Does Money Matter in Africa? New Empirics on Long- and Short-run Effects of Monetary Policy on Output and Prices

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Abstract

Purpose – While in developed economies, changes in monetary policy affect real economic activity in the short-run but only prices in the long-run, the question of whether these tendencies apply to developing countries remains open to debate. In this paper, we examine the effects of monetary policy on economic activity using a plethora of hitherto unemployed financial dynamics in inflation-chaotic African countries for the period 1987-2010.

Design/methodology/approach – VARs within the frameworks of VECMs and simple Granger causality models are used to estimate the long-run and short-run effects respectively. A battery of robustness checks are also employed to ensure consistency in the specifications and results.

Findings – But for slight exceptions, the tested hypotheses are valid under monetary policy independence and dependence. *Hypothesis 1*: Monetary policy variables affect prices in the long-run but not in the short-run. For the first-half (long-run dimension) of the hypothesis, permanent changes in monetary policy variables (depth, efficiency, activity and size) affect permanent variations in prices in the long-term. But in cases of disequilibriums only financial dynamic fundamentals of depth and size significantly adjust inflation to the cointegration relations. With respect to the second-half (short-run view) of the hypothesis, monetary policy does not overwhelmingly affect prices in the short-term. Hence, but for a thin exception *Hypothesis 1* is valid.

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-term. With regard to the short-term dimension of the hypothesis, only financial dynamics of depth and size affect real GDP output in the short-run. As concerns the long-run dimension, the neutrality of monetary policy has been confirmed. Hence, the hypothesis is also broadly valid.

Practical Implications – A wide range of policy implications are discussed. Inter alia: the long-run neutrality of money and business cycles, credit expansions and inflationary tendencies, inflation targeting and monetary policy independence implications. Country/regional specific implications, the manner in which the findings reconcile the ongoing debate, measures for fighting surplus liquidity, caveats and future research directions are also discussed.

Originality/value – By using a plethora of hitherto unemployed financial dynamics (that broadly reflect monetary policy), we provide significant contributions to the empirics of money. The conclusion of the analysis is a valuable contribution to the scholarly and policy debate on how money matters as an instrument of economic activity in developing countries.

JEL Classification: E51; E52; E58; E59; O55
Keywords: Monetary Policy; Banking; Inflation; Output effects; Africa

1. Introduction

In large industrial economies, changes in monetary policy affect real economic activity in the short-term but only prices in the long-run. In transition and developing countries however, the question of whether monetary policy variables affect output in the short-run is open to debate (Starr, 2005). Conversely, the evidence of real effects in a developed economy is supportive of the idea that monetary policy can be used to counter aggregate shocks. Economic theory traditionally suggests that money influences business cycles, not the long-term potential real output. This suggests monetary policy in neutral in the long-run. The neutrality of money has been substantially documented in the literature (Olekalns, 1996; Sarletis & Koustas, 1998; Bernanke & Mihov, 1998; Bullard, 1999; Bae et al., 2005; Nogueira, 2009). In spite of the theoretical and empirical consensus on this neutrality (Lucas, 1980; Gerlach & Svensson, 2003), the role of money as an informational variable for decision making has remained open to debate (Roffia & Zaghini, 2008; Nogueira, 2009; Bhaduri & Durai, 2012)[1].

The potential for using monetary policy in affecting real prices is also less clear. In countries that have experienced high inflation or in which labor markets are chronically slack, prices and wages are unlikely to be particularly sticky so that, monetary policy changes could pass quickly through prices and have little real effect (Gagnon & Ihrig, 2004). Moreover, the globalization of financial markets undercut the potential of independent policy by significantly eroding the ability of small-open economies to determine interest rates independently of world markets (Dornbusch, 2001; Frankel et al., 2004).

In light of the above, three challenges are central in the literature. Firstly, the extent to which monetary policy affects output in the short-run and prices in the long-run in developing countries remains an open debate. Hence, the need to contribute to the scholarly and policy

[1] As a matter of fact, empirical literature provides mixed results and the outcomes are contingent on selected countries and historical periods under investigation (Stock & Watson, 1999; Dwyer & Hafer, 1999; Trecroci & Vega-Croissier, 2000; Leeper & Roush, 2002; Bae et al., 2005).

debates on the manner in which money matters in economic activity by providing an answer to the open question. Secondly, but for a few exceptions (Moosa, 1997; Bae & Ratti, 2000; Starr, 2005; Nogueira, 2009), the literature on the long-run economic significance of money has focused on developed countries for the most part. Evidence provided by these studies may not be relevant for African countries because their financial dynamics of monetary policy have different tendencies. For example, financial depth (liabilities) in the perspective of money supply is not as relevant in African countries because a great chunk of the monetary base does not transit through the banking sector (Asongu, 2012a). Thirdly, the empirical investigation that has focused on monetary aggregates has failed to take account of other proxies that are exogenous to money supply. For instance, other financial dynamics of efficiency (at banking and financial system levels), activity (from banking and financial system perspectives), and size (credit of the banking sector in relation to that of the financial system) substantially affect the velocity of money and hence, the effectiveness of monetary policy (both in the short- and long-run). Indeed, financial allocation efficiency is a serious issue in African countries because of surplus liquidity issues (Saxegaard, 2006) and consequently limited financial activity (credit).

The contribution of this paper to the literature is therefore fivefold. Firstly, it assesses the effects of monetary policy on output and prices in a continent (Africa) that has not received much scholarly attention. Secondly, there are certain specificities in monetary policy variables in developed economies that are not very relevant in Africa. Inter alia: on the one hand, financial depth in the perspective of money supply as applied in the developed world cannot be transported to Africa because a great chunk of the monetary base in the continent does not transit through the banking system; on the other hand, the effectiveness of the credit channel of monetary policy is an issue in Africa owing to the substantially documented surplus liquidity issues (Saxegaard, 2006; Fouda, 2009). Thirdly, soaring food prices that have recently marked the geopolitical landscape of Africa have not been braced with adequate

short-run monetary measures to stem the rising price tide[2]. Fourthly, embryonic African monetary unions like the proposed West African Monetary Zone (WAMZ) and East African Monetary Zone (EAMZ) need to be informed on the relevance of money as an instrument of economic activity (growth and price control). Fifthly, the use of a plethora of hitherto unemployed monetary policy variables complements existing literature by contributing to the empirics of monetary policy.

The rest of the paper is organized as follows. Section 2 highlights the debate and discusses monetary policy in Africa. The intuition motivating the empirics, the data and the methodology are discussed in Section 3. Empirical analysis is covered in Section 4. Section 5 concludes.

2. The debate and African monetary policy

2.1 The debate

For organizational purposes, we present the debate in two strands: the traditional discretionary monetary policy strand and, the second strand of nontraditional policy regimes that limit the ability of monetary authorities to use policy to offset output fluctuations.

In recent years, the rewards of shifting from traditional discretionary monetary policy to arrangements that favor commitments to price stability and international economic integration (such as inflation targeting, monetary unions, dollarization…etc) have been discussed substantially. An appealing prospect of discretionary policy is that the monetary authority can use policy instruments to offset adverse shocks to output by pursuing expansionary policy when output is below its potential and, contractionary policy when output is above its potential. For instance in the former situation, a policy-controlled interest rate can be lowered in a bid to reduce commercial interest rates and stimulate aggregate spending. Conversely, a monetary expansion that lowers the real exchange rate may improve the

[2] According to the Director General of the International Food Policy Research Institute, monetary and exchange rate responses were not effective in addressing food inflation (Von Braun, 2008).

competitiveness of a country's products in domestic and world markets and thereby, boost demand for national output (Starr, 2005). As a matter of principle, a flexible countercyclical monetary policy can be practiced with inflation targeting (Ghironi & Rebucci, 2000; Mishkin, 2002; Cavoli & Rajan, 2008; Cristadoro & Veronese, 2011; Levine, 2012).

In the second strand, nontraditional policy regimes limit the ability of the monetary authorities to use policy to offset output fluctuations. The degree to which a given country can use monetary policy to affect output in the short-term is open to debate. Findings for the US are consistent with the fact that, a decline in the key interest rate controlled by the Federal Reserve tends to boost output over the next two to three years. But the effect dissipates thereafter so that the long-run effect is limited to prices (Starr, 2005). Several studies have assessed whether the short-term effects of monetary policy on output in other countries are similar to those in the US. Mixed results have been found in seventeen industrialized countries (Hayo, 1999) and studies on two middle-income countries have found no evidence of Granger-causality from money to output, regardless of money used (Agenor et al., 2000). Hafer & Kutan (2002) find that, interest rate generally plays a relatively more important role in explaining output in twenty OECD countries while Ganev et al. (2002) find no such evidence in Central and Eastern Europe. The International Monetary Fund (IMF) places great emphasis on monetary policy in its programs for developing countries, especially in sub-Saharan Africa (SSA). It views such policy as crucial in managing inflation and stabilizing the real exchange rate. According to Weeks (2010), such an approach is absurdly inappropriate since the vast majority of governments in SSA lack the instruments to make monetary policy effective[3].

[3] Weeks asserts that SSA lacks two main channels for implementing monetary policy: (1) trying to influence the creation of private credit through so-called open market operations or; (2) seeking to influence the borrowing rates for private sector by adjusting the interest rate at which commercial banks can borrow from the central bank.

2. 2 Monetary policy in Africa

Khan (2011) has looked at the relationship between the growth of GDP and different monetary aggregates in 20 economies of SSA and found empirical support for the hypothesis that credit-growth is more closely linked than in money-growth to the growth of real GDP. Mangani (2011) has investigated the effects of monetary policy on prices in Malawi and established the lack of unequivocal evidence in support of the conventional channel of monetary policy transmission mechanism. The findings suggest that exchange rate was the most important variable in predicting prices. The study recommends that authorities should be more concerned with imported cost-push inflation than with demand-pull inflation[4]. In a slight contradiction, Ngalawa & Viegi (2011) have also investigated the process through which monetary policy affects economic activity in Malawi and found that, bank rate is a more effective measure of monetary policy than reserve money.

Some studies have also focused on South Africa: with Gupta et al. (2010a) finding that house price inflation was negatively related to money policy shocks; Gupta et al. (2010b) showing that during the period of financial liberalization, interest rate shocks had relatively stronger effects on house price inflation irrespective of house sizes and; Ncube & Ndou (2010) complementing Gupta et al. (2010ab)[5] with the suggestion that, the direct effects of high interest rates on consumption appear to be more important in transmitting monetary policy to the economy than through indirect effects. Hence, the inference that monetary policy tightening can marginally weaken inflationary pressures (arising from excessive consumption) operating via house wealth and the credit channel. To demonstrate that monetary expansions and contractions may have different effects in different regions of the same country, Fielding

[4] According to Mangani (2011), in the short-run, pursuing a prudent exchange rate policy that recognizes the country's precarious foreign reserve position could be critical in deepening domestic price stability. Beyond the short-run, policy stability could be sustained via the implementation of policies directed towards the construction of a strong foreign exchange reserve base (as well as developing a sustainable approach to the country's reliance on development assistance).

[5] Gupta et al. (2010ab) do not quantify the indirect effects of interest rate changes working through changes in house prices on consumer spending. Ncube & Ndou (2010) fill this gap by estimating and quantifying the role of house wealth in South Africa using disaggregated house prices.

& Shields (2005) have estimated the size of asymmetries across the nine provinces of South Africa (over the period 1997-2005) and found substantial differences in the response of prices to monetary policy.

Consistent with the position of Weeks (2010) on the inherent ineffectiveness of monetary policy in African countries discussed above, the insights from the 'Blinder credit-rationing model' are useful in solidifying the intuition for African empirics. According to Blinder (1987), a rethinking new monetary policy dynamics is needed at times: "*The reader should understand that this is merely an expositional device. I would not wish to deny that the interest elasticity and expectational error mechanisms have some validity. But the spirit of this paper is that those mechanisms do not seem important enough to explain the deep recessions that are apparently caused by central bank policy*" (p. 2). The postulation of Blinder is even more relevant when existing monetary and exchange rate responses have not been effective in addressing the recent food inflation (Von Braun, 2008).

In light of the points presented in the introduction and the section above, the following hypotheses will be tested in the empirical section.

Hypothesis 1: Monetary policy variables affect prices in the long-run but not in the short-run.

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-term.

3. Data and Methodology

3.1 Intuition for the empirics

Whereas there is vast empirical work on the effects of monetary policy on economic activity based on aggregate measures of money supply, there is yet (to the best of our knowledge) no employment of fundamental financial performance dynamics (that reflect the quantity of money supply) in the assessment of the long-run and short-term effects of monetary policy on output and prices. With this fact in mind, we are aware of the risks of

"doing measurement without past empirical basis" and assert that reporting facts, even in the absence of past supporting studies (in the context of an outstanding theoretical model) may be a useful scientific activity. Moreover, applied econometrics has other tasks than merely validating or refuting economic theories with existing expositions and prior analytical frameworks (Asongu, 2012a,b). Hence, the need to understand the economic/monetary intuition motivating the employment of a plethora of financial performance measures in the assessment of the incidence of monetary policy variables on economic activity.

From a broad standpoint, money supply can be understood in terms of financial depth, financial allocation efficiency, financial activity and financial size. (1) Financial intermediary depth could be defined both from an overall economic perspective and a financial system standpoint. This distinction, as will be detailed in the data section is worth emphasizing because unlike the developed world, in developing countries a great chunk of the monetary base does not transit through the banking sector (Asongu, 2012c). (2) Financial activity (observed from banking and financial system perspectives) reflects the ability of banks to grant credit to economic operators. (3) Financial allocation efficiency (from banking and financial system standpoints) that reflects the fulfillment of the fundamental role of banks (in transforming mobilized deposits into credit for economic operators) could also intuitively be conceived as the ability of banks to increase the velocity of money. (4) Financial size (deposit bank assets/total assets) mirrors the credit allocated by banking institutions as a proportion of total assets in the financial system (deposit bank assets plus central bank assets). Hence, financial intermediary performance dynamics are exogenous to money supply and corrolarily monetary policy.

The choice of the monetary policy variables is broadly consistent with the empirical underpinnings of recent African monetary literature targeting inflation (Asongu, 2013a, b) and real GDP output (Asongu, 2013c). These financial dynamic fundamentals entail all the dimensions identified by the Financial Development and Structure Database (FDSD) of the

World Bank (WB). We are not the first to think out of the box when it comes to the empirics of monetary policy. Blinder (1987) in assessing the effects of monetary policy on economic activity completely banished interest rate elasticities: "*In order to make credit rationing mechanism stand out in bold relief, most other channels of monetary policy (such as interest elasticities and expectational errors) are banished from the model*" (p. 2).

3.2 Data

We investigate a panel of 10 African countries with data from African Development Indicators (ADI) and the FDSD of the WB. The resulting balanced panel spans from 1987 to 2010 due to constraints in data availability and the interest of obtaining results with updated policy implications. In a bid for robustness, we are poised to control for the period 2007-2009 during which the rise in food prices was very substantial. Hence, a sub-panel of the period 1987-2006 will be used to assess the consistency of findings.

We are limited to only 10 African cross-sections because some countries in the continent inherently do not exhibit a unit root in consumer price inflation. Owing to the problem statements of the study, it is imperative to have non-stationary (chaotic) consumer price inflation for consistent long-run modeling. Hence, in accordance with recent African law-finance literature (Asongu, 2011), CFA franc[6] countries of the CEMAC[7] and UEMOA[8] zones have not been included[9] in the sample. Beside these justifications for eliminating CFA

[6]The CFA franc is the name of two currencies used in sub-Saharan Africa (by some former French colonies) which are guaranteed by the French treasury. The two currencies though theoretically separate are effectively interchangeable and include: the West African CFA franc (used in the UEMOA zone) and the Central African CFA franc (used in the CEMAC zone).

[7] Economic and Monetary Community of Central African States.

[8] Economic and Monetary Community of West African States.

[9]The need for inflation to reflect a unit root in order to accommodate the problem statement (and the exclusion of CFA franc countries) also draws from an inflation uncertainty theory in recent African finance literature. "*The dominance of English common–law countries in prospects for financial development in the legal–origins debate has been debunked by recent findings. Using exchange rate regimes and economic/monetary integration oriented hypotheses, this paper proposes an 'inflation uncertainty theory' in providing theoretical justification and empirical validity as to why French civil–law countries have higher levels of financial allocation efficiency. Inflation uncertainty, typical of floating exchange rate regimes accounts for the allocation inefficiency of financial intermediary institutions in English common–law countries. As a policy implication, results support the benefits of fixed exchange rate regimes in financial intermediary allocation efficiency"* Asongu (2011, p.1).

franc countries, the seminal work of Mundell (1972) has shown that African countries with flexible exchange rates regimes have more to experience in '*money and inflation dynamics*' than their counterparts with fixed exchange rate regimes[10].

Consistent with the literature, the dependent variables are measured in terms of annual percentage change in the Consumer Price Index (CPI) and real GDP output (Bordo & Jeanne, 2002; Hendrix et al., 2009; Bae et al., 2005; Kishor & Ssozi, 2010; Moorthy & Kolhar, 2011). For organizational clarity, the independent variables are presented in terms of money (financial depth), credit (financial activity), efficiency and size. Firstly, from a money perspective, we are consistent with the FDSD and recent African finance literature (Asongu, 2013a, b) in measuring financial depth both from overall-economic and financial system perspectives with indicators of broad money supply (*M2/GDP*) and financial system deposits (*Fdgdp*) respectively. Whereas the former denotes the monetary base plus demand, saving and time deposits, the latter represents liquid liabilities of the financial system. It is interesting to distinguish between these two aggregates of money supply because, since we are dealing exclusively with developing countries, a great chunk of the monetary base does not transit via the banking sector. Secondly, credit is appreciated in terms of financial intermediary activity. Thus, the paper seeks to lay emphasis on the ability of banks to grant credit to economic operators. We proxy for both banking-system-activity and financial-system-activity with "private domestic credit by deposit banks: *Pcrb*" and "private credit by deposit banks and other financial institutions: *Pcrbof*" respectively. Thirdly, financial size is measured in terms of deposit bank assets as a proportion of total assets (deposit bank assets plus central bank

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Moreover, before limiting the dataset, we have found from preliminary analysis that, African CFA franc countries have a relatively very stable inflation rate.

[10] "*The French and English traditions in monetary theory and history have been different… The French tradition has stressed the passive nature of monetary policy and the importance of exchange stability with convertibility; stability has been achieved at the expense of institutional development and monetary experience. The British countries by opting for monetary independence have sacrificed stability, but gained monetary experience and better developed monetary institutions*." (Mundell, 1972, pp. 42-43).

assets). Fourthly, financial efficiency[11] measures the ability of deposits (money) to be transformed into credit (financial activity). This fourth measure appreciates the fundamental role of banks in transforming mobilized deposits into credit for economic operators. We adopt indicators of banking-system-efficiency and financial-system-efficiency (respectively 'bank credit on bank deposits: *Bcbd'* and 'financial system credit on financial system deposits: *Fcfd'*).

Whereas definitions of the variables and their corresponding sources are presented in Appendix 2, summary statistics (with presentation of countries) and correlation analysis are detailed in Appendix 1 and Appendix 3 respectively. From a preliminary assessment of the summary statistics, we are confident that reasonable estimated nexuses would emerge. The correlation analysis provides empirical validity for the theoretical categorization of banking and financial system indicators into fundamentals of depth, efficiency, activity and size.

3.3 Methodology

The estimation technique typically follows mainstream literature on testing the long-run neutrality of monetary policy (Nogueira, 2009) and the short-run effects of monetary policy variables on output and prices (Starr, 2005). The approach involves unit root and cointegration tests that assess the stationary properties and long-term equilibriums respectively. In these assessments, the Vector Error Correction Model (VECM) is applied for long-run effects while simple Granger causality is used for short-term effects. While application of the former model requires that variables exhibit unit roots in levels and have a long-run relationship (cointegration), the latter is applied on the condition that variables are stationary (do not exhibit unit roots). Impulse response functions are used to further assess the tendencies of significant Granger causality results.

[11] By financial efficiency here, we neither refer to the profitability-related concept (notion) nor to the production efficiency of decision making units in the financial sector (through Data Envelopment Analysis: DEA).

4. Empirical Analysis

4.1 Unit root tests

We investigate evidence of stationarity with first and second generation panel unit root tests. When the variables exhibit unit roots in levels, we proceed to test for stationarity in their first difference. Employment of the VECM requires that the variables have a unit root (non stationary) in levels. Two main types of panel unit root tests have been documented: first generation (that supposes cross-sectional independence) and the second generation (based on cross-sectional dependence). Accordingly, it is convenient to perform several panel unit root tests to infer an overwhelming evidence in order to verify the order of integration of a series since none of these tests is immune from statistical shortcomings in terms of size and power properties. With regard to the first generation tests, the Levin, Lin & Chu (LLC, 2002) and Im, Pesaran & Shin (IPS, 2003) tests are applied. Whereas the former is a homogenous based panel unit root test (common unit roots as null hypothesis), the latter is a heterogeneous oriented test (individual unit roots as null hypotheses). When the results are different, IPS (2003) takes precedence over LLC (2002) in decision making because, consistent with Maddala & Wu (1999), the alternative hypothesis of LLC (2002) is too powerful. While IPS (2003) controls for cross-sectional dependence to a certain degree, Pesaran (2007) has put forward a test which allows for the presence of more general cross-sectional dependence patterns. This test can be considered as a second-generation of panel unit root tests. In accordance with Liew (2004), goodness of fit (or optimal lag selection) is ensured by the Hannan-Quinn Information Criterion (HQC) for the LLC (2002) and the Akaike Information Criterion (AIC) for the IPS (2003) and Pesaran (2007) tests. Ultimately, Pesaran (2007) takes precedence over LLC (2002) and IPS (2003) in decision making.

Table 1: Panel unit root tests

Panel A: 1987-2010

LLC tests of homogenous panel

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	3.23	1.78	0.24	**-3.70*** **	-0.10	**-1.47***	2.26	3.24	2.16
	ct	0.98	0.04	0.97	**-5.48*** **	0.49	0.35	**-1.49***	1.84	**-1.58***
First difference	c	**-8.39*** **	**-6.28*** **	**-4.64*** **	na	**-4.42*** **	**-4.53*** **	**-10.9*** **	**-2.77*** **	**-8.46*** **
	ct	**-7.04*** **	**-4.41*** **	**-3.42*** **	na	**-2.96*** **	**-3.52*** **	**-10.9*** **	**-2.73*** **	**-8.26*** **

IPS tests for heterogeneous panel

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	2.77	1.86	0.05	**-2.50*** **	1.24	0.06	3.94	-0.76	5.02
	ct	0.83	0.13	0.12	**-3.29*** **	0.20	0.38	-0.96	**-1.86** **	**-1.36***
First difference	c	**-7.30*** **	**-7.50*** **	**-7.15*** **	na	**-4.92*** **	**-5.03*** **	**-12.1*** **	**-13.0*** **	**-8.03*** **
	ct	**-6.79*** **	**-7.01*** **	**-6.19*** **	na	**-3.64*** **	**-4.14*** **	**-11.9*** **	**-8.70*** **	**-7.66*** **

Pesaran CADF *Z* (*t*-bar) test statistics

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	-0.15	-0.71	1.64	-0.01	0.26	**-1.52***	**-2.18** **	2.18	**-1.79** **
	ct	0.37	0.24	-0.15	**-1.90** **	1.10	0.36	0.13	-0.83	0.127
First difference	c	**-3.40*** **	**-2.71*** **	**-5.64*** **	**-3.62*** **	**-1.65** **	**-2.48*** **	**-4.02*** **	**-7.23*** **	**-5.22*** **
	ct	**-2.10** **	**-4.61*** **	**-3.63*** **	**-3.30*** **	**-2.28** **	**-2.64*** **	**-1.93** **	**-5.95*** **	**-3.57*** **

Panel B: 1987-2006

LLC tests of homogenous panel

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	-0.80	-0.98	**-1.60***	**-4.69*** **	**-5.24*** **	**-6.37*** **	0.28	1.06	1.57
	ct	0.62	0.53	**-1.43***	**-1.72** **	0.68	0.94	-1.28	0.77	-0.95
First difference	c	**-7.27*** **	**-5.69*** **	na	na	**-2.43*** **	**-2.37*** **	**-6.43*** **	**-12.0*** **	**-5.64*** **
	ct	**-6.21*** **	**-5.35*** **	na	na	**-4.81*** **	**-5.03*** **	**-6.21*** **	**-8.24*** **	**-7.51*** **

IPS tests for heterogeneous panel

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	**-2.07** **	-0.98	**-1.97** **	**-3.71*** **	**-3.39*** **	**-4.33*** **	1.00	**-2.18** **	4.50
	ct	-0.40	-0.82	**-1.44***	**-2.12** **	0.23	1.12	-0.60	**-2.50*** **	-0.02
First difference	c	**-5.45*** **	**-5.68*** **	na	na	**-3.01*** **	**-3.05*** **	**-7.27*** **	na	**-4.79*** **
	ct	**-5.03*** **	**-4.80*** **	na	na	**-4.81*** **	**-5.31*** **	**-7.54*** **	na	**-6.14*** **

Pesaran CADF *Z* (*t*-bar) test statistics

		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	0.36	-0.06	-0.72	-1.29	0.00	-0.77	**-2.85*** **	13.32	0.21
	ct	0.31	0.65	-1.06	-0.63	2.04	1.90	-0.56	-0.11	1.47
First difference	c	**-2.62*** **	**-1.88** **	**-4.56*** **	**-2.11** **	**-2.79*** **	**-2.29** **	**-3.27*** **	**-5.95*** **	**-3.33*** **
	ct	**-1.50***	**-3.27*** **	**-3.20*** **	**-2.22** **	**-1.77** **	**-1.70** **	**-1.70** **	**-3.57*** **	**-2.65*** **

Notes: ***, **, *denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Maximum lag is 6 and optimal lags are chosen via HQC for LLC test and the AIC for IPS and Pesaran (2007) tests.. LLC: Levin, Lin & Chu (2002). IPS: Im, Pesaran & Shin (2003). M2: Money Supply. Fdgdp: Liquid Liabilities. BcBd: Banking System Efficiency. FcFd: Financial System Efficiency. Pcrb: Banking System Activity. Pcrbof: Financial System Activity. Dbacba: Deposit Bank Assets on Total Assets. CPI: Consumer Price Inflation. GDP: Gross Domestic Product. CADF: Cross Augmented Dickey Fuller.

Table 1 above reports the panel unit root tests results. While Panel A presents the findings for the period 1987-2010, Panel B is for the 1987-2006 span. Based on two information criteria ('constant and trend' and Pesaran (2007)), only financial system efficiency in Panel A is stationary in levels. Hence, the findings indicate the possibility of

cointegration (long-run equilibrium) among the variables; because, in line with the Engel-Granger theorem, two variables that are not stationary may have a linear combination in the long-run (Engle & Granger, 1987).

4.2 Cointegration tests

Consistent with the cointegration theory, two (or more) variables that have a unit root in levels may have a linear combination (equilibrium) in the long-run. In principle, if two variables are cointegrated, it implies permanent movements of one variable affect permanent movements in the other variable. To assess the potential long-run relationships, we test for cointegration using the Engle-Granger based Pedroni test, which is a heterogeneous panel-based test. Whereas we have earlier employed both homogenous and heterogeneous panel based unit roots tests in Section 4.1, we disagree with Camarero & Tamarit (2002) in applying a homogenous Engle-Granger based Kao panel cointegration test because, it has less deterministic components. Accordingly, application of Kao (1999) in comparison to Pedroni (1999) presents substantial issues in deterministic assumptions[12]. The same deterministic trend assumptions employed in the IPS (2003) unit root tests are used in the Pedroni (1999) heterogeneous cointegration test. However, like in panel unit root tests, panel cointegration tests also suffer from cross-sectional dependence. A second-generation cointegration test such as Westerlund (2007) can control for cross-sectional dependence via bootstrapping. The choice of bivariate statistics has a twofold advantage (justification): on the one hand, it is consistent with the problem statements and on the other hand, it mitigates misspecification issues in causality estimations.[13]

[12] Whereas Pedroni (1999) is applied in the presence of both 'constant' and 'constant and trend', Kao (1999) is based only on the former (constant).
[13] For example, multivariate cointegration and corresponding error correction model may involve variables that are stationary in levels (See Gries et al., 2009).

Table 2: Bivariate heterogeneous Pedroni Engle-Granger based panel cointegration tests

Panel A: 1987-2010

Cointegration between Monetary Policy and Inflation

	Financial Depth (Money) & Inflation				Financial Allocation Efficiency & Inflation				Financial Activity (Credit) & Inflation				Fin. Size & Inflation	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	-0.502	0.095	-0.396	-1.263	-0.410	-1.821	na	na	-0.421	-1.659	-0.227	-1.396	-0.009	-1.931
Panel rho-Stats	1.497	1.860	-0.753	-1.033	**-2.278****	**-2.072****	na	na	-1.198	**-1.287***	**-1.308***	**-1.649****	**-2.634*****	**-2.147****
Panel PP-Stats	1.883	1.563	**-1.540***	**-2.810*****	**-3.583*****	**-4.979*****	na	na	**-1.972****	**-3.450*****	**-2.006****	**-3.986*****	**-4.370*****	**-5.481*****
Panel ADF-Stats	1.985	1.673	**-1.692****	**-2.542*****	**-3.592*****	**-5.872*****	na	na	**-2.229****	**-3.687*****	**-1.898****	**-4.465*****	**-5.072*****	**-6.880*****
Group rho-Stats	2.504	2.549	-0.393	0.142	**-1.366***	-0.440	na	na	-0.772	-0.068	-1.260	-0.802	-0.839	-0.234
Group PP-Stats	2.657	2.176	**-2.349*****	**-4.288*****	**-4.113*****	**-4.475*****	na	na	**-2.718*****	**-3.580*****	**-3.075*****	**-4.617*****	**-4.958*****	**-5.616*****
Group ADF-Stats	2.735	1.466	**-2.387*****	**-3.927*****	**-2.381*****	**-3.711*****	na	na	**-2.840*****	**-3.759*****	**-2.725*****	**-4.730*****	**-3.762*****	**-4.341*****

Cointegration between Monetary Policy and Real GDP Output

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	**1.285***	1.364	-0.954	**2.030****	-1.318	2.157	na	na	-1.056	**1.983****	-1.194	**1.934****	0.242	**2.026****
Panel rho-Stats	-0.530	0.855	0.987	0.850	1.595	0.423	na	na	1.549	1.066	1.957	1.038	-0.876	0.565
Panel PP-Stats	-1.275	0.028	0.792	-0.445	1.829	-0.954	na	na	1.828	-0.097	2.482	-0.121	**-1.350***	-0.563
Panel ADF-Stats	**-2.637*****	-0.118	0.573	-1.275	0.444	**-1.568***	na	na	0.479	-0.845	1.402	-0.827	-0.690	-0.259
Group rho-Stats	0.840	1.895	1.908	1.721	2.242	1.680	na	na	2.211	2.155	2.723	2.144	0.113	1.258
Group PP-Stats	-0.501	0.885	1.453	0.188	2.907	0.257	na	na	2.462	0.854	3.412	0.847	**-1.877****	-0.115
Group ADF-Stats	**-2.213****	0.176	0.678	-0.943	0.962	**-2.207****	na	na	-0.181	**-2.011****	0.998	**-1.984****	-0.022	-1.076

Panel B: 1987-2006

Cointegration between Monetary Policy and Inflation

	Financial Depth (Money) & Inflation				Financial Allocation Efficiency & Inflation				Financial Activity (Credit) & Inflation				Fin. Size & Inflation	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	-0.983	-1.302	-0.806	-0.981	-0.739	-1.683	-1.046	-1.608	-0.375	-0.769	-0.574	-0.878	-0.457	-2.042
Panel rho-Stats	-0.114	**-1.341***	-0.046	-1.255	**-1.468***	**-1.295***	-0.701	-1.279	-0.854	**-1.984****	0.419	1.752	**-2.415*****	**-1.738****
Panel PP-Stats	-1.027	**-3.916*****	-0.736	**-3.487*****	**-2.913*****	**-4.255*****	**-2.046****	**-3.452*****	**-1.604***	**-4.633*****	-0.170	1.090	**-4.197*****	**-5.140*****
Panel ADF-Stats	-1.090	**-3.932*****	-0.774	**-3.225*****	**-3.199*****	**-5.253*****	**-2.379*****	**-3.530*****	**-1.318***	**-3.517*****	-0.367	-0.563	**-4.730*****	**-6.970*****
Group rho-Stats	0.711	0.093	0.699	-0.023	-0.406	0.269	0.205	0.168	-0.208	-0.610	1.376	2.743	-0.418	-0.027
Group PP-Stats	**-1.586***	**-4.151*****	**-1.724****	**-3.573*****	**-3.024*****	**-3.510*****	**-2.193****	**-3.336*****	**-2.004****	**-4.254*****	0.210	2.126	**-4.607*****	**-5.146*****
Group ADF-Stats	-1.403	**-3.891*****	**-1.382***	**-3.396*****	**-2.970*****	**-3.665*****	**-2.312****	**-2.786*****	**-1.708****	**-3.113*****	**-1.409***	-0.580	**-3.711*****	**-4.306*****

Cointegration between Monetary Policy and Real GDP Output

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	-0.788	3.893	-0.544	**3.859*****	-0.497	**2.918*****	-0.844	**2.085****	-0.495	**2.538*****	-0.349	**2.178****	0.643	1.818
Panel rho-Stats	2.296	0.847	1.940	0.768	1.824	0.763	2.035	1.091	1.644	1.140	2.059	1.007	-0.522	0.411
Panel PP-Stats	3.194	0.641	2.651	0.481	2.485	-0.063	2.800	0.412	2.076	0.555	2.943	0.418	-0.642	-0.723
Panel ADF-Stats	3.348	-1.056	2.575	-1.005	3.100	-0.923	3.227	**-1.411***	1.735	-0.589	2.873	-0.624	-0.610	**-1.575***
Group rho-Stats	2.929	1.714	2.711	1.463	2.553	1.821	2.979	2.191	2.554	2.289	2.931	2.198	0.626	1.347
Group PP-Stats	4.218	0.807	3.769	0.248	3.610	-0.228	4.285	1.103	2.988	1.597	4.054	1.397	-0.418	-0.166
Group ADF-Stats	3.555	-0.820	2.496	-1.205	4.145	**-1.736****	3.815	-0.877	2.175	0.006	3.488	-0.036	-1.129	-1.187

Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Fin: Financial. PP: Phillips-Peron. ADF: Augmented Dickey Fuller. na: not applicable because one variable in the pair is stationary in levels.

Table 3: Bivariate Westerlund panel cointegration tests

Panel A: 1987-2010

Cointegration between Monetary Policy and Inflation

	Financial Depth (Money) & Inflation				Financial Allocation Efficiency & Inflation				Financial Activity (Credit) & Inflation				Fin. Size & Inflation	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Gt (Z-value)	4.079	2.848	4.703	3.463	0.011	**-3.203*** **	na	na	2.777	2.422	2.035	1.701	3.476	2.509
Ga (Z-value)	2.491	2.952	2.860	3.189	1.492	**0.005** **	na	na	3.246	3.952	2.811	3.469	2.714	1.983
Pt (Z-value)	2.602	1.709	3.194	2.586	-0.642	**-3.828*** **	na	na	**-1.683***	-0.643	**-2.793** **	-0.941	3.237	3.090
Pa (Z-value)	1.594	1.079	2.031	1.421	-0.398	**-1.760** **	na	na	-0.741	0.927	**-1.442***	0.820	1.991	2.197
BP CD Test (Chi²)	**272.455*** **		**321.310*** **		**205.605*** **		**200.705*** **		**259.741*** **		**250.188*** **		**283.760*** **	

Cointegration between Monetary Policy and Real GDP Output

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Gt (Z-value)	1.835	2.983	2.582	3.988	0.075	2.412	na	na	1.579	6.313	0.789	5.377	-0.064	2.436
Ga (Z-value)	1.748	2.861	1.631	3.166	0.632	3.148	na	na	0.780	4.064	**0.188** **	3.736	**-0.011***	2.739
Pt (Z-value)	**-3.362** **	0.802	**-3.595** **	1.061	0.474	3.200	na	na	**-3.565** **	2.554	**-3.221*** **	2.314	0.614	3.377
Pa (Z-value)	**-1.902***	1.112	**-3.151** **	0.864	0.469	2.668	na	na	**-4.279** **	1.056	**-4.152*** **	1.107	-1.258	2.160
BP CD Test (Chi²)	**203.372*** **		**210.310*** **		**205.128*** **		**181.099*** **		**160.262*** **		**174.266*** **		**164.590*** **	

Panel B: 1987-2006

Cointegration between Monetary Policy and Inflation

	Financial Depth (Money) & Inflation				Financial Allocation Efficiency & Inflation				Financial Activity (Credit) & Inflation				Fin. Size & Inflation	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Gt (Z-value)	1.352	0.583	1.339	0.358	**-2.007** **	**-1.555***	**-5.494*** **	**-3.859*** **	**-3.909*** **	**-2.032** **	**-4.418*** **	**-2.355***	2.276	0.236
Ga (Z-value)	2.053	2.772	2.051	2.539	1.081	2.287	**0.487***	2.076	0.959	3.023	0.744	3.131	2.659	3.182
Pt (Z-value)	-0.077	-0.002	-0.276	-0.324	**-3.930** **	**-3.145***	**-6.317*** **	**-5.269** **	**-4.560** **	0.083	**-3.668** **	-0.003	2.761	4.953
Pa (Z-value)	-0.671	0.889	-0.485	0.771	-0.671	1.476	**-1.530** **	1.106	**-1.503***	1.587	**-1.494** **	1.535	1.550	2.988
BP CD Test (Chi²)	**220.303*** **		**251.117*** **		**170.652*** **		**174.723*** **		**184.055*** **		**206.727*** **		**192.462*** **	

Cointegration between Monetary Policy and Real GDP Output

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking System		Financial System			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Gt (Z-value)	3.098	1.147	3.554	1.222	**-2.284** **	0.047	**-4.796*** **	**-2.329** **	**-1.410***	3.186	**-2.348** **	2.385	**-1.984** **	-0.266
Ga (Z-value)	3.365	3.290	3.263	3.293	**0.248***	2.484	**0.515***	2.164	1.613	4.196	0.996	3.869	**0.978***	3.009
Pt (Z-value)	-0.728	1.338	-0.880	1.962	-1.549	-0.467	**-4.850** **	-2.179	**-2.966***	0.694	-1.164	1.324	**-1.910***	1.898
Pa (Z-value)	0.569	2.090	0.387	2.254	-0.282	1.530	-0.651	1.194	0.031	2.159	-0.656	1.825	-0.616	1.900
BP CD Test (Chi²)	**222.781*** **		**242.643*** **		**182.564*** **		**176.632*** **		**205.288*** **		**231.835*** **		**131.766*** **	

Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Fin: Financial. The lag and lead lengths are set to one. Choosing too many lags and leads can result in a deterioration of the small-sample properties of the test. To control for cross-sectional dependence, robust critical values is obtained through 300 bootstrap replications. BP CD Test: Breusch-Pagan LM test of independence.

Tables 2-3 above present the Pedroni and Westerlund cointegration results respectively. Panel A (B) in both tables presents findings for the period 1987-2010 (1987-2006). In Table 2, based on the information criterion of 'constant and trend', there is absence of cointegration between money supply (financial system activity) and inflation in Panel A (B). There is overwhelming (scanty) evidence of long-run equilibriums between monetary policy variables and inflation (output). These findings are broadly consistent with the predictions of economic theory which indicates that monetary policy has no incidence in real output in the long-run, but affects prices in the distant future. Put in other words, the absence of a long-run relationship between monetary policy variables and output shows the long-term neutrality of money. It follows that, permanent changes in financial intermediary dynamics (exogenous to monetary policy) do not affect permanent changes in real GDP output in the long-run. Hence, the need to assess short-run effects by simple Granger causality (Section 4.4). Conversely, permanent movements in monetary policy variables influence prices in the long-tem. Hence, the need to examine the short-term adjustments to the corresponding equilibriums with the VECM (Section 4.3).

The inferences above fail to consider the presence of common factors that affect monetary policy across countries. Table 3 presents bivariate Westerlund cointegration tests that control for cross-sectional dependence[14]. Based on the information criterion of 'constant and trend', while the long-run neutrality of money is still broadly confirmed, evidence of cointegration between monetary variables and inflation is scanty.

Modeling with the VECM and simple Granger causality (unrestricted VAR) will be based on the hypotheses of cross-sectional dependence and independence in cointegration for the following reasons. Firstly, it eases comparison of the present study with prior 2007 Pedroni-based literature. Accordingly, studies before the emergence of the Westerlund (2007)

[14] The Breusch-Pagan (BP) LM test of cross-sectional independence is overwhelming rejected. The BP LM test is chosen because T>N (24>10 for the 1987-2010 period and 20>10 for the 1987-2006 period).

test still constitute useful scientific activity. Secondly, both assumptions are necessary to fully examine the postulated hypotheses under investigation. Thirdly, new comparative insights into monetary policy independence and dependence could emerge. For instance, if no significant differences in results emerge it could be established that monetary policy dependence does not really matter. Fourthly, as an intuition for independence, African monetary union countries (with the likelihood of common monetary policies) have not been considered in the dataset. Fifthly, the assumption of independence matters only for the money-inflation nexus and not for the money-output linkage because Westerlund (2007) is consistent with Pedroni (1999) on the long-run neutrality of money. Hence, one of the underlying hypotheses motivating the study remains sound. Sixthly, the label of 'empirics' on the paper's title means we can make the assumption without being afraid of 'econometrics polices'.

4.3 Vector Error Correction Model (VECM) for Monetary Policy and Inflation

Let us consider inflation and money with no lagged differences, such that:

$$Inflation_{i,t} = \beta Money_{i,t} \qquad (1)$$

The resulting VECMs are the following for Eq. (1):

$$\Delta Inflation_{i,t} = \partial(Inflation_{i,t-1} - \beta Money_{i,t-1}) + \varepsilon_{i,t} \qquad (2)$$

$$\Delta Money_{i,t} = \sigma(Money_{i,t-1} - kInflation_{i,t-1}) + e_{i,t} \qquad (3)$$

In Eqs. (2) and (3), the right hand terms are the Error Correction Terms (ECTs). At equilibrium, the value of the ECT is zero. When the ETC is non-zero, it means that inflation and money have deviated from the long-run equilibrium; and the ECT helps each variable to adjust and partially restore the equilibrium relationship. The speeds of these adjustments are measured by ∂ and σ for inflation and money respectively. Therefore, Eqs. (2) and (3) are replicated for all the 'finance and inflation' pairs. The same deterministic trend assumptions employed in the cointegration tests are used.

Table 4: Vector Error Correction Model (Cointegration and short-term adjustment coefficients)

Panel A: 1987-2010

Estimates of cointegration relationships

Financial Depth (Money)	Money Supply	na	---	---	---	---	---	---
	Liquid Liabilities	---	2.854 (0.126)	---	---	---	---	---
Financial Allocation Efficiency	Banking System	---	---	4.259 (0.245)°	---	---	---	---
	Financial System	---	---	---	na	---	---	---
Financial Activity (Credit)	Banking System	---	---	---	---	13.750 (0.500)	---	---
	Financial System	---	---	---	---	---	15.716 (0.627)	---
Financial Size	Banking System	---	---	---	---	---	---	**29.542** (2.169)**

Estimates of short term adjustment coefficients

	D[Inflation]	na	**-0.204*** (-5.182)**	**-0.190*** (-5.044)**°	na	**-0.200*** (-5.136)**	**-0.202*** (-5.139)**	**-0.253*** (-5.469)**
Financial Depth (Money)	D[Money Supply]	na	**---**	**---**	**---**	---	---	---
	D[Liquid Liabilities]	---	**-0.0001** (-2.552)**	---	---	**---**	**---**	---
Financial Allocation Efficiency	D[Banking System]	---	---	-0.0003 (-1.054)°	---	---	---	---
	D[Financial System]	---	---	---	na	---	---	---
Financial Activity (Credit)	D[Banking System]	---	---	---	---	-0.0000887 (-1.292)	---	---
	D[Financial System]	---	---	---	---	---	-0.0000960 (-1.342)	---
Financial Size	D[Banking System]	---	---	---	---	---	---	**-0.0004** (-2.095)**

Panel A: 1987-2006

Estimates of cointegration relationships

Financial Depth (Money)	Money Supply	9.365 (0.404)	---	---	---	---	---	---
	Liquid Liabilities	---	10.445 (0.370)	---	---	---	---	---
Financial Allocation Efficiency	Banking System	---	---	8.639 (0.398)°	---	---	---	---
	Financial System	---	---	---	7.892 (0.398)°	---	---	---
Financial Activity (Credit)	Banking System	---	---	---	---	21.662 (0.618)	---	---
	Financial System	---	---	---	---	---	na	---
Financial Size	Banking System	---	---	---	---	---	---	**58.027*** (4.742)**

Estimates of short term adjustment coefficients

	D[Inflation]	**-0.203*** (-4.448)**	**-0.207*** (-4.552)**	**-0.189*** (-4.396)**°	**-0.190*** (-4.403)**°	**-0.202*** (-4.509)**	na	**-0.286*** (-4.840)**
Financial Depth (Money)	D[Money Supply]	**-0.0002*** (-3.059)**	**---**	**---**	**---**	---	---	---
	D[Liquid Liabilities]	---	**-0.0001** (-2.455)**	---	---	**---**	**---**	---
Financial Allocation Efficiency	D[Banking System]	---	---	-0.0002 (-0.679)°	---	---	---	---
	D[Financial System]	---	---	---	-0.0001 (-0.582)°	---	---	---
Financial Activity (Credit)	D[Banking System]	---	---	---	---	-0.0000768 (-1.225)	---	---
	D[Financial System]	---	---	---	---	---	na	---
Financial Size	D[Banking System]	---	---	---	---	---	---	**-0.0007*** (-3.522)**

Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. The deterministic trend assumptions and lag selection criteria for the VECM are the same as in the cointegration tests. ( ): t- statistics. D[ ]: First difference. °: values also apply for the monetary policy dependence hypothesis. na: absence of cointegration or stationary in levels.

Table 4 above shows results for the VECM. While the findings in the upper-sections of both panels are consistent with Eq. (1), those in the lower-sections correspond to Eqs (2) and (3). Specifically, the first line in the lower-sections (D[Inflation]) corresponds to Eq. (2) whereas, the estimates shaping the diagonal are consistent with Eq. (3). The signs of the cointegration relations in the upper-sections of the panels are in accordance with the predictions of economic theory. This confirms the existing consensus that in the long-run, money has a positive relationship with inflation. Among the long-run relationships of monetary policy variables, that of financial size is the most significant. In other words, the ratio of bank assets in proportion of total assets (Deposit bank assets plus Central bank assets) has the most significant positive relationship with inflation in the long-run.

The lower-sections of the panels of Table 4 show feedbacks coefficients for the cointegrating vectors or the short-run adjustments of inflation and the monetary policy variables. Some adjustments are significantly different from zero, implying that these monetary policy variables are not weakly exogenous with regard to the parameters of the cointegration relationships in the upper-sections. In case of any deviation from the long-run equilibriums, these variables respond and adjust the system back to the equilibrium relationships. Only the monetary policy variables of financial depth and financial size are particularly significant in adjusting inflation to the equilibrium. Monetary policy fundamentals of credit and ability of banks to transform money into credit are not significant in adjusting inflation to the equilibrium. Therefore, in event of disequilibriums in the long-run, short-term adjustments in the ability of banks to transform money into credit do not matter in significantly correcting inflation. A possible and logical explanation for this outcome is the substantially documented surplus liquidity issues in African financial institutions (Saxegaard, 2006; Fouda, 2009). This is robustly confirmed by the insignificance of the credit adjusting estimates of financial activity. Hence, allocation inefficiency and

correspondingly, limited financial activity (credit) partially explain these insignificant contributions of credit and allocation efficiency in error correction. The ECTs have the expected signs and are in the right interval for a stable error correction mechanism (See the last point on robustness checks in Section 4.6 for discussion). It should be noted that the discussion above is both relevant for the hypotheses of independence and dependence in monetary policy. The degree sign (°) in Table 4 has been used to emphasize values that represent both.

Consistent with the Engle-Granger theorem, we examine short-run effects of the nexuses under investigation if the pairs are either not cointegrated or a variable is stationary in levels.

4. 4 Granger Causality for Monetary Policy and Economic Activity

Let us consider the following basic bivariate finite-order VAR models:

$$Inflation_{i,t} = \sum_{j=1}^{p} \lambda_{ij} Inflation_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} Money_{i,t-j} + \mu_i + \varepsilon_{i,t} \qquad (4)$$

$$Output_{i,t} = \sum_{j=1}^{p} h_{ij} Output_{i,t-j} + \sum_{j=0}^{q} k_{ij} Money_{i,t-j} + v_i + e_{i,t} \qquad (5)$$

Simple Granger causality is based on the assessment of how past values of a monetary policy variable could help past values of inflation in explaining the present value of inflation (Eq. 4). In the same line of thought, it also implies investigating how past values of monetary policy variables are significant in helping the past values of output to explain the present value of output (Eq. 5). In mainstream literature, this model is applied on variables that are stationary.

In light of the above, the resulting VAR models in first difference (for pairs that have failed the cointegration test) are the following:

$$\Delta Inflation_{i,t} = \sum_{j=1}^{p} \lambda_{ij} \Delta Inflation_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta Money_{i,t-j} + \mu_i + \varepsilon_{i,t} \qquad (6)$$

$$\Delta Output_{i,t} = \sum_{j=1}^{p} h_{ij}\Delta Output_{i,t-j} + \sum_{j=0}^{q} k_{ij}\Delta Money_{i,t-j} + v_i + e_{i,t} \qquad (7)$$

The null hypothesis of Eq. (4) is the position that, *Money* does not Granger causes *Inflation*. Therefore, a rejection of the null hypothesis is captured by the significant F-statistics; which is the Wald statistics for the joint hypothesis that estimated parameters of lagged values equal zero. Optimal lag selection for goodness of fit is in accordance with the AIC (Liew, 2004).

Table 5: Short-run Simple Granger causality analysis

	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
Panel A: Hypothesis of Monetary Policy Independence							
Panel A1: 1987-2010							
Monetary policy does not cause Real GDP Output							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	nc(sfd)	0.231	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	1.741	1.812	0.0198	nc(sl)	0.671	0.511	1.463
Monetary policy does not cause Inflation							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	na	na	1.468	na	na	na
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	0.455	na	na	nc(sl)	na	na	na
Panel A2: 1987-2006							
Monetary policy does not cause Real GDP Output							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	**2.513***	**2.695***	0.028	0.005	1.700	1.224	**2.647***
Monetary policy does not cause Inflation							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	na	na	na	na	na	nc(sfd)	na
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	na	na	na	na	na	0.439	na
Panel B: Hypothesis of Monetary Policy Dependence							
Panel B1: 1987-2010							
Monetary policy does not cause Real GDP Output							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	nc(sfd)	0.231	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	1.741	1.812	0.019	nc (sl)	0.671	0.511	1.463
Monetary policy does not cause Inflation							
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	na	1.468	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	0.455	1.153	na	nc(sl)	0.393	0.403	0.118
Panel B2: 1987-2006							
Monetary policy does not cause Real GDP Output							

	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	**2.513***	**2.695***	0.028	0.005	1.700	1.224	**2.647***
	Monetary policy does not cause Inflation						
	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	nc(sfd)	nc(sfd)	na	na	nc(sfd)	nc(sfd)	nc(sfd)
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	0.387	0.420	na	na	0.424	0.439	0.260

Null Hypotheses of Panel A1: Monetary Policy does not Granger cause real GDP output and Monetary Policy does not Granger cause inflation. M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposit (Banking System Intermediary Efficiency). FcFd: Financial credit on Financial deposits (Financial System Intermediary). Pcrb: Private domestic credit from deposit banks (Banking System Intermediary Activity). Pcrbof: Private domestic credit from deposit banks and other financial institutions (Financial System Intermediary Activity). Dbacba: Deposit bank asset on Total assets (Banking System Size). Fin: Financial. Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. na: not applicable because of cointegration. nc(sl): no cointegration and stationary in levels. nc(sfd): no cointegration and stationary in first difference.

Table 5 above presents the Granger causality results. Within the framework of this study, we are applying the model only to pairs that have failed the cointegration test (na). Accordingly, the 'not cointegrated' (nc) pairs may either be stationary in levels (sl): nc(sl) or in first difference(sfd): nc(sfd). While Panel A shows results based on the hypothesis of monetary policy independence, Panel B depicts findings grounded on the hypothesis of monetary policy dependence. From horizontal and vertical comparative standpoints, two main findings can be established. Firstly, for both samples and either hypothesis, monetary policy does not affect prices in the short-run. Secondly, consistent across hypothetical specifications for the period 1987-2006, financial depth and financial size affect real output in the short-run. The overwhelming absence of significant causalities flowing from monetary policy to inflation in the short-term is consistent with economic theory and in line with expectations. The simple fact that monetary policy dynamics (of depth and size) granger cause real GDP output is not enough to draw any economic inferences. Hence, impulse-response functions (IRFs) of the nexuses will provide additional material on the scale and timing of output responses to monetary policy innovations.

4.5 Impulse responses

Using Choleski decomposition on a VAR with ordering: 1) output, 2) a monetary policy variable; we compute IRFs for output and financial fundamentals of depth and size. Appendix 4 shows Figures 1-3 for the VAR ordering: output, monetary policy; while Appendix 5 shows Figures 4-6 for the VAR ordering: monetary policy, output. In the graphical representation of the IRFs, the dotted lines are the two standard deviation bands which are used to measure the significance (Agénor et al., 1997, p. 19). By virtue of the causality analysis, whereas we are more concerned with the first VAR ordering, the second VAR ordering has been presented simply for robustness purposes.

Based on the first VAR ordering, from intuition we expect a positive shock (expansionary policy) in monetary variables to positively affect real GDP output in the short-term and a negative shock (contractionary policy) to negatively affect real GDP output in the short-run. Accordingly, the innovations and responses in Figures 1-3 are consistent with our intuition and economic theory. Firstly, from Figure 1, a one standard deviation positive shock (innovation) in money supply sharply increases output in the first period before the effect steadily decreases during the next three years and finally disappears in the fourth year. Secondly, the dynamic responses of Figure 2 broadly confirm those of Figure 1. A one standard deviation innovation in liquid liabilities increases real GDP output sharply during the first period, the effect levels-up during the second year before steadily decreasing during the next three years and disappearing in the fifth year. Thirdly, from Figure 3, a positive shock in financial size sharply increases output over the next two years, after which the effect also sharply drops for a year before falling steadily during the next two years and disappearing in the fifth year.

From the second VAR ordering in Appendix 5, the positive nexuses among the innovations of output in money supply (Figure 4), financial deposits (Figure 5) and financial size (Figure 6) are consistent with the predications of economic theory. Accordingly, a one

standard deviation positive innovation (shock) in output increases financial dynamic fundamentals of depth (size) during the first (first-two) year(s). The effects disappear in the third year, fourth year and fifth year for money supply (Figure 4), liquid liabilities (Figure 5) and financial size (Figure 6) respectively.

4.6 Robustness checks

In order to ensure that our results and estimations are robust, we have performed and checked the following. (1) For almost every monetary policy variable (money, efficiency or credit) two indicators have been employed. Thus, the findings have encapsulated measures of monetary policy dynamics both from banking and financial system perspectives. (2) By using bivariate analysis in cointegration tests and correspondingly in VECM estimations, we have focused on the problem statements and limited (mitigated) causality misspecification issues. (3) Optimal lag selection for goodness of fit in model specifications has been consistent with the recommendations of Liew (2004)[15]. (4) Simple Granger causality has been carefully calibrated to be consistent with the Engle-Granger theorem. (5) In the error correction analysis, the ability of financial allocation efficiency to insignificantly contribute in restoring inflation to its long-run equilibrium is consistent with the estimates of financial activity[16]. (6) The signs and intervals of the ECTs conform to theory. It is worthwhile laying emphasis on this seventh point. As a matter of principle, the speed of adjustment should be between zero and 'minus one' (0, -1) for a stable error correction mechanism. Therefore, if the ECTs are not

[15] "*The major findings in the current simulation study are previewed as follows. First, these criteria managed to pick up the correct lag length at least half of the time in small sample. Second, this performance increases substantially as sample size grows. Third, with relatively large sample (120 or more observations), HQC is found to outdo the rest in correctly identifying the true lag length. In contrast, AIC and FPE should be a better choice for smaller sample. Fourth, AIC and FPE are found to produce the least probability of under estimation among all criteria under study. Finally, the problem of over estimation, however, is negligible in all cases. The findings in this simulation study, besides providing formal groundwork supportive of the popular choice of AIC in previous empirical researches, may as well serve as useful guiding principles for future economic researches in the determination of autoregressive lag length"* (Liew, 2004, p. 2).

[16] As we have observed, if allocation inefficiency is a substantial cause for the insignificant contribution of the monetary policy variable of financial efficiency in adjusting inflation to its long run equilibrium, then correspondingly, financial activity (credit) which indirectly reflects bank efficiency (ability of banks to transform deposits into credit) should also be insignificant in adjusting inflation to its long-run equilibrium relationship. This hypothesis is consistent with our findings.

within this interval, then either the model is misspecified (and needs adjustment), the data is inadequate (perhaps owing to issues with degrees of freedom)[17] or ultimately the error correction mechanism is unstable.

4.7 Discussion and policy implications

4.7.1 Retrospect to tested hypotheses

Hypothesis 1: Monetary policy variables affect prices in the long-run but not in the short-run.

For the first-half (long-run dimension) of the hypothesis, permanent changes in monetary policy variables (depth, efficiency, activity and size) affect permanent variations in prices in the long-term. But in cases of disequilibriums only financial dynamic fundamentals of depth and size significantly adjust inflation to the cointegration relations. With respect to the second-half (short-run view) of the hypothesis, monetary policy does not overwhelmingly affect prices in the short-term. Hence, but for a thin exception *Hypothesis 1* is valid.

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-term.

With regard to the short-term dimension of the hypothesis, only financial dynamics of depth and size affect real GDP output in the short-run. As concerns the long-run dimension, the neutrality of monetary policy has been confirmed. Hence, the hypothesis is also broadly valid.

Accordingly, had we used only the 1987-2006 sample period and restricted monetary policy variables to fundamental financial dynamics of depth and size, both hypotheses would have been overwhelmingly valid.

[17] "*The error correction term tells us the speed with which our model returns to equilibrium following an exogenous shock. It should be negatively signed, indicating a move back towards equilibrium, a positive sign indicates movement away from equilibrium. The coefficient should lie between 0 and 1, 0 suggesting no adjustment one time period later, 1 indicates full adjustment. The error correction term can be either the difference between the dependent and explanatory variable (lagged once) or the error term (lagged once), they are in effect the same thing*" (Babazadeh & Farrokhnejad, 2012, p.73).

4.7.2 Implications for the long-run neutrality of money and business cycles

Economic theory has traditionally suggested that monetary policy can influence the business cycle, but not the long-run potential output. Despite theoretical and empirical consensus on money neutrality well documented in the literature, the role of money as an informational variable for money policy decisions has remained opened to debate with empirical works providing mixed outcomes. By using hitherto unemployed monetary policy variables, results offer only partial support for the traditional economic theory. While evidence of the long-run neutrality of money has been confirmed, the influence of monetary policy in short-run economic activity is apparent only with respect to monetary policy fundamentals of depth and size, with a greater effect from the latter (see discussion on IRFs). It follows that contractionary and expansionary policies based on financial size would be more effective than those based on financial depth. Overall, this finding is not consistent with studies on two middle-income countries by Agenor et al. (2000), which establish no evidence of Granger-causality flowing from money to output, regardless of the measurement of money used.

The inability of monetary policy fundamentals of efficiency and activity to affect output in the short-run indicates that they cannot be used as policy instruments to influence business cycles (through expansionary and contractionary policies). Surplus liquidity issues (financial allocation inefficiency) and limited credit facilities (financial inactivity) could explain this side of the findings.

4.7.3 Implications for credit expansions and inflationary tendencies

There is a general consensus among analysts that significant money stock expansions that are not coupled with sustained credit increases are less likely to have any inflationary tendencies. This is at least true in the long-run because monetary policy variables theoretically have no incidence on prices in the short-term. This paper has reframed the consensus into an

important question policy makers are most likely to ask today. In the long-run, do short-term adjustments in monetary policy variables matter in the restoration of the long-run inflation-money equilibrium? The findings have three mains implications on this account: (1) there are significant long-run equilibriums between inflation and monetary policy variables; (2) the error correction mechanism is stable such that, in event of a disequilibrium, for all monetary policy variables under consideration, inflation is adjusted to the long-run relationship and; (3) only adjustments in the monetary policy fundamentals of financial size and financial depth are significant in the restoration of inflation to its equilibrium. This broadly implies that financial depths and size (if well calibrated) could be used for inflation targeting by the monetary authorities.

4.7.4 Implications for inflation targeting

Three main policy implications could be derived with respect to inflation targeting. Firstly, we have seen that financial depth is a significant tool in fighting inflation with the effect of money supply doubling that of liquid liabilities. This difference in magnitude is broadly consistent with the fundamentals of financial development in African countries. It has been substantially documented that, a great chunk of the monetary base does not transit through the banking sector (Asongu, 2012c). Hence, it is only normal to expect that adjustments in bank deposits (liquid liabilities) are less significant in magnitude in the restoration of inflation to its long-term equilibrium. Corollary to this explanation is the growing phenomenon of mobile banking and other informal financial activities that contribute to inflation but are not captured by formal (mainstream) financial (banking) activities (Asongu, 2013d). Secondly, we have also noticed that the monetary policy variable of financial size (in terms of magnitude) more significantly adjusts inflation than financial intermediary depth (from money supply and liquid liabilities perspectives). In plainer terms, decreasing financial intermediary assets (in relation to total assets in the financial system)

more substantially exerts deflationary pressures on consumer prices. It could thus be inferred that, tight monetary policy targeting the ability of banks to grant credit (in relation to central bank credits) is more effective[18] in fighting consumer price inflation than that targeting the ability of banks to receive deposits (financial depth). Thirdly, we have also seen that monetary policy variables of financial depth and financial size are more significant adjusters of inflation than financial efficiency and activity. The inherent surplus liquidity issues in African banks still explain this insignificance in adjustments (Saxegaard, 2006).

4.7.5 Implications for the ongoing monetary policy debate

The monetary policy effects (long-run and short-term) on economic activity (output and prices) are broadly consistent with traditional discretionary monetary policy arrangements that favor commitment to price stability and international economic integration (such as inflation targeting, monetary unions…etc). Hence; on the one hand, a flexible countercyclical monetary policy (with financial fundamentals of depth and size) can be practiced with inflation targeting (Ghironi & Rebucci, 2000; Mishkin, 2002) and; on the other hand, contractionary and expansionary monetary policies based on financial depth and size can be used to offset output in the short term (Starr, 2005).

Conversely, the absence of short-run effects from some monetary policy fundamentals on output is in line with the second strand of the debate which sustains that non-traditional policy regimes limit the ability of monetary authorities to use policy to offset output fluctuations. The inability of monetary policy authorities to use financial fundamentals of efficiency and activity to affect short-run real GDP is consistent with Week (2010) who views this IMF oriented approach as absurdly inappropriate because a vast majority of governments

[18] Effectiveness here refers to the rate at which inflation is adjusted to its long-run equilibrium.

in SSA countries lack the instruments to make monetary policy effective[19]. From our findings, the monetary authorities can only use policy instruments of depth and size to offset adverse shocks to output by pursuing either an expansionary or a contractionary policy. In the same vein, we have also discovered that financial fundamentals of efficiency and activity do not significantly adjust inflation to the long-run equilibrium (see Table 4).

4.7.6 Implications for monetary policy independence

Beside the underlying hypotheses motivating the inquiry, the empirics have given birth to another hypothesis of monetary policy independence. While the intuition of and justification for the hypothesis have already been substantially covered in Section 4.2, it is relevant to take stock of how the assumption of monetary policy independence has influenced the results. Two points clearly stand out. Firstly, the assumption has not affected the relevance of *Hypothesis 2* for two main reasons: on the one hand, the Westerlund (2007) and Pedroni (1999) tests are consistent on the long-run neutrality of money; on the other hand, short-run Granger estimates are not affected (see Panel A2 and Panel B2 in Table 5). Secondly, if the hypothesis of independence in monetary policy is relaxed, two facts emerge: on one hand, only financial efficiency has a long-term equilibrium with inflation and; on the other hand, in case of disequilibrium, adjustments in the fundamental dynamics of allocation efficiency do not significantly adjust inflation to the cointegration relationship. Ultimately, the issue of surplus liquidity still emerges even without the hypothesis of monetary policy independence.

4.7.7 Country/regional-specific implications

We now devote space to discussing specific implications for some of the sampled countries. The surplus liquidity issues may be due to the weight of political instability in

[19] The International Monetary Fund (IMF) places great emphasis on monetary policy in its programs for developing countries in sub-Saharan Africa (SSA). It views such policy as crucial in managing inflation and stabilizing the real exchange rate.

some of the sampled countries. Fielding & Shortland (2005) have established a positive nexus between violent political incidents (arising from conflicts between radical Islamic groups and the Egyptian state) and excess liquidity. While categorizing 'conflict-affected' countries present analytical and practical difficulties, essentially because few countries in the world are completely conflict-free, few would object the extension of the Fielding & Shortland interpretation to Nigeria and Sudan. Also, Uganda is still technically at war with the Lord Resistance Army (LRA) because its leader Kony (who refused to sign the 2007 peace agreement) is still at large. Beyond pointing out countries that have experienced conflicts during a significant interval of the sampled period, it is also relevant to emphasize that in the same vein, the protracted Arab Spring revolutions (Egyptian and Tunisian) and sectarian crisis in Nigeria would only fuel excess liquidity issues.

Like most countries in the sample, since 2002 the Bank of Algeria has conducted active policy aimed at solving the problem of excess liquidity. The plethora of measures implemented to curb the issue has led to some satisfactory results (IMF, 2013, p. 22). The internal impediments to financial intermediation are being exacerbated by Lesotho's small size and its proximity to South Africa. Accordingly, the excess liquidity management measures may not sustain the domestic economy in the long run. While potential customers are taking businesses to the much better and developed South African market, at the same time, instead of looking for business opportunities in Lesotho, the banks are investing excess liquidity in South African securities.

A recent short-run Schumpeterian trip to embryonic African monetary zones (Asongu, 2013c) has established a positive causality flowing only from financial efficiency to real GDP output for the East African Monetary Zone (EAMZ) and none for the West African Monetary Zone (WAMZ). Hence, these results indirectly confirm the need to implement structural and institutional convergence reforms by candidate members of the potential monetary unions (especially the WAMZ).

4.7.8 Fighting surplus liquidity

It is also relevant to devote space in discussing how to fight surplus liquidity in African banking institutions for two main reasons. Firstly, as we have seen above it is a common issue resulting from monetary policy independence and dependence scenarios. Secondly, the two hypotheses motivating the empirics would have been overwhelmingly validated only and only if we had used the 1987-2006 sample period and restricted monetary policy variables to fundamental financial dynamics of depth and size.

Measures aim at tackling over-liquidity will be efficient if they are consistent with the reasons for holding liquidity: voluntary or involuntary. Firstly, voluntary holding of excess liquidity could be mitigated by: easing difficulties encountered by banks in tracking their positions at the central bank that may require them to hold reserves above the statutory limits; reinforcement of institutions that would favor interbank lending so as to ease borrowing between banks for contingency purposes and; improve infrastructure so that remote bank branches may not need to hold excess reserves due to transportation problems. Secondly, involuntary holding of excess liquidity could also be avoided by: decreasing the inability of banks to lend, especially in situations where interest rates are regulated[20]; creating conditions to sustain the spread between bonds and reserves so that, commercial banks can invest excess liquidity in the bond markets; stifling the unwillingness of banks to expand lending by reducing asymmetric information and lack of competition and; developing regional stock exchange markets to broaden investment opportunities for commercial banks.

4.7.9 Caveats and future directions

The first draw-back to the analysis is the limited sample in the dataset. We have limited our sample to only 10 countries because of substantial reasons already discussed in the

[20] For instance this is the case of the CEMAC region where the central bank sets a floor for lending rates and a ceiling for deposit rates above and below which interest rates are negotiated freely.

data section. Hence, generalization of the results to the entire African continent should be treated with caution. Secondly, while the intuition motivating the empirics is sound and the employment of all fundamental financial dynamics identified by the Financial Development and Structure Database (FDSD) of the World Bank (WB) innovative, interest rates and exchange rates have not been directly taken into account. Thirdly, given the length of the sample period, there could have been structural breaks or regime shifts which have not been taken into account due to technical and logistical reasons. Fourthly, we have only considered financial intermediary determinants of output and inflation in the analysis. However, in the real world, economic activity in terms of output and inflation are endogenous to a complex set of variables: exchange rates, wages, price controls…etc. Therefore, the interaction of money, credit, efficiency and size elasticities of inflation and output with other determinants of economic activity could result in other dynamics of consumer price and output variations. Hence, replicating the analysis in a multivariate VAR context would be interesting. Another interesting future research direction could be to assess whether the findings apply to country-specific cases of the sample.

5. Conclusion

While in developed economies, changes in monetary policy affect real economic activity in the short-run but only prices in the long-run, the question of whether these tendencies apply to developing countries remains open to debate. In this paper, we have examined the real effects of monetary policy using a battery of estimation techniques in inflation-chaotic African countries for the period 1987-2010. By using a plethora of hitherto unemployed financial dynamics (that broadly reflect monetary policy), we have provided significant contributions to the empirics of money. Two main hypotheses have been tested.

Hypothesis 1: Monetary policy variables affect prices in the long-run but not in the short-run. For the first-half (long-run dimension) of the hypothesis, permanent changes in

monetary policy variables (depth, efficiency, activity and size) affect permanent variations in prices in the long-term. But in cases of disequilibriums only financial dynamic fundamentals of depth and size significantly adjust inflation to the cointegration relations. With respect to the second-half (short-run view) of the hypothesis, monetary policy does not overwhelmingly affect prices in the short-term. Hence, but for a thin exception *Hypothesis 1* is valid.

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-term. With regard to the short-term dimension of the hypothesis, only financial dynamics of depth and size affect real GDP output in the short-run. As concerns the long-run dimension, the neutrality of monetary policy has been confirmed. Hence, the hypothesis is also broadly valid.

Accordingly, had we used only the 1987-2006 sample period and restricted monetary policy variables to fundamental financial dynamics of depth and size, both hypotheses would have been overwhelmingly valid. Moreover, but for slight exceptions, the tested hypotheses are valid under monetary policy independence and dependence. The conclusion of the analysis is a valuable contribution to the scholarly and policy debate on how money matters as an instrument of economic growth. A wide range of policy implications have been discussed.

Appendices

Appendix 1: Summary Statistics and Presentation of Countries

Panel A : Summary Statistics

		Variables	Mean	S.D	Min.	Max.	Obser.
Monetary Policy Dynamics	Financial Depth	Money Supply	0.384	0.256	0.001	1.141	240
		Liquid Liabilities	0.310	0.218	0.001	0.948	240
	Financial Efficiency	Banking System Efficiency	0.642	0.346	0.139	2.103	240
		Financial System Efficiency	0.644	0.343	0.139	1.669	240
	Financial Activity	Banking System Activity	0.203	0.194	0.001	0.825	240
		Financial System Activity	0.213	0.207	0.001	0.796	240
	Fin. Size	Banking System Size	0.672	0.299	0.017	1.609	240
Output Variable		Real Gross Domestic Product	10.193	0.628	8.561	11.340	240
Price Variable		Consumer Price Index	19.714	31.862	-9.616	200.03	240

Panel B : Presentation of countries (10)

Algeria, Egypt, Lesotho, Morocco, Nigeria, Sudan, Tunisia, Uganda, Zambia, Tanzania

S.D: Standard Deviation. Min: Minimum. Max: Maximum. Obser : Observations. Fin: Financial.

Appendix 2: Variable Definitions

Variables	Signs	Variable Definitions	Sources
Inflation	Infl.	Consumer Price Index (Annual %)	World Bank (WDI)
Real Output	Output	Logarithm of Real GDP	World Bank (WDI)
Economic financial depth (Money Supply)	M2	Monetary Base plus demand, saving and time deposits (% of GDP)	World Bank (FDSD)
Financial system depth (Liquid liabilities)	Fdgdp	Financial system deposits (% of GDP)	World Bank (FDSD)
Banking system allocation efficiency	BcBd	Bank credit on Bank deposits	World Bank (FDSD)
Financial system allocation efficiency	FcFd	Financial system credit on Financial system deposits	World Bank (FDSD)
Banking system activity	Pcrb	Private credit by deposit banks (% of GDP)	World Bank (FDSD)
Financial system activity	Pcrbof	Private credit by deposit banks and other financial institutions (% of GDP)	World Bank (FDSD)
Banking System Size	Dbacba	Deposit bank assets/ Total assets (Deposit bank assets plus Central bank assets)	World Bank (FDSD)

Infl: Inflation. M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposits. FcFd: Financial system credit on Financial system deposits. Pcrb: Private domestic credit by deposit banks. Pcrbof: Private domestic credit by deposit banks and other financial institutions. WDI: World Development Indicators. FDSD: Financial Development and Structure Database. GDP: Gross Domestic Product.

Appendix 3: Correlation Analysis

Financial Depth		Fin. Efficiency		Financial Activity		Fin. Size	Inflation	GDP	
M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	Infl.	Output	
1.000	0.993	0.146	0.183	0.796	0.778	0.513	-0.332	0.501	M2
	1.000	0.157	0.189	0.801	0.782	0.538	-0.354	0.464	Fdgdp
		1.000	0.949	0.630	0.646	0.392	-0.173	0.284	BcBd
			1.000	0.668	0.708	0.371	-0.195	0.274	FcFd
				1.000	0.987	0.536	-0.321	0.422	Pcrb
					1.000	0.546	-0.339	0.412	Pcrbof
						1.000	-0.323	0.385	Dbacba
							1.000	-0.219	Inflation
								1.000	Output

M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposit (Banking System Intermediary Efficiency). FcFd: Financial credit on Financial deposits (Financial System Intermediary Efficiency). Pcrb: Private domestic credit by deposit banks (Banking System Intermediary Activity). Pcrbof: Private credit domestic credit from deposit banks and other financial institutions (Financial System Intermediary Activity). Dbacba: Deposit bank asset on Total assets (Banking system size). Infl: Inflation. Fin: Financial.

Appendix 4: IRFs with VAR ordering: economic activity; monetary policy

Figure 1: Dynamic responses of Output and Money Supply

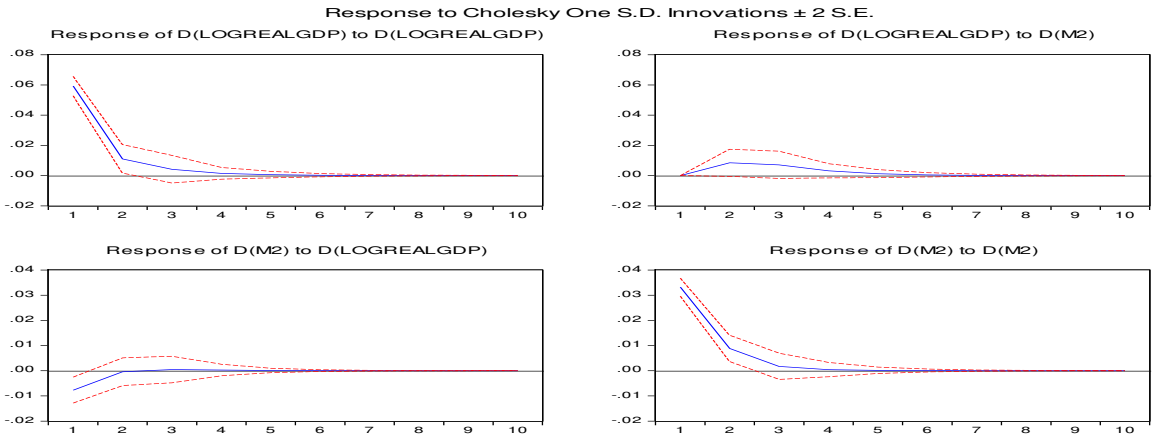


Figure 2: Dynamic responses of Output and liquid liabilities

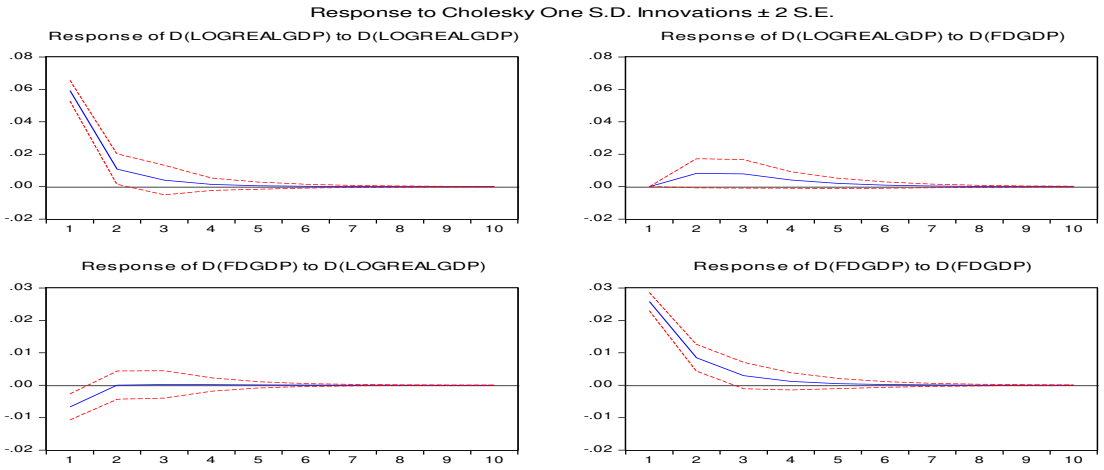
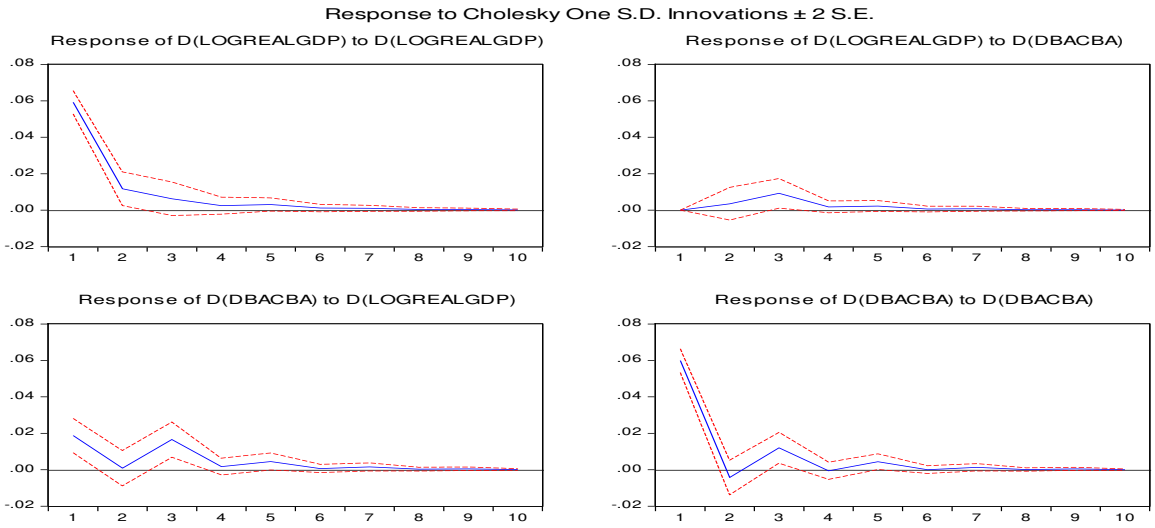


Figure 3: Dynamic responses of Output and financial size



Appendix 5: IRFs with VAR ordering: monetary policy; economic activity

Figure 4: Dynamic responses of Output and Money Supply

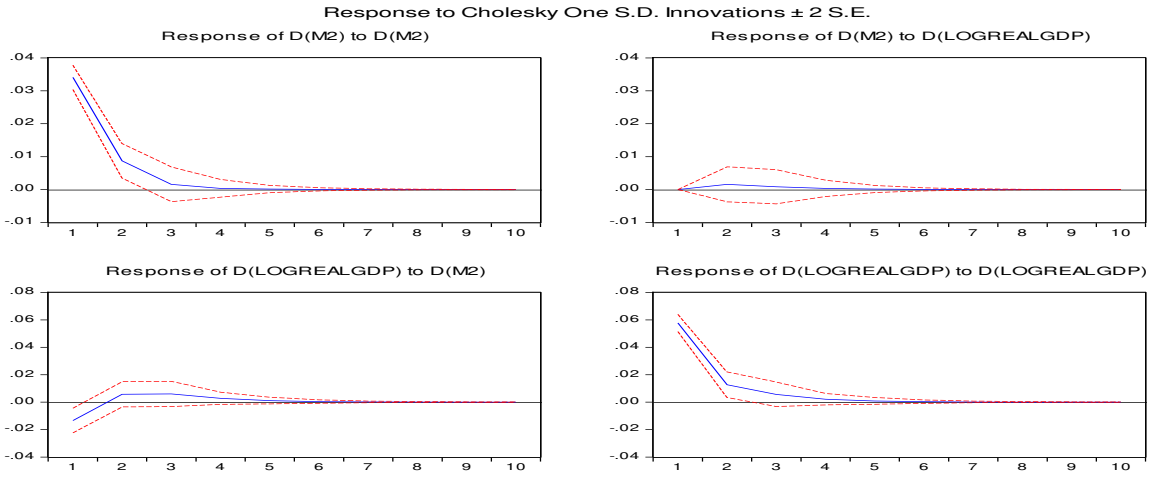


Figure 5: Dynamic responses of Output and liquid liabilities

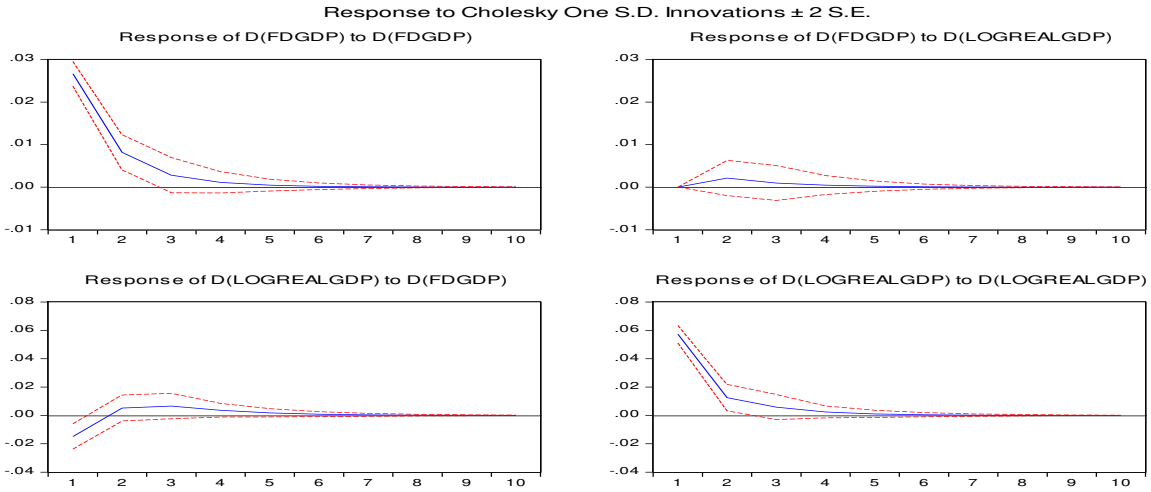
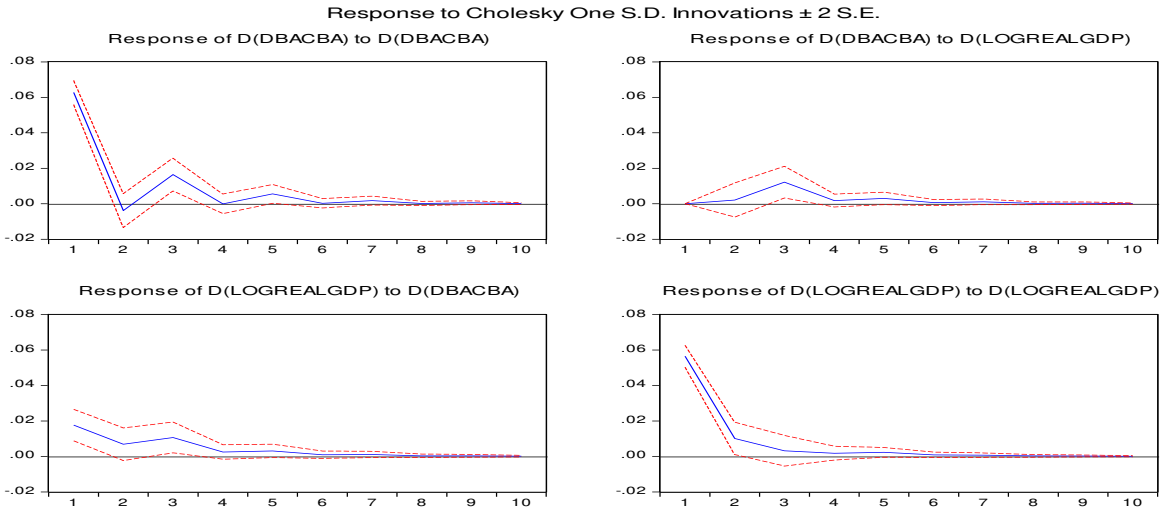


Figure 6: Dynamic responses of Output and financial size



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