Financial Development and Monetary Policy Effectiveness in Africa

Effiong, Ekpeno and Esu, Godwin and Chuku, Chuku

Department of Economics, University of Uyo, Nigeria

31 May 2017

Financial Development and Monetary Policy Effectiveness in Africa

Ekpeno Effiong*[1], Godwin Esu[1], and Chuku Chuku†[1,2]

[1]*Department of Economics, University of Uyo, Nigeria*

[2]*Department of Economics, University of Manchester, United Kingdom*

This Version: May, 2017

Abstract

As African countries await the birth of her monetary union, the link between economic policies and the real economy will continue to dominate policy debate. This paper investigates whether financial development influences the effectiveness of monetary policy on output and inflation in Africa. We apply standard panel data techniques to annual data from 1990–2015 for a panel of 39 African countries, and find a weak relationship between financial development and monetary policy effectiveness in Africa. The results show no statistical evidence of the relationship for output growth, whereas a negative relationship exist in the case of inflation, but only at their contemporaneous levels. Thus, there is need to strengthen the monetary transmission mechanism in African countries through deliberate efforts to deepen financial sector development.

Keywords: Financial development; Monetary policy; Africa.

JEL Classification: C33; E52; G21; O55

*Correspondence: Department of Economics, University of Uyo, P.M.B 1017, Uyo, Akwa Ibom, Nigeria. Email: ekpenoeffiong@uniuyo.edu.ng; ekpenol@gmail.com. Tel. +234 802 789 0160

†Email: chukuachuku@gmail.com

1 Introduction

As African countries await the birth of the African Monetary Union and the adoption of a single currency, this move no doubt raises numerous challenges, which among others include the potential economic adjustments, and more importantly, the relationship between economic policies and the real economy.[1] Primary among such issues is that monetary policy changes of the proposed African Central Bank will become even more difficult with possible asymmetric impact across countries. Therefore, a better appreciation of this issue requires deeper understanding of the fundamental determinants of monetary policy effectiveness on economic activity in the continent. In this paper, we focus on financial sector development as a plausible determinant, and thus examine whether the financial development exert considerable influence on the effectiveness of monetary policy an instrument for macroeconomic stabilization, especially on output and inflation in Africa.

Current views on the monetary transmission mechanism assign a crucial role to financial sector development - and the overall financial structure - in understanding the effectiveness of monetary policy actions on output and prices. Essentially, monetary policy transmission is a financial process with the financial system as the conduit through which monetary policy impulses affect the real economy. In fact, both the traditional money and credit channels of monetary policy transmission operate through the financial system. The credit channel, in particular, predicts a strong monetary transmission mechanism with higher financial frictions in the financial system, and thus an amplified effect of monetary policy on the real economy (see Bernanke and Gertler, 1995). Hence, the degree of financial sector development is considered important in explaining monetary policy effectiveness as the efficacy of monetary policy crucially depends on the structure and condition of the financial system (Carranza et al., 2010; Mishra et al., 2012; Ma and Lin, 2016).

Although, the relationship between financial development and monetary policy effectiveness is complex, the general consensus is that a well-functioning financial system is a prerequisite for an effective monetary policy transmission. However, differences in countries' financial structure can lead to substantial differences in the monetary transmission mechanism, and in turn possible asymmetric effects of monetary policy. For instance, increased financial innovation in an economy with a developed and competitive financial sector tend to reduce monetary policy effectiveness, since it provides an insurance mechanism for private agents against unanticipated monetary shocks and expenditure volatility. Whereas, it could be stronger for economies with a weak financial system but high firms' dependence on bank credit. With undercapitalized banks, credit expansion is significantly constrained, and

[1] See Masson and Pattillo (2005) for a discussion on the monetary geography in Africa.

monetary policy may become less effective or at best have a long time staggered effect on the real economy (Carranza et al., 2010). Thus, both positive and negative relationships can be rationalized for the nexus between financial development and monetary policy effectiveness.[2] So far, empirical analysis on the relationship is relatively nascent as only a limited number of studies have examined the question of whether financial development influences the effectiveness of monetary policy. Most of these studies are dominated by micro and macro analysis of the relationship for developed economies such as the Euro area and the United States, with few exceptions including some developing countries in their samples (see e.g. Carranza et al., 2010; Ma and Lin, 2016). Overall, empirical evidence on the relationship is mixed and inconclusive.

As earlier mentioned, this paper contributes to the existing literature by investigating the potential effects of financial development on monetary policy effectiveness vis-á-vis output growth and inflation in Africa. Although, there are several discussions on monetary policy in Africa as well as the role of the financial system (see e.g. Ncube, 2008; Kasekende and Brownbridge, 2011; Heintz and Ndikumana, 2011; Khan, 2011), empirical evidence on the relationship is considerably lacking. To the best of the authors' knowledge, only Saxegaard (2006) has examined the relationship within the context of Sub-Saharan Africa (SSA) and with particular focus on excess liquidity and its consequent effect on monetary policy effectiveness. Hence, there is need for further empirical analysis to shed more light on the effects of financial development on monetary policy in the African continent. Such analysis has wider implications for both monetary and financial stability in the region as African economies become increasingly interdependent through financial markets integration and the various initiatives for regional economic and financial cooperation. Consequently, annual data from 1990–2015 period for a panel of 39 African countries is used to estimate the relationship between financial development and the effects of monetary policy on output growth and inflation. The main results of the paper shows that there is a weak relationship between financial development and monetary policy effectiveness in Africa. Specifically, no statistical evidence of the relationship is observed for output growth, whereas a negative relationship exist in the case of inflation, but only at their contemporaneous levels.

The balance of this paper is organized as follows. Section 2 provides a background literature on the nexus between financial development and the effects of monetary policy. Section 3 develops the estimation strategy vis-á-vis the econometric model and data description. Section 4 conducts the empirical analysis and discusses the estimation results, and Section 5 concludes.

[2]A positive (negative) relationship would suggest an amplification (dampening) of the impact of financial development on the effects of monetary policy.

2 Background literature

Two perspectives exist on the interconnectedness between financial system and the monetary transmission mechanism.[3] These include the traditional money and credit views of monetary policy transmission. Both channels underscore the importance of the financial system in the transmission of monetary policy and thus share a common thread: monetary policy actions transmitted to the real economy influences first and foremost financial sector variables, and later aggregate demand behaviour. The traditional money view sees the financial system as being passive and a mere pass-through mechanism for monetary policy transmission. Here, changes in money supply (or outside money) influence the interest rates and aggregate demand through separate effects on investment demand and the exchange rate respectively. Monetary tightening, for example, increases the interest rates and lead to a decline in investment spending. Similarly, higher interest rate causes an appreciation of the domestic currency, and thus an expenditure-switching effect from foreign to domestically produced goods. For its functionality, this view rest on the conditions of limited price flexibility and absence of market imperfections.

On the other hand, the credit view assigns an active role to financial system because of the importance of credit markets to the monetary transmission mechanism. Building on the enlarged literature on the role of financial intermediaries and credit market frictions associated with information asymmetry problems of adverse selection and moral hazard in an economy, the credit view shows that financial frictions generate an external finance premium – the cost of external and internal finance – which helps explain the effect of monetary policy on the real economy. The credit view operates through two channels: the bank lending channel which traces the impact of monetary policy on the supply of bank loanable funds (i.e. intermediated credit),[4] and the balance sheet channel, which focuses on how such policy changes affect the borrower's financial position in terms of net worth, cash flow and debt collateral (see Bernanke and Gertler, 1995). Both the bank lending and balance sheet channels provide the theoretical linkage of how the supply and demand sides of the financial system are respectively influenced by changes in monetary policy. Overall, the strength of the credit view depends on the degree of financial frictions. Higher levels of financial frictions generate an amplified effect of monetary policy on the real economy through the larger impact on the external finance premium.

[3] See Bean et al. (2002), Peek and Rosengren (2013), and Beck et al. (2014) for a discussion and a survey of the literature.

[4] The mechanism operates through the effect of monetary policy on reverse holdings: a fall in reserves reduces the banks' ability to create credit. The assumption is that there are imperfect substitutes for bank loans. Hence, monetary policy changes will affect disproportionately bank-dependent firms, and therefore, a reduction in loan supply will lead to a decline in economic activity.

In all, the basic prediction of the monetary policy transmission models based on the financial system is that the efficacy of monetary policy depends on the degree of financial sector development. In other words, monetary policy effectiveness will be stronger in countries with less developed financial system, and where firms are bank-dependent for credit funding such that limited access to credit market by firms and non-reservable deposits by banks does not obviate the contractionary effect of monetary tightening on bank loans and balance sheets respectively (Cecchetti, 1999). Whereas, monetary policy effectiveness will be weaker in well-functioning and sophisticated financial system because of the effect of financial innovation (including securitization) and development which reduces the state verification cost of loanable funds.

Numerous studies have sort to test the relationship between the financial system and monetary policy transmission. For example, Kashyap and Stein (1997, 2000) find evidence in support of the bank lending channel as monetary policy will be effective through the influence on loans supply especially when banks have less liquid balance sheets. Loutskina and Strahan (2009) show evidence of a diminishing effect of the bank lending channel with greater financial securitization as opposed to its stronger effect on the balance sheet channel (see e.g. Ashcraft and Campello, 2007; Aysun and Hepp, 2011). Aysun and Hepp (2011) find that monetary policy has a larger impact on banks with asset-back securitization than non-securitizing banks. Aysun et al. (2013) and Ciccarelli et al. (2014) show that the credit channel is stronger in the presence of financial frictions as it amplifies the effect of monetary policy shocks on output and inflation. Carranza et al. (2010) find evidence that monetary policy has a larger impact when the financial system is less developed, albeit a longer gestation period than in more developed financial system. Mishra et al. (2012) show that for low-income countries (LICs) with low levels of financial development, the bank lending channel tend to dominate other channels of the monetary transmission. Ma and Lin (2016) find that monetary policy effectiveness and financial development are negatively correlated as monetary policy has a dampening effect on output and inflation with higher levels of financial development. Moreover, there is asymmetric effect of financial development on monetary policy effectiveness as it reduces output and inflation in developing and advanced economies respectively.

Similarly, there is evidence that differences in the financial structure are a proximate cause for cross-country differences of the monetary policy transmission especially in a monetary union. Most of these studies focus on the European Monetary Union with the underlying premise that regional monetary policy will have differential effects among member countries due to heterogeneity in their financial structures (e.g. Arnold, 2001; Rodríguez-Fuentes and Dow, 2003; Cecchetti, 1999; Elbourne and de Haan, 2006). Cecchetti (1999) find that monetary policy shocks on output and inflation vary across member countries of

the EU. Such variation is explained by each countries' financial system which are "different in the size, concentration, and health of the banking system and exhibit differences in the availability of primary capital market financing". Therefore, monetary policy will have greater sensitivity in countries with a weak banking system. Elbourne and de Haan (2006) find little evidence linking financial structure indicators with monetary policy shocks in transition EU countries.

Lastly, there is also a complementary literature on the importance of institutions for financial sector development and monetary policy effectiveness. This strand of the literature builds from the studies on the link between the legal system and the financial system in a country (see e.g. La Porta et al., 1997, 1998). Cecchetti (1999) find differences in the financial system of countries as a consequence of different legal structures, and hence the cross-country heterogeneous effects of monetary policy. Djankov et al. (2007) show that better legal protection undermines the effectiveness of monetary transmission mechanism. Aysun et al. (2013) find evidence that legal origin particularly in countries with stronger credit rights weaken the strength of the monetary transmission. Moreover, central bank independence does not affect monetary policy effectiveness despite evidence that it leads to significant price (but not output) adjustment. For Mishra et al. (2012), weak central bank independence coupled with deficiencies in the domestic institutional environment (e.g. weak property and credit rights, inefficient legal system, poor accounting and disclosure standards, corruption etc.) tend to undermine the efficient functioning of the financial intermediation process, and also the scope and effectiveness of monetary policy.

3 Estimation strategy

3.1 Model specification

Following the previous literature on monetary policy effectiveness (see Karras, 1999; Aysun and Hepp, 2011; Ma and Lin, 2016), we examine the relationship between financial development and the effectiveness of monetary policy in Africa. Although, there is no precise measurement of monetary policy effectiveness, the literature on monetary policy transmission uses the dominant VAR methodology to derive impulse response functions (IRFs) of real macroeconomic variables such as output and prices following an unanticipated monetary policy shock. Due to its methodological shortcomings,[5] we instead use standard panel data models for macroeconomic analysis to gauge the direct and interactive effects of financial

[5] Mishra and Montiel (2013) highlights these issues to include identification of the intermediate target of monetary, and exogenous monetary policy shocks through various identification schemes such as Choleski decompositions or non-recursive (simultaneous) identification.

development and monetary policy on output and inflation. The direct impact of money growth on output growth and inflation are specified as follows:

$$\Delta y_{j,t} = \beta_0 + \sum_{i=1}^{Q} \beta_i^y \Delta y_{j,t-i} + \sum_{i=0}^{R} \beta_i^{oil} \Delta OIL_{j,t-i} + \sum_{i=0}^{S} \beta_{i,j,t}^m \Delta m_{j,t-i} + u_{j,t}^y \tag{1}$$

$$\Delta p_{j,t} = \gamma_0 + \sum_{i=1}^{Q} \gamma_i^p \Delta p_{j,t-i} + \sum_{i=0}^{R} \gamma_i^{oil} \Delta OIL_{j,t-i} + \sum_{i=0}^{S} \gamma_{i,j,t}^m \Delta m_{j,t-i} + u_{j,t}^p \tag{2}$$

where j and t indexes over countries and time respectively. Δy is the output growth rate , Δp is the inflation rate, Δm is the money growth rate, and ΔOIL is the growth rate of real oil prices which is included as a proxy for possible supply shocks. Following Karras (1999), Eqs. (1) and (2) represents the reduced-form expressions for output growth and inflation with β's and γ's as coefficients; and $u_{j,t}^y$ and $u_{j,t}^p$ as the output and inflation shocks respectively, which are modelled as $u_{j,t}^y = u_j^y + w_{j,t}^y$ and $u_{j,t}^p = u_j^p + w_{j,t}^p$, where u_j^ys and u_j^ps denote country fixed effects.

To capture the impact of financial development on the effects of money growth on output and inflation, an interaction term for financial development is incorporated in the following manner:

$$\beta_{j,t-1}^m = \vartheta_i^m + \vartheta_i^f f d_{j,t-1} \tag{3}$$

$$\gamma_{j,t-1}^m = \phi_i^m + \phi_i^f f d_{j,t-1} \tag{4}$$

where $fd_{j,t}$ is a measure of financial development in country j at time t, while ϑs and ϕs are the parameters. Incorporating Eq.(3) into Eq.(1), gives the output equation which measures the effect of financial development on the money growth and output growth relationship; while the inflation equation is obtained by incorporating Eq.(4) into Eq.(2), to measure the effect of financial development on the money growth and inflation relationship. The resulting equations are as follows:

$$\begin{aligned}\Delta y_{j,t} = \beta_0 + \sum_{i=1}^{Q} \beta_i^y \Delta y_{j,t-i} + \sum_{i=0}^{R} \beta_i^{oil} \Delta OIL_{j,t-i} + \sum_{i=0}^{S} (\vartheta_{i,j,t}^m \Delta m_{j,t-i} \\ + \vartheta_i^{fm} f d_{j,t-1} \Delta m_{j,t-1}) + u_{j,t}^y\end{aligned} \tag{5}$$

$$\Delta p_{j,t} = \gamma_0 + \sum_{i=1}^{Q} \gamma_i^p \Delta p_{j,t-i} + \sum_{i=0}^{R} \phi_i^{oil} \Delta OIL_{j,t-i} + \sum_{i=0}^{S} (\phi_{i,j,t}^m \Delta m_{j,t-i} + \phi_i^{fm} fd_{j,t-1} \Delta m_{j,t-1}) + u_{j,t}^p \quad (6)$$

where $fd_{j,t-1}\Delta m_{j,t-1}$ is the interaction between financial development and money growth on output growth and inflation respectively, while all other variables remain as earlier defined.

The overall strength of monetary policy on output growth and inflation in Eqs. (5) and (6) is easily identified from the the sum of the money growth coefficients, that is $\sum_{i=0}^{S} \vartheta_i^m$ and $\sum_{i=0}^{S} \phi_i^m$ respectively. For example, monetary policy shocks – an increase in Δm_{t-i} – that leads to larger values in these coefficients would imply a larger overall effect of monetary policy on output growth and inflation, whereas the reverse for smaller values would suggest a dampening effect of monetary policy. Moreover, our main focus centres on the coefficients of the interaction term between financial development and money growth, that is $\sum_{i=0}^{S} \vartheta_i^{fm}$ and $\sum_{i=0}^{S} \phi_i^{fm}$, which measures the impact of financial development on money growth to output and inflation respectively. Specifically, if the coefficient sign is positive (negative), then this would imply that higher levels of financial development will amplify (dampen) the effects of monetary policy on output growth and inflation. Meanwhile, the magnitude of the impact will depend on the coefficient size.

At this point, it is necessary to highlight the rationale behind our chosen methodology. First, we do not identify or separate between the traditional interest rate or credit channels of monetary policy transmission. This is because aside from providing the mechanism in explaining the effect of monetary policy on real economic activity, both channels often complement each other. Therefore, we treat the monetary transmission mechanism as a black box. Second, short-term interest rates as an important policy target are not uniform across countries for meaningful cross-country analysis because of differences in monetary policy stance. A useful alternative is the monetary aggregates. In fact, we consider monetary aggregates apt for our analysis as most African countries are known to use it as their intermediate target in the conduct of monetary policy (Kasekende and Brownbridge, 2011; Mishra and Montiel, 2013). Third, we follow a single-stage instead of the dominant two-stage methodology. The two-stage approach involve generating proxies for monetary policy effectiveness in the first-stage using the VAR methodology with relevant identification strategies, while the maximum amplitude of the response of output and inflation to an unanticipated monetary policy shock is then used as the measure of monetary policy effectiveness. In the second-stage, this generated proxy is regressed on variables of interest including measures of financial development or frictions. The caveat with this methodology is that this measure of monetary policy effectiveness may be vulnerable to the generated regressor problem if their standard errors in the first-stage are unaccounted for

in the second stage estimation (see Gawande, 1997). Moreover, there is no consensus on which identification strategy is suitable to mirror the effect of monetary policy shocks on output and inflation. At best, most studies use different identification schemes depending on the countries' stage of development and whether the evidence of liquidity and price puzzles (the increase in monetary aggregates and prices following a monetary shock) are non-traceable. In view of these issues, we must re-emphasize that our objective is to test whether monetary policy effectiveness is considerably influenced by the level of financial sector development in Africa.

As usual, standard panel data models of pool least squares (PLS), fixed effects (FE) and random effects (RE) can be used to estimate Eqs. (5) and (6).[6] However, in the presence of lagged terms of the dependent variable, both RE and PLS models return identical estimates; whereas the FE model is more consistent under plausible general assumptions (see Judge et al., 1985). Similarly, potential endogeneity problems with such dynamic panel data specification can be addressed using the system Generalized Method of Moments (system-GMM) estimator (see Arellano and Bond, 1991; Blundell and Bond, 1998). In all, the use of different panel data estimators reduces the likelihood of spurious empirical results through robust sensitivity analysis.

3.2 Data

This paper uses annual data of 39 African countries over the period 1990 to 2015, where countries and time span are selected subject to data availability. The datasets are retrieved mainly from the World Bank's *World Development Indicators* and the IMF's *International Financial Statistics* except for oil prices which is sourced from the U.S. Energy Information Administration website. Our main variables for the analysis include, broad money supply (M2), consumer price index (CPI), real gross domestic product (GDP), real oil prices (OIL), and a measure of financial development (*fd*). The first three variables are expressed in growth rates (i.e., annual percentage change) as follows respectively:

$$\begin{aligned}\Delta m_{j,t} &= (M2_{j,t} - M2_{j,t-1})/M2_{j,t-1} \\ \Delta p_{j,t} &= (CPI_{j,t} - CPI_{j,t-1})/CPI_{j,t-1} \\ \Delta y_{j,t} &= (GDP_{j,t} - GDP_{j,t-1})/GDP_{j,t-1}\end{aligned}$$

We use as a measure of financial development, domestic credit to private sector relative

[6]The PLS model provides the benchmark for panel data analysis, while the Hausman test is used to select between the FE and RE models.

to GDP. This measure captures the extend of credit allocation within the financial system as well as the overall depth of financial intermediation. Other plausible candidates in the finance literature for measuring financial development include, liquid liabilities relative to GDP which captures the size of the financial sector, and stock market development indices such as market capitalization relative to GDP. We do not use these measures because the former is correlated with the money growth ($\Delta m_{j,t}$), and the latter because stock markets in African economies are relatively less developed. Lastly, we deflate U.S. dollar oil prices by the U.S. implicit price deflator to obtain the real oil prices.

Table 1 shows the list of the 39 African economies and their country averages over the sample period for each measure of inflation, output growth, money growth and financial development. A quick eye-balling of the information indicate substantial variation across countries for the variables of interest. For instance, the average annual rate of inflation ranged from a minimum of 2.694% in Senegal to a maximum of 40.278% in Sudan; while the average annual output growth rate ranged from 0.49% in Burundi to 21.071% in Equatorial Guinea. Also, the annual money growth ranged from 6.607% in the Central African Republic to 46.648% in Guinea Bissau. This sizable differences in the data information points to the possibility that monetary policies may have asymmetric impact on output and prices across countries. That is, the output and price response of an unanticipated monetary policy shock will differ substantially across African countries. Furthermore, the average annual values for the measure of financial development in Table 1, ranged from 3.877% in Sierra Leone to 66.305% in Mauritius, with South Africa following closely with 64.82%. Only three economies namely, Mauritus, South Africa and Tunisia, have above 50% domestic credit contribution to the GDP. Moreover, the panel average of approximately 18% indicate that the level of financial sector development is significantly low, and that considerable differences exist in the financial structure of African economies. Whether these differences in the financial structure and development across African countries exert any significant influence on the effects of monetary policy on output growth and inflation remains an empirical question that this paper hopes to ascertain in the next section.

Table 1: Sample means (1990-2015)

Country	Δp	Δy	Δm	fd
1. Algeria	9.464	2.885	16.085	13.872
2. Benin	4.414	4.520	13.105	13.771
3. Botswana	8.905	4.664	16.144	19.762
4. Burkina Faso	3.178	5.361	12.147	13.842
5. Burundi	11.448	1.225	15.639	14.790
6. Cabo Verde	3.642	7.059	13.838	37.568
7. Cameroon	3.668	2.604	7.079	11.793
8. Central African Rep.	5.627	0.490	6.607	7.1606
9. Chad	4.241	5.969	12.351	4.494
10. Congo, Rep.	5.155	3.188	13.275	8.191
11. Cote d'Ivoire	3.903	2.554	9.275	17.958
12. Egypt, Arab Rep.	9.178	4.224	14.043	38.244
13. Equatorial Guinea	5.845	21.071	27.306	7.953
14. Gabon	2.928	2.455	9.069	10.533
15. Gambia, The	5.895	3.366	15.948	9.434
16. Ghana	20.527	5.490	34.369	11.451
17. Guinea-Bissau	16.029	2.285	46.648	6.471
18. Kenya	12.688	3.612	16.876	25.339
19. Lesotho	8.286	4.162	11.978	13.998
20. Madagascar	12.415	2.372	16.706	11.477
21. Malawi	21.615	4.293	29.776	8.163
22. Mali	3.038	4.439	11.525	13.895
23. Mauritius	6.041	4.671	12.623	66.305
24. Morocco	2.710	3.978	10.192	44.655
25. Mozambique	18.782	7.467	29.832	15.156
26. Niger	2.975	3.601	9.816	8.238
27. Nigeria	18.886	5.651	27.389	14.908
28. Rwanda	7.434	5.519	16.254	11.471
29. Senegal	2.694	3.535	9.716	21.919
30. Seychelles	5.063	3.817	12.019	17.992
31. Sierra Leone	21.420	2.822	27.908	3.877
32. South Africa	7.364	2.446	12.656	64.820
33. Sudan	40.278	4.966	40.445	6.607
34. Swaziland	8.092	3.886	12.598	16.865
35. Tanzania	13.598	5.319	22.753	9.269
36. Togo	4.357	2.773	9.551	21.001
37. Tunisia	4.222	4.105	9.7928	57.795
38. Uganda	10.330	6.652	24.841	8.422
39. Zambia	37.739	4.517	36.106	8.267
Panel	10.105	4.462	17.802	18.403

Note: Δp is the CPI inflation rate (%), Δy is the real growth rate of GDP (%), Δm is the growth rate of M2 (%), fd is the domestic credit to private sector by banks as a fraction of GDP.

4 Estimation Results

4.1 Main results

As a starting point, we follow previous literature (e.g. Karras, 1999) and include only the first lag of output growth and inflation in the output and inflation regressions respectively so as to capture the degree of persistence. Also, we include the first lag of oil price growth in addition to its contemporaneous effect. The rationale is to have a parsimonious model while reducing possible overparametization as we experiment with different lag structure of money growth and its interaction with financial development. Before incorporating the possible effect of financial development, we consider the baseline results for Eqs. (1) and (2) which is presented in Table 2 with the output growth and inflation regressions reported in Columns (1) – (5) and Columns (6) – (10) respectively.[7]

From Table 2, both output growth and inflation show considerable degree of persistence as indicated by the statistically significant positive AR(1) terms in all regressions. For the oil price growth, both its contemporaneous and first lagged effect have a positive and negative impact on output growth and inflation respectively, although there are differences in terms of statistically significance. The contemporaneous effect of oil price growth is statistically significant for all output growth regressions while its lag is only significant for regressions in Columns (1) – (3). The reverse scenario holds for the inflation regressions as the contemporaneous effect is significant only in Columns (1) – (3) whereas its lag is significant across all regressions.

As for the impact of money growth, its contemporaneous effect is positive across both output growth and inflation regressions and is also statistically significant except in Column (5) of the output growth regression when up to its fourth lag is included. This implies that an expansion in money supply will cause an increase in output growth and inflation. Further inclusion of additional lags for money growth up to its fourth in a stepwise manner show that their impacts are mostly positive in both output growth and inflation regressions. However, statistical significant is observed for only the first two lags of money growth in Columns (7) and (8) for the inflation regressions, and none for the output growth regressions. At this point, It is important to emphasize that our interest is not in the individual effects of both the contemporaneous and different lags of money growth, but rather in its cumulative impact which would indicate the overall strength of the variable, and monetary policy in particular. In other words, the emphasis is on the magnitude and statistical significance

[7]Through out this paper, we report empirical estimations using the FE model as the system-GMM which controls for possible endogeneity issues does not alter the empirical results. However, the results are available on request from the authors.

Table 2: Financial Development and monetary policy effectiveness in Africa: baseline results

Dependent variable: real output growth Δy_t						Dependent variable: inflation rate Δp_t					
Variables	(1)	(2)	(3)	(4)	(5)	Variables	(6)	(7)	(8)	(9)	(10)
Δy_{t-1}	0.206**	0.204**	0.197**	0.205**	0.207**	Δp_{t-1}	0.582***	0.531***	0.499***	0.467***	0.372***
	(2.446)	(2.438)	(2.534)	(2.592)	(2.380)		(16.258)	(17.132)	(14.734)	(13.807)	(6.146)
Δoil_t	0.0222***	0.0225***	0.0210***	0.0193***	0.0165**	Δoil_t	-0.0242*	-0.0252*	-0.0218*	-0.0184	-0.0174
	(3.499)	(3.526)	(3.442)	(3.015)	(2.565)		(-1.894)	(-1.944)	(-1.695)	(-1.495)	(-1.489)
Δoil_{t-1}	0.0202**	0.0199**	0.0224**	0.0209	0.0173	Δoil_{t-1}	-0.0208*	-0.0275**	-0.0319**	-0.0269**	-0.0262**
	(2.293)	(2.321)	(2.341)	(1.621)	(1.411)		(-1.832)	(-2.316)	(-2.477)	(-2.208)	(-2.193)
Δm_t	0.0382**	0.0388**	0.0371*	0.0423*	0.0350	Δm_t	0.203***	0.223***	0.213***	0.175***	0.178***
	(2.204)	(2.155)	(1.873)	(1.969)	(1.521)		(4.956)	(5.641)	(6.268)	(5.839)	(5.617)
Δm_{t-1}		0.00849	0.00344	0.000703	0.00489	Δm_{t-1}		0.0844***	0.0745*	0.0579	0.0549
		(1.015)	(0.190)	(0.036)	(0.201)			(4.382)	(1.799)	(1.540)	(1.459)
Δm_{t-2}			0.0113	0.0462	0.0457	Δm_{t-2}			0.0305***	0.0189	0.0241
			(0.552)	(1.106)	(0.977)				(3.406)	(0.780)	(1.044)
Δm_{t-3}				0.0224	0.0346	Δm_{t-3}				0.0115	0.0412
				(1.150)	(1.231)					(0.923)	(1.620)
Δm_{t-4}					-0.0180	Δm_{t-4}					0.000641
					(-0.664)						(0.038)
Constant	2.714***	2.560***	2.543***	1.547	1.856	Constant	0.544	-0.757	-0.762	0.255	0.323
	(5.305)	(3.998)	(2.852)	(0.969)	(1.179)		(0.654)	(-0.693)	(-0.567)	(0.185)	(0.174)
$\sum_{i=0}^{S} \vartheta_i^m$	0.0382***	0.0473	0.0518	0.1117	0.1021	$\sum_{i=0}^{S} \phi_i^m$	0.203***	0.3069***	0.3175***	0.2634***	0.2989***
	(2.204)	(2.089)	(1.500)	(1.618)	(1.481)		(4.956)	(5.414)	(4.338)	(3.356)	(2.965)
N	975	975	936	897	858	N	975	975	936	897	858
adj. R^2	0.056	0.056	0.053	0.070	0.067	adj. R^2	0.511	0.528	0.504	0.441	0.345

Note: $\sum_{i=0}^{S} \vartheta_i^m$ is the sum of the money growth coefficients ($\Delta m_t s$) in the output equation, $\sum_{i=0}^{S} \phi_i^m$ is the sum of the money growth coefficients ($\Delta m_t s$) in the inflation equation. with their F-statistic of Wald test in the parenthesis. t-statistics in parentheses. ***, **, * indicates 1%, 5% and 10% significance level.

of the sum of money growth coefficients ($\sum_{i=0}^{S}\vartheta_i^m, \sum_{i=0}^{S}\phi_i^m$). For the output regressions, the cumulative impact of money growth is positive with the only statistical significance observed in Column (1) where it corresponds to the contemporaneous money growth, and with approximately 4% impact on output growth. The absence of statistical significance for the sum of the estimated money growth coefficients in Columns (2) – (5) is consistent with money neutrality in the long-run. Turning to the inflation regressions, the cumulative impact of money growth is positive and statistically significant across regressions in Columns (6) – (10). Moreover, the magnitude of the sum for the money growth coefficients are higher than those obtained in the output growth regressions, as an expansion in money supply is associated with higher inflation.

Table 3: Financial development and monetary policy effectiveness in Africa: main results

Dependent variable: real output growth Δy_t				Dependent variable: inflation rate Δp_t			
Variables	(1)	(2)	(3)	Variables	(4)	(5)	(6)
Δy_{t-1}	0.205**	0.203**	0.199**	Δp_{t-1}	0.564***	0.522***	0.483***
	(2.436)	(2.464)	(2.574)		(16.333)	(17.512)	(13.564)
Δoil_t	0.022***	0.023***	0.021***	Δoil_t	-0.026*	-0.026*	-0.023*
	(3.508)	(3.552)	(3.457)		(-1.996)	(-2.018)	(-1.783)
Δoil_{t-1}	0.020**	0.019**	0.023**	Δoil_{t-1}	-0.020*	-0.027**	-0.032**
	(2.279)	(2.259)	(2.245)		(-1.772)	(-2.248)	(-2.514)
Δm_t	0.029*	0.036	0.028	Δm_t	0.260**	0.301**	0.287**
	(1.798)	(1.673)	(0.993)		(4.677)	(5.804)	(5.721)
Δm_{t-1}		-0.005	-0.019	Δm_{t-1}		0.037	0.068
		(-0.148)	(-0.808)			(0.784)	(1.262)
Δm_{t-2}			0.059	Δm_{t-2}			-0.004
			(1.142)				(-0.155)
$\Delta m_t fd_t$	0.001	0.001	0.001	$\Delta m_t fd_t$	-0.006***	-0.008***	-0.008***
	(0.897)	(0.410)	(0.565)		(-2.784)	(-3.905)	(-3.119)
$\Delta m_{t-1} fd_{t-1}$		0.001	0.001	$\Delta m_{t-1} fd_{t-1}$		0.003	0.002
		(0.585)	(1.417)			(1.593)	(0.667)
$\Delta m_{t-2} fd_{t-2}$			-0.003	$\Delta m_{t-2} fd_{t-2}$			0.002
			(-1.332)				(1.496)
Constant	2.613***	2.445***	2.348***	Constant	1.311*	-0.006	-0.136
	(4.460)	(3.423)	(2.714)		(1.818)	(-0.007)	(-0.118)
$\sum_{i=0}^{S}\vartheta_i^m$	0.029*	0.031	0.067	$\sum_{i=0}^{S}\phi_i^m$	0.260**	0.338***	0.351***
	(1.798)	(1.149)	(1.214)		(4.677)	(3.761)	(3.662)
$\sum_{i=0}^{S}\vartheta_i^{fm}$	0.001	0.002	-0.0003	$\sum_{i=0}^{S}\phi_i^{fm}$	-0.006***	-0.005	-0.004
	(0.897)	(1.382)	(-0.184)		(-2.784)	(-1.490)	(-1.264)
N	975	975	936	N	975	975	936
adj. R^2	0.056	0.055	0.058	adj. R^2	0.515	0.534	0.510

Note: $\sum_{i=0}^{S}\vartheta_i^m$ and $\sum_{i=0}^{S}\phi_i^m$ are the sum of the money growth coefficients ($\Delta m_t s$) in the output and inflation equation respectively; $\sum_{i=0}^{S}\vartheta_i^{fm}$ and $\sum_{i=0}^{S}\phi_i^{fm}$ are the sum of the coefficients of the interaction terms ($fd_t \Delta m_t s$) in the output and inflation equation respectively with their F-statistic of Wald test in the parenthesis. t-statistics in parentheses. ***, **, * indicates 1%, 5% and 10% significance level.

Following the above baseline regressions, we introduce the effect of financial development as explicitly captured in Eqs. (5) and (6) in order to assess quantitatively its importance for monetary policy effectiveness in Africa. In the estimations that follow, we report results for only the first two lags of money growth and its interaction term with financial development which are presented in Table 3 for both the output growth and inflation regressions.[8] As shown, the introduction of financial development does not change significantly the results presented above in Table 2. Both AR(1) terms of output growth and inflation still show considerable degree of persistence. Oil price growth and its lag have significantly positive and negative impact on output growth and inflation respectively. As for money growth, the sum of its coefficients ($\sum_{i=0}^{S} \vartheta_i^m, \sum_{i=0}^{S} \phi_i^m$) is positive with strong significant effect in the inflation regressions than for output growth of which only its contemporaneous effect is statistically significant in Column (1). Thus, the sign, significance and size of the sum of the money growth coefficients does not differ significantly from the results presented in Table 2 despite the introduction of financial development. On the sum of the coefficients of the interaction terms ($\sum_{i=0}^{S} \vartheta_i^{fm}, \sum_{i=0}^{S} \phi_i^{fm}$) which is the main interest of this paper, Table 3 show that it is positive and not statistically different from zero for all the output growth regressions in Columns (1) – (3). Moreover, the magnitude of these coefficients indicate a negligible impact. Meanwhile, the sum of these coefficients are negative across all inflation regressions with statistical significance observed only when their contemporaneous term is considered in Column (4). Elsewhere in Columns (5) and (6), these coefficients are not significant. The upshot of these results is that the impact of financial development on monetary policy effectiveness in Africa is very weak. In addition, the explanatory power of these model estimations as indicated by the adjusted R^2 values in Tables 2 and 3 are considerably higher in all the inflation regressions whereas those of the output growth regressions are very low which suggest the importance of other factors in the determination of output growth.

4.2 Robustness checks

4.2.1 Robustness to long-term averages

Our first sensitivity analysis involves varying the data frequency to address possible long-term business cycle effects often associated with annual data over a long time dimension in panel regression analysis. Thus, we re-estimate the output growth and inflation regressions using a three-year non-overlapping panel averages for each variables. Consequently, the sample is split into eight non-overlapping three-year periods which are 1990-1992, 1993-1995,

[8]The inclusion of further lags beyond two does not alter the results obtained.

Table 4: Robustness to long-term panel average (three-year averages)

Dependent variable: real output growth Δy_t				Dependent variable: inflation rate Δp_t			
Variables	(1)	(2)	(3)	Variables	(4)	(5)	(6)
Δy_{t-1}	0.257***	0.260***	0.258***	Δp_{t-1}	0.276***	0.311***	0.202***
	(3.762)	(3.593)	(2.774)		(3.905)	(3.180)	(3.688)
Δoil_t	0.045***	0.045***	0.009	Δoil_t	-0.125***	-0.119***	-0.009
	(2.958)	(2.944)	(0.404)		(-3.730)	(-3.477)	(-0.399)
Δoil_{t-1}	-0.019	-0.008	-0.026	Δoil_{t-1}	-0.036	-0.037	0.033
	(-0.451)	(-0.212)	(-0.584)		(-0.674)	(-0.724)	(0.944)
Δm_t	0.039	0.002	0.159	Δm_t	0.550***	0.607***	0.164***
	(1.140)	(0.057)	(1.480)		(4.773)	(5.339)	(3.196)
Δm_{t-1}		0.081*	0.186*	Δm_{t-1}		-0.165	-0.022
		(1.783)	(1.958)			(-1.613)	(-0.408)
Δm_{t-2}			-0.168	Δm_{t-2}			0.037
			(-1.464)				(0.527)
$\Delta m_t fd_t$	0.001	0.003	-0.002	$\Delta m_t fd_t$	-0.013***	-0.017***	-0.005**
	(0.775)	(1.154)	(-1.260)		(-2.962)	(-3.822)	(-2.655)
$\Delta m_{t-1} fd_{t-1}$		-0.004	-0.004	$\Delta m_{t-1} fd_{t-1}$		0.012**	0.005*
		(-1.586)	(-1.517)			(2.670)	(1.822)
$\Delta m_{t-2} fd_{t-2}$			0.004	$\Delta m_{t-2} fd_{t-2}$			0.001
			(1.018)				(0.362)
Constant	2.384***	1.939*	1.915	Constant	1.130	0.544	1.534*
	(3.166)	(1.963)	(1.501)		(0.654)	(0.304)	(1.790)
$\sum_{i=0}^{S} \vartheta_i^m$	0.039	0.083	0.177*	$\sum_{i=0}^{S} \phi_i^m$	0.550***	0.442**	0.179**
	(1.140)	(1.407)	(1.998)		(4.773)	(2.631)	(2.572)
$\sum_{i=0}^{S} \vartheta_i^{fm}$	0.001	-0.001	- 0.002	$\sum_{i=0}^{S} \phi_i^{fm}$	-0.013***	-0.005	0.001
	(0.775)	(0.426)	(-1.036)		(-2.962)	(-0.722)	(0.228)
N	273	273	234	N	273	273	234
adj. R^2	0.079	0.090	0.217	adj. R^2	0.499	0.520	0.303

Note: $\sum_{i=0}^{S} \vartheta_i^m$ and $\sum_{i=0}^{S} \phi_i^m$ are the sum of the money growth coefficients ($\Delta m_t s$) in the output and inflation equation respectively; $\sum_{i=0}^{S} \vartheta_i^{fm}$ and $\sum_{i=0}^{S} \phi_i^{fm}$ are the sum of the coefficients of the interaction terms ($fd_t \Delta m_t s$) in the output and inflation equation respectively with their F-statistic of Wald test in the parenthesis. t-statistics in parentheses. ***, **, * indicates 1%, 5% and 10% significance level.

1996-1999, 2000-2002, 2003-2005, 2006-2009, 2010-2012, and 2013-2015. The results are presented in Table 4.

As can be seen from Table 4, the sum of the money growth coefficients ($\sum_{i=0}^{S} \vartheta_i^m, \sum_{i=0}^{S} \phi_i^m$) are positive in both output growth and inflation regressions. However, statistical significance is obtained only in Column (3) for the output growth regressions with two lags of money growth with an approximate impact of 18%; while those of the inflation regressions are statistically significant. For the sum of the interaction coefficient terms ($\sum_{i=0}^{S} \vartheta_i^{fm}, \sum_{i=0}^{S} \phi_i^{fm}$), the estimates in the output growth regressions are not statistically significant whereas only the contemporaneous effect of the interaction term is significant, negatively signed with 1.3% impact in Column (4). From these results, there is no statistical evidence to show

that the degree of financial sector development influences the effect of monetary policy on output growth. Meanwhile, there is a negative contemporaneous relationship between financial development and the effects of monetary policy on inflation. This finding of a negative and statistical significant relationship disappears with further inclusion of more lags for the variables of interest. Hence, for the analysis on inflation, the relationship can be considered as being weak. Overall, the results in Table 4 does not differ from the earlier result in Table 3 after accounting for possible long-term business cycle effects.

4.2.2 Robustness across sub-samples

Our sub-samples analysis involves considering a pertinent question of whether the above empirical findings differ considerably across sub-regional groupings of countries in Africa. Thus, we re-estimate the panel regressions for output growth and inflation for countries classified into Central Africa, East Africa (including the Horn of Africa), West Africa, North Africa and Southern Africa. Table 5 and Table 6 presents the empirical result for both output growth and inflation regressions respectively.

A look at Table 5 shows no significant variation between the results across sub-samples and our main result. The sum of money growth coefficients ($\sum_{i=0}^{S} \vartheta_i^m$) which captures the strength of monetary policy is not statistically significant across the various regional groups with the exception of Northern Africa in Column (8) with two lags of money growth and Southern Africa in Column (9) with only a single lag. The magnitude of these money growth effect is small and the the variation in the signs of the coefficients suggest possible asymmetric impact of monetary policy across the African regions. As for the sum of the interaction coefficient terms ($\sum_{i=0}^{S} \vartheta_i^{fm}$), the effect is positive and and statistically significant only for Central Africa in Column (1) and West Africa in Column (5) only when a single lag of money growth is considered. For these two regions, the result implies that financial development can enhance the effectiveness of monetary policy in accelerating output growth albeit in the short-run; whereas, for other regions, such relationship is non-existent. Again, this finding indicate the fact that monetary policy may have asymmetric effect on output because of differences in the financial structure across the regions.

Turning to the effect of monetary growth on inflation, Table 6 show that the sum of the money growth coefficients ($\sum_{i=0}^{S} \phi_i^m$) has a positive and statistically significant impact on inflation with the only exception being for Central Africa in Column (2) and North Africa in Column (7). This evidence suggest that an increase in money supply leads considerably to higher inflation across African regions and is therefore consistent with our previous findings for the whole sample. For the sum of the interaction terms coefficients ($\sum_{i=0}^{S} \phi_i^{fm}$),

Table 5: Robustness across sub-samples: output regression results

	Central Africa		East Africa		West Africa		North Africa		Southern Africa	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δy_{t-1}	0.3081***	0.2845***	0.0618	0.0588	0.0994	0.1100	-0.1037	-0.1033	-0.1041	-0.1316*
	(5.957)	(7.775)	(0.901)	(0.910)	(1.580)	(1.656)	(-0.347)	(-0.287)	(-1.758)	(-2.069)
Δoil_t	-0.00757	-0.0231	0.0252*	0.0193*	0.0253*	0.0246*	0.0179**	0.0153***	0.0342**	0.0353**
	(-0.382)	(-1.427)	(2.306)	(2.286)	(1.858)	(1.864)	(4.197)	(8.248)	(2.566)	(2.539)
Δoil_{t-1}	0.0776	0.0694	0.0297*	0.0351*	0.00771	0.0056	0.0142	0.0105	0.0060	0.0062
	(1.219)	(1.705)	(2.045)	(2.222)	(0.754)	(0.642)	(1.264)	(0.944)	(0.513)	(0.526)
Δm_t	-0.0726	-0.0107	0.1906	0.2096	0.0251	0.0396	0.0073	-0.0002	-0.0338	-0.0311
	(-1.021)	(-0.207)	(1.090)	(1.115)	(1.121)	(1.467)	(0.635)	(-0.010)	(-0.699)	(-0.607)
Δm_{t-1}	0.0674	0.0563	-0.0529	-0.0297	-0.0541*	-0.0594*	0.0052	-0.0040	-0.0436	-0.0395
	(0.808)	(0.500)	(-0.972)	(-0.919)	(-2.137)	(-1.954)	(0.379)	(-0.395)	(-1.333)	(-1.083)
Δm_{t-2}		0.2724*		-0.0412		-0.0147		0.0133		-0.0002
		(2.327)		(-0.788)		(-0.369)		(0.964)		(-0.007)
$\Delta m_t fd_t$	0.0252	0.0181	-0.0049	-0.0048	0.0017	0.0008	-0.0001	0.0011	0.0011	0.0010
	(1.862)	(1.439)	(-0.980)	(-0.927)	(0.656)	(0.276)	(-0.082)	(0.587)	(0.351)	(0.343)
$\Delta m_{t-1} fd_{t-1}$	-0.0023	-0.0011	0.0028	0.0015	0.0036**	0.0044**	-0.0003	0.0009	0.0014	0.0018
	(-0.293)	(-0.095)	(0.719)	(0.708)	(2.877)	(2.429)	(-0.180)	(0.470)	(0.731)	(0.832)
$\Delta m_{t-2} fd_{t-2}$		-0.0192***		0.00150		0.0003		-0.0016		-0.0011
		(-6.204)		(0.480)		(0.140)		(-0.888)		(-1.232)
Constant	2.249	-0.0608	1.914	1.998	2.959***	3.007***	4.298***	4.084**	5.556***	5.790***
	(1.778)	(-0.023)	(0.815)	(0.888)	(5.752)	(3.810)	(5.049)	(4.311)	(8.081)	(8.517)
$\sum_{i=0}^{S} \vartheta_i^m$	-0.0052	0.3180	0.1377	0.1387	-0.0290	-0.0345	0.0126	0.0091**	-0.0774**	-0.0708
	(-0.092)	(1.754)	(0.926)	(1.014)	(-0.878)	(-0.519)	(1.999)	(2.447)	(-2.121)	(-1.484)
$\sum_{i=0}^{S} \vartheta_i^{fm}$	0.2290***	-0.0022	-0.0021	-0.0018	0.0053*	0.0055	-0.0004	0.0004	0.0025	0.0017
	(2.957)	(-0.223)	(-0.788)	(-0.828)	(1.811)	(1.366)	(-0.328)	(0.269)	(1.271)	(0.816)
N	150	144	200	192	325	312	125	120	175	168
Countries	6	6	8	8	13	13	5	5	7	7
adj. R^2	0.099	0.134	0.047	0.045	0.053	0.050	-0.013	-0.025	0.053	0.042

Note: $\sum_{i=0}^{S} \vartheta_i^m$ is the sum of the money growth coefficients ($\Delta m_t s$), $\sum_{i=0}^{S} \vartheta_i^{fm}$ is the sum of the coefficients of the interaction terms ($fd_t \Delta m_t s$) in the output equation with their F-statistic of Wald test in the parenthesis. t-statistics in parentheses. ***, **, * indicates 1%, 5% and 10% significance level.

Table 6: Robustness across sub-samples: inflation regression results

	Central Africa		East Africa		West Africa		North Africa		Southern Africa	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δp_{t-1}	0.1212	0.1387	0.3661***	0.3731***	0.4781***	0.4045***	0.4658*	0.3954*	0.4467***	0.4254***
	(0.976)	(1.075)	(3.874)	(3.601)	(10.134)	(7.605)	(2.696)	(2.335)	(4.653)	(4.153)
Δoil_t	-0.1122***	-0.1167***	0.0208	0.0245	-0.0315	-0.0294	-0.0101	0.0116	-0.0183	-0.0129
	(-5.031)	(-4.608)	(1.565)	(1.798)	(-1.371)	(-1.440)	(-0.598)	(1.292)	(-0.479)	(-0.348)
Δoil_{t-1}	-0.0278	-0.0147	0.0289	0.0255	-0.0316*	-0.0307	-0.0399*	-0.0484*	-0.0635*	-0.0699*
	(-1.556)	(-1.034)	(1.106)	(0.996)	(-2.106)	(-1.724)	(-2.218)	(-2.189)	(-1.962)	(-2.205)
Δm_t	0.2455***	0.2434**	0.1451*	0.1552**	0.2857***	0.2277***	0.4462**	0.4023**	0.4945**	0.4837*
	(4.644)	(3.257)	(2.165)	(2.378)	(5.269)	(3.634)	(3.234)	(4.530)	(2.574)	(2.400)
Δm_{t-1}	-0.0441	-0.0515	0.109	0.0962	0.0581	0.1189**	0.1758	0.2585	0.2863	0.3571
	(-1.161)	(-1.440)	(1.608)	(0.942)	(0.891)	(2.596)	(1.118)	(1.398)	(1.443)	(1.515)
Δm_{t-2}		-0.0435		0.0026		-0.0026		0.0227*		-0.0508
		(-1.129)		(0.033)		(-0.043)		(2.201)		(-0.537)
$\Delta m_t fd_t$	-0.0078	-0.0086	-0.0003	-0.0004	-0.0082***	-0.0046	-0.0052	-0.0085***	-0.0150	-0.0142
	(-1.020)	(-0.915)	(-0.075)	(-0.111)	(-3.287)	(-1.242)	(-1.144)	(-10.937)	(-1.469)	(-1.392)
$\Delta m_{t-1} fd_{t-1}$	0.0054	0.0048	0.0034	0.0043	0.0014	-0.0068	0.0036	-0.0017	0.0031	-0.0015
	(1.603)	(0.596)	(0.580)	(0.613)	(0.376)	(-1.370)	(0.855)	(-0.190)	(0.490)	(-0.195)
$\Delta m_{t-2} fd_{t-2}$		0.0014		-0.0023		0.0027		0.0069		0.0072
		(0.204)		(-0.543)		(0.940)		(0.795)		(0.756)
Constant	2.2714**	3.1175**	0.3921	0.6852	-0.1299	0.7744	-3.7829*	-4.1701	-4.0420	-5.2365
	(3.128)	(3.066)	(0.211)	(0.357)	(-0.177)	(0.697)	(-2.772)	(-1.609)	(-1.143)	(-1.207)
$\sum_{i=0}^{S} \phi_i^m$	0.2014***	0.1484	0.2541***	0.2540***	0.3438***	0.3440***	0.6220	0.6835*	0.7808*	0.7900*
	(3.967)	(1.853)	(2.868)	(3.381)	(4.026)	(3.442)	(2.111)	(2.416)	(2.279)	(2.286)
$\sum_{i=0}^{S} \phi_i^{fm}$	-0.0024	-0.0025	0.0031	0.0016	-0.0068*	-0.0088*	-0.0016	-0.0033	-0.0119	-0.0085*
	(-0.482)	(-0.194)	(0.579)	(0.275)	(-1.802)	(-1.865)	(-0.209)	(-0.948)	(-1.443)	(-1.952)
N	150	144	200	192	325	312	125	120	175	168
Countries	6	6	8	8	13	13	5	5	7	7
adj. R^2	0.239	0.242	0.282	0.256	0.517	0.449	0.668	0.717	0.655	0.632

Note: $\sum_{i=0}^{S} \phi_i^m$ is the sum of the money growth coefficients ($\Delta m_t s$), $\sum_{i=0}^{S} \phi_i^{fm}$ is the sum of the coefficients of the interaction terms ($fd_t \Delta m_t s$) in the inflation equation respectively with their F-statistic of Wald test in the parenthesis. t-statistics in parentheses. ***, **, * indicates 1%, 5% and 10% significance level.

we can see in terms of the signs that with the exception of East Africa, there is a negative relationship between financial development and the effect of money growth on inflation across other African regions. However, this relationship is only significant for West Africa in Columns (5) and (6), and for Southern Africa in Column (10). This means that for West Africa and Southern Africa, the degree of financial development tend to dampen the effect of monetary policy on inflation. For other regions, our empirical results show no statistical evidence of a possible relationship between financial development and monetary policy effectiveness particularly in affecting the level of inflation.

4.3 Discussion of findings

As a recap, the main objective of this paper is to investigate the importance of financial sector development on the effectivenss of monetary policy vis-á-vis output growth and inflation in Africa. Generally, evidence from the panel regressions show that a weak relationship exist between financial development and monetary policy effectiveness in Africa. More specifically, there is no statistical evidence of the relationship for output growth; whereas in the case of inflation, the relationship is weak with only a significant contemporaneous effect. Our finding corroborate with Carranza et al. (2010) in that for less developed countries with underdeveloped financial system, monetary policy effectiveness may have short-lasting impact or in some cases mostly ineffective .

One possible explanation for this outcome can be linked to the abysmal low levels of financial depth in Africa. African countries lags considerable behind their counterparts across the rest of the globe in terms of financial sector development. As highlighted by Mishra et al. (2012), the effectiveness of monetary policy hinges on a well-functioning and competitive financial system. This requires several conditions such as an independent and credible central bank capable of formulating monetary policy as well as influencing public expectations in the direction of the desired monetary policy objectives; a well-functioning money and secondary markets for financial instruments and government securities; a strong institutional environment; higher degree of international financial capital mobility; and exchange rate flexibility etc. In the context of African countries and after various financial reforms implemented over the last three decades, majority of African countries' financial system are still characterized by a small size formal financial sector with less-developed financial markets, limited competition, an oligopolistic banking sector, weak institutional and regulatory environment, limited degree of international financial integration with the global financial markets, and frequent foreign exchange market interventions. By implication, the lack of a well-developed financial system weakens the various monetary transmission channels through the interest rate, asset price and exchange rate. This leaves

the banking channel as the only viable channel for monetary transmission which can be equally impaired by the institutional environment, low degree of competitiom, and degree of substitutability among different bank portfolio assets in the banking sector (Mishra et al., 2012). Hence, a weakening of the bank lending channel will in turn lead to a weakening of the overall monetary transmission mechanism. Recently, Mishra and Montiel (2013) surveys the literature on the effectiveness of monetary transmission in low-income countries, and finds that monetary policy transmission is at best weak in Sub-Saharan Africa (SSA) because of the small size of the financial sector and its inherent structural imperfections.

Other pertinent issues that affect the relationship between financial development and monetary policy effectiveness in Africa include excess liquidity, fiscal dominance and dollarisation (Christensen, 2011). For instance, Saxegaard (2006) show that excess liquidity weakens the monetary transmission in SSA, and constrains the effect of monetary policy on demand conditions in the economy. With high cost of financial intermediation, African banks are more disposed to holding reserves with monetary authorities or government and foreign securities rather than credit lending to the private sector; which when extended, are often for short-term instead of long-term financing of investment capital. Such build-up of excess reserves tend to reflect the underdeveloped nature of financial markets in the continent such as the lack of money and secondary market, an ineffective interbank market, asymmetric information, lack of low-risk lending opportunities, and lack of competition. On the other hand, fiscal dominance tend to crowd out private sector credit, weaken the credibility of monetary authorities, distort monetary policy, and create macroeconomic instability (e.g. increased inflation) as inflation expectations become intrinsically linked to fiscal events and performance. While, greater intensity of dollarisation in an economy severely limits the scope for an independent monetary policy. Thus, increasing the financial depth and alleviating the adverse effects of financial frictions through a strong institutional environment and regulatory framework remains indispensable to meaningful development of the financial sector and the effectiveness of monetary policy as a tool for macroeconomic stabilization.

5 Conclusion

This paper investigates the impact of financial development on monetary policy effectiveness in Africa. The paper is motivated by the mixed evidence from a limited number of studies that have explored the relationship, and more importantly, the considerable lack of empirical evidence on the relationship between financial development and the effects of monetary policy on output growth and inflation in Africa. Therefore, we provide empirical evidence

on financial development and monetary policy effectiveness in Africa using annual data for a panel of 39 countries over the period 1990–2015. Generally, we find a weak relationship between the financial development and the effects of monetary policy on output growth and inflation. In other words, we find no statistical evidence for the relationship between on output growth, while there is a negative relationship in the case of inflation with significance obtained only at their contemporaneous levels. Our findings does not differ significantly after various robustness checks of varying data frequency and sub-samples analysis on the basis of sub-regional groupings of African countries.

Since African countries' financial system are still less developed with its attendant structural imperfections, the effectiveness of monetary policy will remain conspicuously undermined. Therefore, there is need to strengthen the monetary transmission mechanism in African countries through deliberate efforts to deepen the financial sector development, enhance the competitiveness of African financial markets, build strong institutional and regulatory framework that strengthens creditor and property rights, foster the development and smooth functioning of secondary and money markets so as to deepen the influence of monetary policy instruments on market interest rates in the financial sector, and ensuring gradual integration of African financial markets for greater capital mobility.

References

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: monte carlo evidence and an application to employment equations. *Review of Economic Studies*, 58:277–297.

Arnold, I. J. M. (2001). The regional effects of monetary policy in Europe. *Journal of Economic Integration*, 16(3):399–420.

Ashcraft, A. and Campello, M. (2007). Firm balance sheets and monetary policy transmission. *Journal of Monetary Economics*, 54:1515–1528.

Aysun, U., Brady, R., and Honig, A. (2013). Financial frictions and the strength of monetary transmission. *Journal of International Money and Finance*, 32:1097–1119.

Aysun, U. and Hepp, R. (2011). Securitization and the balance sheet channel of monetary transmission. *Journal of Banking and Finance*, 35(8):2111–2122.

Bean, C., Larsen, J., and Nikolov, K. (2002). Financial frictions and the monetary transmission mechanism: theory, evidence and policy implications. ECB Working Paper No. 113 , European Central Bank.

Beck, T., Colciago, A., and Pfajfar, D. (2014). The role of financial intermediaries in monetary policy transmission. *Journal of Economic Dynamics and Control*, 43:1–11.

Bernanke, B. S. and Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4):27–48.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel panel-data models. *Journal of Econometrics*, 87:115–143.

Carranza, L., Galdon-Sanchez, J. E., and Gomez-Biscarri, J. (2010). Understanding the relationship between financial development and monetary policy. *Review of International Economics*, 18(5):849–864.

Cecchetti, S. (1999). Legal structure, financial structure and monetary policy transmission. *Federal Reserve Bank of New York Economic Policy Review*, 5(2):9–28.

Christensen, B. V. (2011). Have monetary transmission mechanisms in Africa changed? BIS Working Paper No. 56, Bank of International Settlement.

Ciccarelli, M., Maddaloni, A., and Peydró, J.-l. (2014). Trusting the bankers : a new look at the credit channel of monetary policy. *Review of Economic Dynamics*, 1:1–24.

Djankov, S., McLiesh, C., and Shleifer, A. (2007). Private credit in 129 countries. *Journal of Financial Economics*, 84:299–329.

Elbourne, A. and de Haan, J. (2006). Financial structure and monetary policy transmission in transition countries. *Journal of Comparative Economics*, 34:1–23.

Gawande, K. (1997). Generated regressors in linear and nonlinear models. *Economic Letters*, 54:119–126.

Heintz, J. and Ndikumana, L. (2011). Is there a case for formal inflation targeting in Sub-Saharan Africa ? *Journal of African Economies*, 20:67–103.

Judge, G., Griffiths, W., Hill, R., Lutkepohl, H., and Lee, T. (1985). *The Theory and Practice of Econometrics*. John Wiley Press, New York.

Karras, G. (1999). Openness and the effects of monetary policy. *Journal of International Money and Finance*, 18:13–26.

Kasekende, L. and Brownbridge, M. (2011). Post-crisis monetary policy frameworks in Sub-Saharan Africa. *African Development Review*, 23(2):190–201.

Kashyap, A. K. and Stein, J. C. (1997). The role of banks in monetary policy: a survey with implications for the European Monetary Union. *Economic Perspectives*, 21(3):2–18. Federal Reserve Bank of Chicago.

Kashyap, A. K. and Stein, J. C. (2000). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, 90:407–428.

Khan, M. S. (2011). The design and effects of monetary policy in Sub-Saharan African countries. *Journal of African Economies*, 20:16–35.

La Porta, R., Lopez-de Silanes, F., Shleifer, A., and Vishny, R. (1997). Legal determinants of external finance. *Journal of Finance*, 52:1131–1150.

La Porta, R., Lopez-de Silanes, F., Shleifer, A., and Vishny, R. (1998). Law and finance. *Journal of Political Economy*, 106:1113–1155.

Loutskina, E. and Strahan, P. (2009). Securitization and the declining impact of bank on loan supply: evidence from mortgage originations. *Journal of Finance*, 64:861–889.

Ma, Y. and Lin, X. (2016). Financial development and the effectiveness of monetary policy. *Journal of Banking and Finance*, 68:1–11.

Masson, P. R. and Pattillo, C. (2005). *The Monetary Geography of Africa*. Brookings Institution Press, Washington, DC.

Mishra, P. and Montiel, P. (2013). How effective is monetary transmission in low-income countries? a survey of the empirical evidence. *Economic Systems*, 37(2):187–216.

Mishra, P., Montiel, P. J., and Spilimbergo, A. (2012). Monetary transmission in low-income countries: effectiveness and policy implications. *IMF Economic Review*, 60(2):270–302.

Ncube, M. (2008). Financial Systems and monetary policy in Africa. African Economic Research Consortium, Nairobi.

Peek, J. and Rosengren, E. S. (2013). The role of banks in the transmission of monetary policy. Public Policy Discussion Papers No. 13–5 , Federal Bank of Boston.

Rodríguez-Fuentes, C. and Dow, S. (2003). EMU and the regional impact of monetary policy. *Regional Studies*, 37(9):969–980.

Saxegaard, M. (2006). Excess liquidity and effectiveness of monetary policy: evidence from Sub-Saharan Africa. IMF Working Paper No. 06/115, Washington, DC.