diagnostic test results								
Cantered R^2	0.964				0.963			
Standard error	0.024				0.024			
Log-likelihood	306.812				305.469			
Observations	131				131			
Degrees of freedom	124				127			

Table 2: Preferred Parsimonious Results

Parameter	Model 1	Model 2	Model 3	Signif
	Coeff	Coeff	Coeff	
a_0	-8.927	-8.927	-9.125	0.000
a_1	-2.942	-2.942	-3.014	0.000
a_2	3.272	3.272	3.149	0.000
a_3	6.191	6.191	1.938	0.000
a_4	0.551	0.551	0.561	0.000
b_1	-0.436	-0.436	-0.484	0.000
b_2	1.480	1.480	1.646	0.000
b_3	1.024	1.024	0.709	0.000
b_4	-0.381	-0.381	-0.401	0.000
c_0	-10.203	-10.203	-10.626	0.000
c_1	2.555	2.554	2.493	0.000
c_2	0.246	0.246	0.234	0.000

Parameter	Model 1	Model 2	Model 3	Signif
	Coeff	Coeff	Coeff	
c_3	-0.121	-0.121	-0.127	0.000
c_4	0.305	0.305	0.308	0.000
c_5	-3.598	-3.598	-3.565	0.000
d_0	-18.675	-18.675	-19.570	0.000
d_1	-3.098	-3.098	-3.489	0.000
d_2	9.341	9.341	6.692	0.000
d_3	0.221	0.221	0.219	0.000
d_4	11.304	11.305	11.338	0.000
h_0	0.013	0.014	0.014	0.000
h_1	0.354	0.354	0.261	0.000
k_0	0.008	0.008	0.009	0.000
$k1$	0.347	0.348	0.377	0.000
k_2	1.259	1.259	1.324	0.000
l_0	0.011	0.011	0.013	0.000
l_1	0.118	0.118	0.115	0.000
n_0	-0.115	0.115	-0.110	0.000
n_1	0.900	0.900	0.903	0.000
n_2	0.211	0.212	0.240	0.000
e_0	2.032	2.032	2.031	0.000
e_1	0.663	0.663	0.462	0.000
pa_0	0.010	0.009	0.010	0.000
pa_1	0.149	0.149	0.161	0.000
p_0	0.005	0.004	0.004	0.000
p_1	0.921	0.921	1.083	0.000
q_0	-0.356	-0.356	-0.345	0.000
q_1	0.580	0.580	0.588	0.000
wu_0	0.106	0.107	0.111	0.000
wu_1	0.822	0.822	0.882	0.000
bet_0	0.011	0.012	[n/a]	0.000
bet_1	0.997	0.997	[n/a]	0.000
σ_{bd}	0.002	0.002	72.017	0.000
$\sigma_{creditp}$	0.000	0.000	13.631	0.000
σ_{cob}	0.001	0.001	5.167	0.000
$\sigma_{creditg}$	0.002	0.002	15.790	0.000

Parameter	Model 1 Coeff	Model 2 Coeff	Model 3 Coeff	Signif
σ_{depo}	0.000	0.000	0.459	0.000
σ_{lendp}	0.000	0.000	12.969	0.000
σ_{lendg}	0.000	0.000	0.199	0.000
σ_{gnpls}	0.003	0.007	107.681	0.000
σ_{y}	0.001	-0.004	102.672	0.000
σ_{s}	0.001	-0.002	1950.353	0.000
σ_{prov}	0.000	0.000	21.736	0.000
σ_{dirtax}	0.098	0.098	3393.233	0.000
σ_{cbr}	0.007	0.007	53.818	0.000
σ_{pac}	0.000	0.000	0.2475	0.000
Log likelihood	-1.6,184e+09	-1.6,132e+09	-355,376.954	0.000
No. of iterations	6	9	39	
Usable observations	97	97	97	
Rank of observables	485	485	485	
Study sample	Monthly data from 2009:03 to 2017:03			

Notes: Model1 specified using net nominal interest rates, **Model 2** specified using gross nominal interest rates and **Model 3** is specified using net nominal interest rates and p_{ac} is specified as a function of excessive money supply where the money supply is the aggregate of cob, credit, and credit.

5.2 Discussion of Results

5.2.1 Goodness of Fit

We have plotted Figures 6, 7 and 8 which show that the core financial intermediation model fits the sample data for basic principal bank deposits, principal bank credit in the private sector and the public sectors very well. The time paths of fitted and actual values of the variables not only coincide but are also confined to within the 95 percent confidence interval in the period 2009:03 – 2017:03. There is no reason not to believe that these results hold beyond 2017:03.

Secondly, the parsimonious linear regression analysis results provide information which is indicative of the goodness of fit of the preferred Model 1 results. The centred coefficients of determination, which show the proportion of fluctuations in basic bank deposits, currency outside banks, principal bank credit in the private and public sectors are estimated at 92.5 percent, 96.3 percent, 99.4 percent, and 93.7 percent, respectively. In other words, using the parsimonious linear regression results, which are not radically different from the preferred Model 1 results, one can account for up to, for instance, 99.4 percent of observed fluctuations in bank credit in the private sector during the study period 2009:02 to 2017:03. Thus, the core financial intermediation model considers the most critical factors which determine bank deposit mobilisation and credit creation.

Figure 6: Basic Bank Deposits

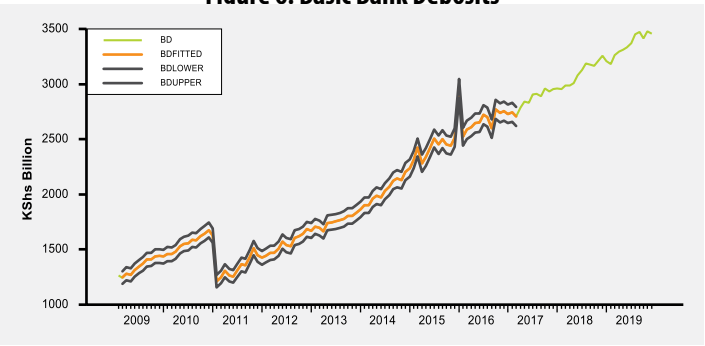


Figure 7: Bank Credit to Private Sector

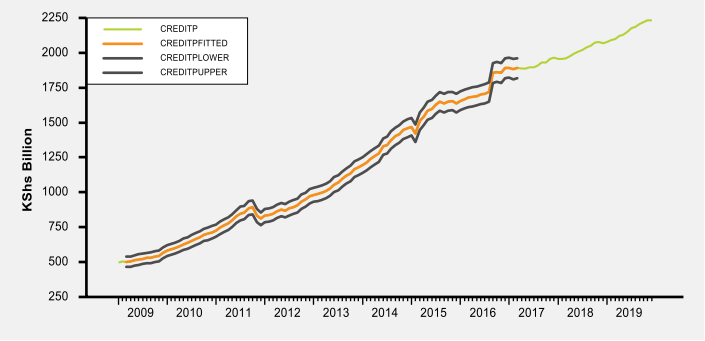
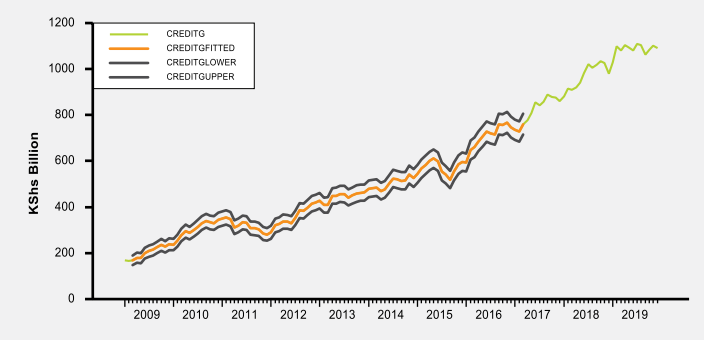


Figure 8: Bank Credit to Public Sector



5.2.2 Determination of Basic Bank Deposits

The results on the determination of nominal basic/core bank deposits net of disbursed bank credit are provided by (1). The results show that *other factors held constant*, basic bank deposits are expected to increase by 6.191 percentage points for every 1 percentage point increase in disbursed bank credit. The qualitative effect of the lagged amount of bank credit disbursement is consistent with theoretical expectations under the core financial intermediation model.

The results show further that, *other factors remaining constant*, a 1 percentage point increase in real disposable income leads to an increase in by 3.272 percentage points. These results are not only theoretically consistent, where basic bank deposits increase with increasing real disposable income, but also empirically consistent with past study findings. For instance, Finger and Hesse (2009) find that a 1 percentage point increase in the level of economic activity leads to an increase in bank deposits by 0.419 percentage points.

Considering the concept of real disposable income and the effect of the disposable income on basic bank deposits, changes in the government direct taxation rate , output and the gross domestic product deflator do also indirectly influence basic bank deposits. Other factors remaining constant, an increase in by 1 percentage point leads to a 2.942 percentage point decrease in basic bank deposits. Intuitively, as the domestic final good becomes more expensive, households must draw down on their financial resources including bank deposits relatively more than there before the increase in prices to buy the same quantity of goods and services that they could buy before the price increase. Moreover, an increase in good prices elicits expectations of further price increases thereby motivating households to spend their financial resources, in this case, basic bank deposits, before the resources' real purchasing power is eroded any further.

Somewhat paradoxically, *other factors remaining constant*, an increase in currency outside banks leads to an increase in basic bank deposits. One would expect that other factors remaining constant, an increase in currency outside banks must be at the expense of basic bank deposits. Intuitively, however, an increase in currency outside banks through other sources other than basic bank deposits leaves households with excess cash balances which they must bank to attain initial financial assets portfolio balance. We believe that it is within that context that, according to the results, an increase in currency outside banks by 1 percentage point leads to an increase in basic bank deposits by 0.551 percentage points.

Most importantly, when the factors explicitly incorporated in (1), which we have discussed above, remain constant, an increase in the composite of the variable representing all the other factors in the extended classical quantity theory that are not

explicitly incorporated in (1) and which is captured by the drift term/constant in (1) leads to a decrease in basic bank deposits by -8.927 percentage points.

Considering the persistent reduction in real economic growth and a steady increase in domestic final good prices during the most of the second half of the decade ending in Dec. 2019, see Figure 1, it is not surprising that a persistent deceleration in basic bank deposits occurred in the same period. For instance, considering the empirical results, acceleration in the consumer price index rate of inflation from 3.2 percent per annum in 2012:12 to 11.7 percent per annum in 2015:12 must have contributed to deceleration of basic bank deposits from its peak of 29 percent per annum in 2015:02 to its lowest rate of growth of -13 percent per annum in 2016:12 with adverse implications for not only bank credit creation but also for real economic growth and disposable incomes.

Using the mathematical trick of subtracting from the left-hand side and adding to the right-hand side and then simplifying the expression of the results, it can be shown that the results suggest that the demand for real bank deposits is provided by (1.1).

$$rbd = -8.927 - 1.942p_{ac} + 3.272y_{dis} + 6.191creditp\{1\} + 0.551cob \ldots\ldots\ldots\ldots\ldots (20)$$

Intuitively, having assumed long-run price homogeneity to express basic bank deposits in real terms as captured by rbd and therefore controlled for the effect of the domestic output market prices in the determination of nominal bank deposits, the balance of the effect of the prices is attributable to the role of expectations about the prices on the nominal bank deposits. Accordingly, an increase in the expected p_{ac} in (1.1), which represents an increase in expected domestic final goods prices, leads to a reduction in at the rate of .

5.2.3 Determination of Bank Credit

We analyse determination of the economy-wide bank credit by its private and public sector components as well as by its principal amounts and the interest cost to borrowers. We have therefore specified the bank credit equations for the private and public sectors in terms of principal amounts. We then derive the bank credit inclusive of the interest cost using the gross bank lending interest rates in the private and public sectors as provided by (18) and (19) where the interest rates are also modelled separately as provided by (6) and (7).

5.2.3.1 Determination of Bank Credit to the Private Sector

The results on the determination of bank credit $creditp$ in the private sector are provided by (3). The results show that real disposable income is the second most important determinant among the 5 specific determinants incorporated into the analysis. The bank lending interest rate in the private sector $lendp$ is the most important factor.

The results are consistent with theoretical expectation where, *other factors remaining constant*, demand for the principal amount of bank credit decreases with the bank lending interest rate , which is the price of bank credit. The results show that the elasticity of demand for bank credit in the private sector to the bank lending interest rate in the sector is -3.598. In the absence of credit repayment default and refinancing risks where, therefore, effective demand for bank credit in the private sector was assured, the supply-side effect of the bank lending interest rate is a positive one. Bank credit is a positive one. Having controlled for the credit repayment default and refinancing risks by incorporating the gross non-performing loans and the effect of the lending interest rate is negative. We infer that the negative effective reveals inadequate effective demand for bank credit in the private sector and which is confirmed by the decreasing effect on bank credit in the sector caused by the gross non-performing loans.

Consistent with theoretical expectations; also, the results show that bank lending in the private sector increases with disposable income. For every 1 percentage point increase in disposable income, *other factors remaining constant*, equilibrium bank credit in the private sector will, on average, be expected to increase by 2.555 percentage points. Intuitively, disposable income is important for bank credit in the private sector in two ways. It represents households and firms' creditworthiness, thereby positively influencing the supply of bank credit in the private sector. It also represents an effective demand for bank credit in the sector. Barring the difference in the magnitudes of effect, the result collaborates that which was obtained by Guo and Stepanyan (2011) where the elasticity of bank credit in the private sector to the lagged gross domestic product is 1.121.

That a nominal foreign exchange rate depreciation leads to an increase in bank credit in the private sector, where the applicable elasticity is 0.305, is not a surprising result. See the discussion provided by Rosenberg and Tirpak (2008) and the empirical results obtained by Guo and Stepanyan (2011) where private sector credit increase with the depreciation of the nominal foreign exchange rate with an elasticity of 0.133.

It is notable that an increase in the bank credit repayment default risk, which is captured by the gross non-performing loans ***gnpls*** adversely affects bank lending to the extent of 1:0.121. As discussed in the introduction section, the gross non-performing loans grew rather strongly during the second half of the decade ending in Dec 2019, and it is not therefore surprising, given these results, that growth in bank lending in the private sector plummeted.

Basic bank deposits are essential for bank lending to the private sector. An increase in the deposits by 1 percentage point, other factors remaining constant, eventually leads to an increase in bank lending to the private sector by 0.246 percentage points. To the

extent that bank deposits do not similarly affect bank lending to the public sector, this effect is unique to the private sector bank credit market. Intuitively, the effect represents a two-fold supply-side effect. Firstly, bank deposits are the raw material out of which bank credit is made and the bulky of bank lending is to the private sector. So, the larger the deposits become, other factors remaining constant, the greater the capacity of banks to create credit and lend to the private sector. Secondly, bank deposits are a component of depositors' wealth, and they accord the bank with knowledge of the depositors' track record in saving with attendant implications for the depositors' creditworthiness. Intuitively, the larger the deposits become, the higher the creditworthiness of the depositors become thereby enjoying larger credit application approvals.

Other factors not incorporated into the analysis in specific terms and are captured by the collective term, namely, the constant, have an appreciable reductional effect on bank lending in the private sector. A 1 percentage point increase in the combined value of these factors, whose effect is to tighten conditions in the private domestic credit market, factors which are explicitly incorporated in the analysis remaining constant, eventually reducing bank lending to the private sector by an average of 10.203 percentage points.

5.2.3.2 Determination of Bank Credit to Public Sector

In their descending order of relative importance, the specific determinants of bank credit in the public sector are the: lending interest rate, domestic output prices, disposable income, and bank credit repayment default risk which is captured by the gross non-performing loans.

It is somewhat surprising that bank lending to the public sector increases with increasing bank lending interest rate. It is also surprising that the magnitude of the effect is relatively large where, for every 1 percentage point increase in bank lending interest rate in the public sector, the principal amount of bank lending in the public sector increases by an average of 11.304 percentage points.

For the government to tolerate a higher cost of borrowing, it must be in a desperate situation to borrow, such as when faced with significant shocks with adverse effects on tax revenues. It can also happen when bank lending interest rates in the public sector must be too low amid a limited private sector credit market that banks are better off lending to the public sector despite the interest rates being low. This is likely to happen when there is risk aversion due to severe credit repayment default among banks to the private sector.

Alternatively, the decreasing effect arising from an increase in the prices of final domestic goods on commercial bank lending with respect to the public sector is considered to be an inflation tax or merely playing a seigniorage effect role. By funding its fiscal operations by creating money, the government borrows less from commercial banks. Meanwhile, the printed money causes demand-pull inflation. In other words, the decrease in commercial bank lending to the public sector amid increasing domestic final good prices is induced by a shared factor between the prices and lending. The shared factor being government borrowing from the monetary authority, which substitutes out government borrowing from domestic, commercial banks and causes an increase in the domestic final good prices.

It would also be that as part of the fiscal-monetary policy coordination, government refrains from borrowing heavily from domestic, commercial banks when domestic final good prices are relatively high. To meet its resource needs, the government diversifies its deficit financing from domestic, commercial bank sources to external sources. Under such circumstances, external public debt tends to increase as a proportion of the total public debt. This is a good description of Kenya's economy in the second half of the decade ending in Dec. 2019.

The elasticity of the principal amount of bank credit in the public sector with respect to the real disposable income is 0.341. An increase in disposable income, which is an economic feature of the private sector, affects public sector funding outcomes in 3 possible ways. Firstly, an increase in the disposable income due to a reduction in the effective government taxation rate, the level of economic activity remaining constant, results in reduced public revenues and the public sector must then rely more on borrowing including bank credit to sustain its operations. An increase in the disposable income, due to an increase in the gross domestic incomes with the same level of the effective tax rate results in increased public revenues which motivates the public sector to expand its operations and increase public debt "headroom" thereby leading to increased bank credit in the public sector. There is also a potential supply-side effect where consequent to the increase in real disposable income, households save more in bank deposits to pave the way to enhanced bank lending in the economy including lending to the public sector.

5.2.3.3 Determination of Currency Outside Banks

We have noted that a change in currency outside banks has implications for basic bank deposits with spill-over effects to bank lending in the private sector. But what are the determinants of currency outside banks? As shown by the results provided by (2), the specific determinants of currency outside banks in their descending order of relative importance are the bank deposits interest rate , bank credit to the private sector, and disposable incomes.

Somewhat surprisingly, on theoretical grounds, an increase in the deposit interest rate causes an increase in currency outside banks where the applicable elasticity is 1.48. This result is surprising because, being an opportunity cost of cash balances, the bank deposits interest rate should under normal circumstances lead to a decrease in currency outside banks.

One of the unusual circumstances which would lead to the paradoxical results is suppressed bank deposit interest rates where an increase in the nominal bank deposit interest rates does not represent an increase in real bank deposit interest rates. Instead, the increase lags the domestic final good prices such that it is accompanied by decreasing real interest rates. To that extent, depositors are better off holding more currency outside banks for it does not pay to hold bank deposits only for the deposits' real purchasing power to be eroded by increasing domestic final good prices. This point finds clarification in Fisherian interest rate equation where the nominal interest rate disaggregates into a real and an expected inflation rate component.

Thus, the results suggest that expected rates of inflation must have been perceived to be relatively high during the sample period 2009:03-2017:03. For instance, we have noted that the consumer price index rate of inflation accelerated from 3.2 percent per annum in 2012:12 to 11.7 percent per annum in 2015:12. The results also show that o*ther factors remaining constant*, an increase in bank deposits must be offset by a decrease in currency outside banks to restore equilibrium. The applicable elasticity is -0.381.

Logically, part of an increase in bank credit to the private sector finds its way to currency outside banks for use as a medium of exchange in cash-based payment and settlement. Thus, the elasticity of currency outside banks with respect to bank credit to the private sector is not surprising. What is surprising is the enormous magnitude of the elasticity, which is 1.024. This suggests that most of the bank lending in the private sector funds cash transactions which are most likely to be household expenditures. This seems to be consistent with the relatively muted effect of real bank credit on final domestic output, as shown in (9).

The results provided by (2) show that the elasticity of currency outside banks with respect to real disposable income is -0.436. This suggests, somewhat surprisingly, that an increase in real disposable income induces a decrease in currency outside banks when one would have expected that the demand for currency outside banks as a medium of exchange increases. It would as well be that with the adoption of mobile banking, an increase in disposable income leads to the adoption of mobile banking with relatively less demand for cash balances. Electronic modes of payments and settlement would also have the same effect as mobile banking on demand for currency outside banks, the decreasing effect of real disposable income on currency outside banks is a regime change effect; moving to a cashless economy.

5.2.4 Determination of Bank Interest Rates

5.2.4.1 Bank Deposit Interest Rates

The results on the determination of bank deposit interest rates are provided by (5). They show that the nominal bank deposit interest rates increase with increments in the central bank rate by an average of 0.354 for every 1 percentage point increase. The combined effect of all other factors that are not incorporated in the analysis in specific terms is relatively less significant than that of the policy rate.

5.2.4.2 Bank Lending Interest Rates in Private Sector

Like the bank deposit interest rates, the bank lending interest rate in the private sector, whose results are provided by (6), increase with increments in the central bank late. The elasticity of the nominal bank lending interest rates in the private sector with respect to the central bank rate is 0.347 which is, for practical purpose and to decimal places of measurement precision, equal to that for the nominal bank deposit interest rate.

Thus, the central bank rate affects the bank deposit and lending interest rates symmetrically, and that suggests that in adjusting the deposit and lending interest rates, banks mind about the lending-deposit interest rate spreads which are their profit margins in the core financial intermediation services. The results suggest further that commercial banks have control over the setting deposit and lending interest rates and as such are monopsonists in the deposit mobilisation market and monopolists in the bank credit market.

The bank lending interest rate in the public sector is, however, relatively more important in the determination of bank lending interest rates in the private sector. Other factors remaining constant, the bank lending interest rates in the private sector increased at a rate of 1.259 percentage points for every percentage point increase in the bank lending interest rate compared to 0.347 for the central bank rate. The conventional argument for the bank lending interest rate in the public sector influencing bank lending interest rates in the private sector is the "risk-free" argument; that since the public sector is devoid of the credit repayment default risk, the bank lending interest rate to the public sector must be the credit market reference/ benchmark interest rate and such other credit market interest rates such as the bank lending interest rate in the private sector must change in tandem with the bank lending interest rate in the public sector.

There is, therefore, the potential for the public sector to crowed out the private sector in the domestic bank credit market should it go flat out to borrow as much as it could thereby raising the bank lending interest rate in the public sector with adverse implications for the bank lending interest rate in the private sector and the consequent adverse implications for bank lending in the private sector as shown in the results provided by (3).

As in the case of determination of the bank deposit interest rate, the combined effect of all other factors not incorporated in the determination of the bank lending interest rate in the private sector, which is 0.008, is negligible albeit being statistically significant.

5.2.4.3 Bank Lending Interest Rates in Public Sector

Unlike the bank deposit and bank lending interest rate in the private sector for which the central bank rate has statistically significant direct effects, the central bank does not have any direct effect on the bank lending interest rate in the public sector. The central bank rate does, however, affect the bank lending interest rate in the public sector indirectly through its effect on the bank lending interest rate in the private sector.

Intuitively, other factors remaining constant, an increase in bank lending interest rate in the private sector means that banks find it relatively more remunerative lending to the private sector than to the public sector and this causes a substitution effect in bank lending to the private sector at the expense of the public sector. To restore the initial parity in bank lending to the two sectors, the bank lending interest rate in the public sector must increase to match the increase in bank lending in the private sector. Thus, other factors remaining constant, the bank lending interest rate in the public sector increases with bank lending in the private sector.

The results show that the elasticity of the bank lending interest rate in the public sector with respect to the bank lending interest rate in the private sector is 0.118. This suggests that the indirect effect of the central bank rate on the bank lending interest rate in the public sector is 0.041 percentage points for every 1percentage point increase in the central bank rate. This suggests that changes in the central bank rate affect bank lending interest rate in the private sector relatively more than it affects the bank lending interest rate in the public sector.[3]

5.2.4.4 Bank Lending-Deposit Interest Rates Spreads

Using the results provided by (5) and (6), it can be shown that the bank lending-deposit interest rate spreads $lenddepop$ is determined as provided by (21) where the most important factor which determines the ban lending-deposit interest rate spreads is the bank lending interest rate in the public sector $lendpg$.

$$\text{lenddepop} = 0.00\ 3 - 0.007\text{cbr} + 1.259\text{lendg} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ (21)$$

Analogously, the private-public sector bank lending interest rate spreads $lendpg$ are provided by (22).

$$\text{lendpg} = -0.003 + 0.347\text{cbr} + 1.259\text{lendg} - 0.118\text{lendp} \quad \ldots\ldots\ldots\ldots\ (22)$$

3 Notice that 0.041=0.347*0.118 where 0.347 and 0.118 are from (6) and (7) consequent to using (6) in (7).

The economic significance of $lenddepop$ is that it is indicative of the competitiveness of the banking industry. Meanwhile, $lendpg$ is indicative of the bank credit risk premium charged on bank lending to the private sector relative to the public sector. It should be positively correlated with the gross non-performing loans ratio, which captures the credit repayment default risk in the private sector.

Figure 9 shows that except for the period when the Banking (Amendment) Act 2016 was operational and, actual bank lending-deposit interest rate spreads $lenddepo_{ac}$ fell below the equilibrium bank lending-deposit interest rate spreads $lenddepo$, the actual spreads rode higher than the equilibrium during the pre-capped interest rate sub-period. It is however notable that the actual spreads were progressively converging on the equilibrium, which was also on a declining trend, in 2012 – 2014.

Notably, the introduction of capped interest rates swung $lenddepo_{ac}$ way below the $lenddepop$ instead of ensuring that $lenddepo_{ac}$ coincided with $lenddepop$. The discrepancy introduced by the Act between $lenddepop_{ac}$ and $lenddepo$ represents a distortion in the banking lending and deposit interest rates. The discrepancy is plotted in Figure 10 as $xlenddepop$ where the graph falls below the zero-line to show the extent of distortion.

Figure 11 shows that during the most of the study period, except for the capped interest rate period, the actual private-public bank lending interest rate spreads $lendpg_{ac}$ rode higher than the equilibrium spreads $lendpg$ where the excess of $lendpg_{ac}$ of over $lendpg$ is the amount of the disequilibrium in the actual spreads which is shown in Figure 10 as $xlendpg$ and the equilibrium is represented by the zero-line represents the equilibrium.

Figure 9: Actual and Equilibrium Private Lending-Deposit Interest Rate Differentials

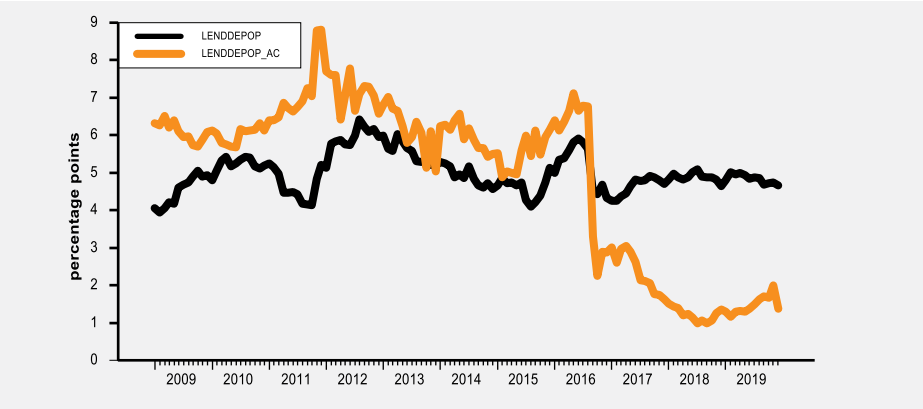
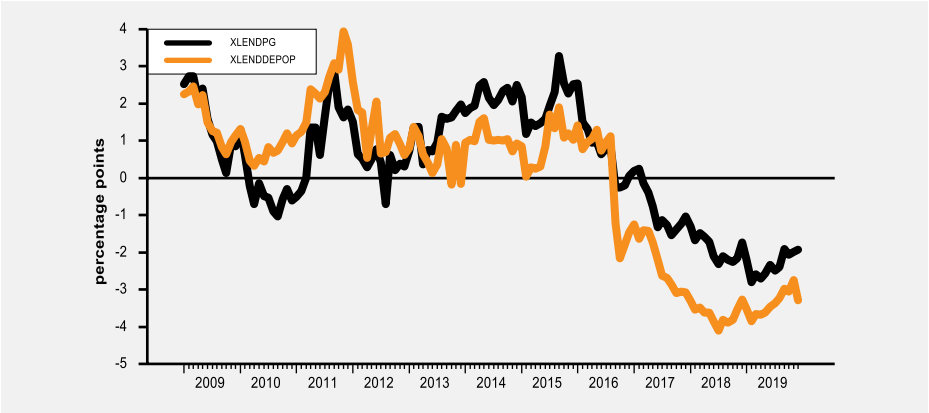


Figure 10: Excessive Bank Lending-Deposit and Private-Public Interest Rate Differentials



We have plotted the *equilibrium* private-public sector bank lending interest rate spreads ***lendpg*** and the gross non-performing loans ratio ***gnplsratio*** in Figure 12 where ***lendpg*** is the risk premium charged on bank lending interest rate in the private sector relative to the public sector, and the ***gnplsratio*** is the credit repayment default risk. There was an appreciable rise in the equilibrium private-public sector

Figure 11: Actual and Equilibrium Private-Public Bank Lending Interest Rate Differential

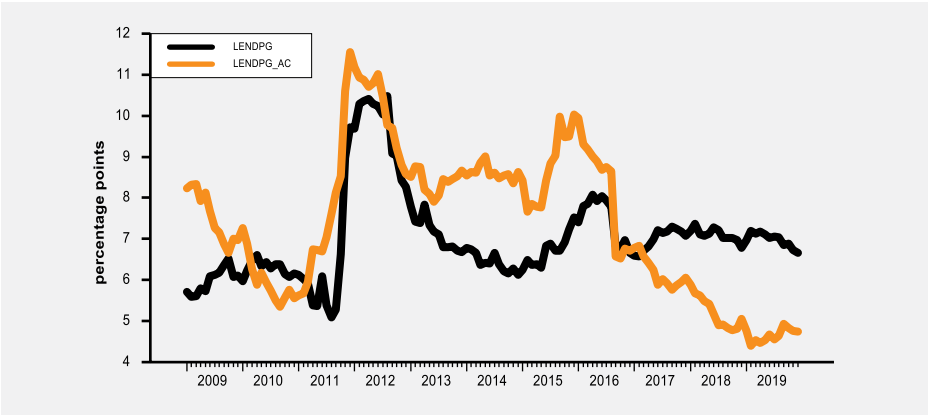
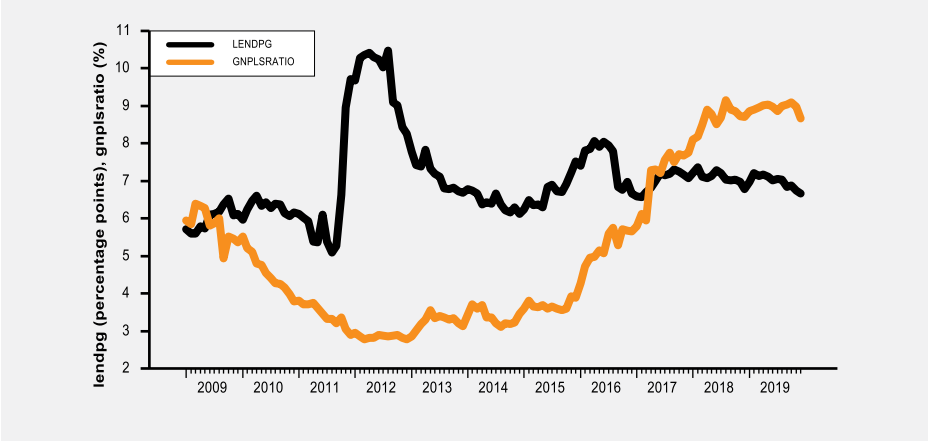


Figure 12: Private-Public Lending Interest Rate Differentials and Non-Performing Loans Ratio



lending interest rate spreads in 2011-2012 with some correction thereafter due to tightening of monetary policy stance using the central bank rate. See Figure 5 for the time path of the net nominal foreign exchange rate and comparative time paths of the other market interest rates. It is notable that the credit repayment default risk surpassed the equilibrium risk premium on the bank lending interest rate in the private sector and that therefore banks were not fully pricing credit since the operationalisation of the Banking (Amendment) Act 2016. It is not surprising; therefore, that bank lending to the private sector plummeted during capped interest rates period.

5.2.5 Determination of Gross Non-Performing Loans

The estimated gross non-performing loans equation is provided by (8). It is counter-intuitive that the gross non-performing loans $gnpls$ increase with increasing provisioning $prov$. Intuitively, however, provisioning is important in the stabilisation of gross non-performing loans. This is because, in the absence of $prov$, the persistence coefficient in the law of motion of the gross non-performing loans ends up being unity, thereby representing n explosive adjustment process for the gross non-performing

loans. As shown in (8); however, the persistence parameter falls within the range of 0 and unity. This suggests that much as the results suggest that gross non-performing loans increase with increasing provisioning, provisioning stabilises/slows down the growth in the gross non-performing loans.

5.2.6 Determination of Domestic Final Output

The results on the role of the real principal amount of bank credit $rcredit$ in determining domestic final output are provided by (9). They show that the real bank credit plays a crucial role in driving final domestic output. Holding other factors constant, an increase in the principal amount of real bank credit by 1 percentage point is expected to lead to an increase in the final domestic output by 0.663 percentage points. The induced increase in y then feeds into the real disposable income y_{dis} as provided by (15) only for the induced increase in y_{dis} in to feed into basic bank deposits bd, currency outside banks coc, bank credit in the private sector $creditp$, bank credit in the public sector $creditg$ through (1), (2), (3) and (4) thereby completing the circular flow of causality between bank deposits, bank credit and final domestic output which would be vicious or virtuous. In the event of a vicious circle, a downward spiral occurs while a virtuous circle involves an upward spiral for the economic variables in the model..

6.0 Conclusions

We must now use the empirical results to answer the question: what ails bank deposit mobilisation and credit creation in Kenya? The empirical results suggest that the observed persistent deceleration in bank deposits, bank credit and domestic final output during the most of the second half of the decade ending Dec. 2019 is a vicious circle of bank deposits, bank credit and final domestic output. As to what sparked the vicious circle, the key suspects are increased taxation which reduced real disposable income that adversely affected bank deposits, demand and supply of bank credit through increased bank credit repayment default, with adverse feedback to final domestic output only for the adverse process to repeat itself in a vicious circle. The vicious circle was compounded by adverse shocks, including the 2007 post-election violence and the global economic and financial crises. These challenges motivated the pursuit of accommodative economic and financial policies which spurred imprudent bank lending with an accumulation of gross non-performing loans. As the policies were being vacated for being unsustainable, the embers of a vicious circle of bank deposits, bank credit and final domestic output grew.

The specific determinants of bank deposits, in their descending order of relative importance based on elasticities, are the preceding period bank credit with an elasticity of 6.191, real disposable income with an elasticity of 3.272, the domestic final output prices with an elasticity of -2.942, and currency outside banks with an elasticity of 0.551. The coefficient of determination in the preliminary linear regression analysis is 0.925, and that shows that the bank deposits equation accounts for 92.5 percent of observed fluctuations in bank deposits.

Analogously, the specific determinants of bank credit in the private sector are the bank lending interest rate (-3.598), real disposable income (2.555), the nominal foreign exchange rate (0.305), bank deposits (0.46), and gross non-performing loans (-0.121). The coefficient of determination is 99.4 percent. The determinants of bank credit in the public sector are the bank lending interest rate (11.304), domestic final output prices (-3.098), real disposable income (0.341), and the gross non-performing loans (0.221). The coefficient of determination is 93.7

percent. The determinants of currency outside banks are bank deposit interest rate (1.48), the preceding period bank credit (1.024), real disposable income (-0.436) and bank deposits (0.381). The coefficient of determination is 96.3 percent. The determinants of final domestic output in terms of real bank credit yields an elasticity of 0.663.

Since we have analysed bank deposits and bank credit by quantity and prices, determination of the bank deposit interest rate, bank credit lending interest rates by the private and public sectors is essential. The results show that the effect of the central bank rate on the bank deposit and bank lending interest rate in the private sector is symmetrical in magnitude and direction of causation. This suggests that banks endeavour to guard their interest income profit margins where deposit and lending interest rates change in the same direction by the same magnitude. The net nominal bank deposit interest rates are an increasing function of the net nominal central bank rate (0.354). The nominal bank lending interest rate in the private sector is determined by the net nominal bank lending interest rate in the public sector (1.259) and the net nominal central bank rate (0.347).

The net nominal bank lending interest rate in the public sector is an increasing function of the net nominal bank lending interest rate in the private sector (0.118), and therefore the net central bank rate indirectly affects the net nominal bank lending interest rate in the public sector (0.04). Thus, the central bank rate asymmetrically affects the bank lending interest rates in the private and public sectors. The bank lending-deposit interest rate spreads in the private sector, which are indicative of the competitiveness of the banking industry, are determined by the net nominal lending interest rate in the public sector (1.259) and the net nominal central bank rate (-0.007). Except for the capped interest rates regime that was introduced by the Banking (Amendment) Act 2016 when the actual spreads appreciably fell below the equilibrium spreads, the actual spreads rode higher than the equilibrium spreads during the study sample. There were episodes of a tendency to convergence between the actual and equilibrium spreads.

The private-public sector lending interest rate spreads, which are indicative of the bank lending interest rate in the private sector risk premium relative to the public sector, are determined by net nominal lending interest rates in the public sector (1.259), the net nominal central bank rate (0.347) and the net nominal bank lending interest rate in the private sector (-0.118). The equilibrium private-public sector lending interest rate spreads averaged 7 percentage points in 2009:03-2017:03 and, generally, assumed a declining trend 2012-2014 upon which an increasing trend set in through 2016 only to remain stable in 2017-2019. Except for the capped interest rates period 2017-2019 when the gross non-performing loans rate surpassed the equilibrium private-public sector lending interest rate spreads, the gross non-performing loans rate was below the equilibrium private-public sector lending interest rate spreads.References

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Kenya Bankers Association
13th Floor, International House, Mama Ngina Street
P.O. Box 73100– 00200 NAIROBI
Telephone: 254 20 2221704/2217757/2224014/5
Cell: 0733 812770/0711 562910
Fax: 254 20 2221792
Email: research@kba.co.ke
Website: www.kba.co.ke

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