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A note on the long-run neutrality of monetary policy: new empirics

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Abstract

Economic theory traditionally suggests that monetary policy can influence the business cycle, but not the long-run potential output. Despite well documented theoretical and empirical consensus on money neutrality in the literature, the role of money as an informational variable for monetary policy decision has remained opened to debate with empirical works providing mixed outcomes. This paper addresses two substantial challenges to this debate: the neglect of developing countries in the literature and the use of new financial dynamic fundamentals that broadly reflect monetary policy. The empirics are based on annual data from 34 African countries for the period 1980 to 2010. Using a battery of tests for integration and long-run equilibrium properties, results offer overall support for the traditional economic theory.

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1. Introduction

Economic theory traditionally suggests that monetary policy can influence the business cycle, but not the long-run potential output (Nogueira, 2009). Put in other words, monetary policy is neutral in the long-run. Evidence of this neutrality has been substantially documented in the literature (Olekalns, 1996; Sarletis & Koustas, 1998; Bernanke & Mihov, 1998; Bullard, 1999; Bae et al., 2005; Nogueira, 2009). Despite theoretical and empirical consensus on money neutrality (Lucas, 1980; Gerlach & Svensson, 2003), the role of money as an informational variable for monetary policy decision has remained opened to debate (Roffia & Zaghini, 2008; Nogueira, 2009; Bhaduri & Durai, 2012). Accordingly, empirical studies provide mixed outcomes and findings are contingent on selected countries and historical periods under consideration (Stock & Watson, 1999; Dwyer & Hafer, 1999; Trecroci & Vega-Croissier, 2000; Leeper & Roush, 2002; Bae et al., 2005[2]; Assoumou-Ella, 2012; Mezui-Mbeng, 2013; Nguena & Tsafack, 2014).

In light of above debate, two challenges are central in the literature (Nogueira, 2009). Firstly, but for a few exceptions (Moosa, 1997; Bae & Ratti, 2000; Starr, 2005; Nogueira, 2009), the literature on the long-run money neutrality has focused on developed countries for the most part. Evidence provided by these studies may not be relevant for developing countries because the financial dynamics of monetary policy may not be the same. For instance, financial depth (liabilities) in the perspective of money supply is not similar in developing countries because a great chunk of the monetary base does not transit through the banking sector. Moreover, Weeks (2010) has recently postulated that the standard approach of monetary policy in sub-Saharan Africa (SSA) is absurdly inappropriate since the vast majority of governments in SSA lack the instruments to make monetary policy effective[3].

[2] The case of Sweden in the sample that does not confirm the consensus of long-run money neutrality.

[3] Weeks has asserted that SSA lacks two main channels for implementing monetary policy: (1) seeking to influence the borrowing rates for private sector by adjusting the interest rate at which commercial banks can

Secondly, the empirical investigation focusing on monetary aggregates has not taken into account all financial dynamic fundamentals of monetary policy identified by the Financial Development and Structure Database (FDSD) of the World Bank. For example, 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. The employment of these financial fundamentals is further justified by the substantially documented surplus liquidity issues in developing countries. Accordingly, financial allocation efficiency is a serious concern in developing countries (especially in African financial institutions) because of surplus liquidity (Saxegaard, 2006) and limited financial activity (credit).

The contribution of this paper to the literature is therefore twofold. On the one hand, it assesses the long-run neutrality of monetary policy in a continent (Africa) that has not received the much needed scholarly focus. On the other hand, it employs new financial dynamics that broadly reflect the level of money supply. The rest of the paper is organized as follows. Section 2 highlights the intuition for the empirics, presents the data and discusses the methodology. Empirical analysis is covered in Section 3. Section 4 concludes.

2. Intuition, Data and Methodology

2.1 Intuition for the empirics

While there is vast empirical work on the long-run monetary policy neutrality based on aggregate measures of money supply, there is yet (as far as we have reviewed) no employment of fundamental financial dynamics (that reflect the quantity of money supply) in the assessment of the neutrality theory. To this end, we are aware of the risks of "doing measurement without past empirical basis" and assert that reporting facts even in the absence

borrow from the central bank or; (2) trying to influence the creation of private credit through so-called open market operations.

of past supporting studies in the context of an outstanding theoretical model is a useful scientific activity. Beside this fact, applied econometrics has other tasks than the mere validation or refutation of economic theories with existing exposition and prior analytical frameworks (Asongu, 2014ab). Hence, we provide the economic intuition motivating the use of a plethora of financial measures in the assessment of the long-run neutrality of monetary policy. Accordingly, money supply can be understood in terms of financial depth, financial allocation efficiency, financial activity and financial size. (1) Financial intermediary depth could be seen both from an overall economic perspective and a financial system standpoint. This distinction, as will be detailed in the data section is worth pointing out because, unlike the developed world, in developing countries a great chunk of the monetary base does not transit through the banking sector. (2) Financial allocation efficiency (at banking and financial system levels) 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. (3) Financial activity (from banking and financial system angles) reflects the ability of banks to grant credit to economic operators. (4) Financial size (deposit bank assets/total assets) reflects the credit allocated by banking institutions as a proportion of total assets in the financial system (deposit bank assets plus central bank assets). It follows that financial dynamic fundamentals are exogenous to money supply and hence, monetary policy.

In accordance with the stance 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 providing more justification for the empirics. Consistent with 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 at offsetting output shocks in Africa owing to the substantially documented surplus liquidity issues (Saxegaard, 2006).

The choice of the monetary policy variables is in line with the empirical underpinnings of recent African monetary literature targeting inflation and real GDP output (Asongu, 2014ab). These financial dynamic fundamentals are consistent with all the dimensions identified by the FDSD of the World Bank. Moreover, we are not the first to think out of the box when it comes to the empirics of monetary policy. Blinder (1987) in examining 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).

2.2 Data

We examine a panel of 34 African countries with data from African Development Indicators (ADI) and the FDSD of the World Bank (WB) for the period 1980-2010. Our restriction to only thirty-four countries in the continent is due to constraints in data availability. Summary statistics (with presentation of countries) and correlation analysis are presented in Appendix 1 and Appendix 2 respectively. The descriptive statistics suggest that the variables are quite comparable, with the variations showing that we should be confident that significant estimations would emerge. The correlation analysis presents justifications for our usage of alternative indicators in almost every financial intermediary dynamic for

robustness purposes[4]. Definitions of the variables as well as their corresponding sources are presented in Appendix 3.

Consistent with the literature (Nogueira, 2009), output is measured in terms of real GDP. For clarity in organization, the monetary variables are presented in terms of money (financial depth), credit (financial activity), efficiency (of allocation) and size. Firstly, from a money standpoint, we are consistent with the FDSD and recent African development literature (Asongu, 2014bc, 2013c) 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. While 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 measures because, since we are dealing exclusively with African countries a great chunk of the monetary base does not transit via the banking sector. Secondly, financial intermediary activity is measured in terms credit. Hence, the paper seeks to point out the ability of banks to grant credit to economic operators. We measure both banking-system-activity and financial-system-activity with "private domestic credit by deposit banks: *Pcrb*" and "private credit by domestic banks and other financial institutions: *Pcrbof*" respectively. Thirdly, financial efficiency[5] measures the ability of deposits (money) to be transformed into credit (financial activity) 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'*). Fourthly, financial size is measured in terms of deposit bank assets as a proportion of total assets (deposit bank assets plus central bank assets).

[4] For instance, in the financial depth measurement, money supply is highly correlated with liquid liabilities. This analogy can be extended to financial efficiency and financial activity in which we have employed both banking and financial system measures that can robustly check one another.

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

2.3 Methodology

The estimation technique typically follows mainstream literature on testing the long-run neutrality of monetary policy (Nogueira, 2009). The approach involves unit roots and cointegration tests that assess the stationary properties and long-term equilibriums respectively.

3. Empirical analysis

3.1 Unit root tests

We examine stationary properties with two types of panel unit root tests. When the variables exhibit unit roots in levels, we proceed to investigate their stationary properties in first difference. Both the Levin, Lin & Chu (LLC, 2002) and Im, Pesaran & Shin (IPS, 2003) tests are applied. Whereas the former is a homogenous oriented panel unit root test (common unit root as null hypothesis), the latter is a heterogeneous based test (individual unit roots as null hypotheses). When the results are different, IPS (2003) takes precedence over LLC (2002) in decision making because, with respect to Maddala & Wu (1999), the alternative hypothesis of LLC (2002) is too powerful. In accordance with Liew (2004), goodness of fit (or optimal lag selection) is ensured by the Hannan-Quinn Information Criterion (HQC) and the Akaike Information Criterion (AIC) for the LLC (2002) and IPS (2003) tests respectively.

Table 1 below reports the results of panel unit root tests. It can be observed that with the exception of financial system efficiency, the variables are overwhelmingly non stationary in levels; that is, they exhibit a unit root. This interpretation is substantially consistent for both tests (with homogenous and heterogeneous assumptions). These results highlight the possibility of cointegration (long-run equilibrium) among the variables because according to the Engel-Granger theorem, two variables that are not stationary may have a linear combination in the long-run (Engle & Granger, 1987).

Table 1 – Panel unit root tests

		LLC tests for homogenous panel				IPS tests for heterogeneous panel			
		Panel A: Financial Depth and Efficiency							
Deterministic components		Financial Depth		Financial Efficiency		Financial Depth		Financial Efficiency	
		M2	Fdgdp	BcBd	FcFd	M2	Fdgdp	BcBd	FcFd
Level	c	3.135	3.963	-3.52***	-0.801	2.391	4.516	-2.53***	-1.81**
	ct	4.207	5.563	-0.415	3.555	2.997	4.944	-1.015	-2.75***
First difference	c	-12.78***	-10.88***	-16.00***	n.a	-14.33***	-12.44***	-18.18***	n.a
	ct	-11.63***	-10.73***	-13.97***	n.a	-12.37***	-10.74***	-17.07***	n.a
		Panel B: Financial Activity, Financial size and Real Output							
		Financial Activity		Fin. Size	Real	Financial Activity		Fin. Size	Real
		Pcrb	Pcrbof	Dbacba	Ouput	Pcrb	Pcrbof	Dbacba	Output
Level	c	-0.661	-0.764	3.584	5.358	1.478	0.610	2.789	9.380
	ct	3.029	3.313	2.597	0.447	2.488	2.251	1.486	-0.524
First difference	c	-5.31***	-6.03***	-18.50***	-18.6***	-9.83***	-9.68***	-18.81***	-18.3***
	ct	-3.71***	-4.19***	-12.01***	-15.1***	-7.76***	-7.91***	-13.85***	-15.4***

Notes: *, **, *** denote significance at 10%, 5% and 1% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Maximum lag is 8 and optimal lags are chosen with the HQC for LLC test and the AIC for IPS test. Optimal lag for the most part is 2. 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. Dabcba: Financial Size. Fin: Financial.

3.2 Cointegration tests

Consistent with the cointegration theory, two (or more) variables that exhibit unit roots in levels may have a linear combination (equilibrium) in the long-term. A distant equilibrium indicates permanent changes of one variable affect permanent movements in the other variable. To examine this long-turn relationship, we test for cointegration using both the Engle-Granger based Pedroni and Engle-Granger based Kao tests, which are heterogeneous and homogenous panel-based respectively (Camarero & Tamarit, 2002). Application of both heterogeneous and homogenous tests is in line with our earlier application of both types of tests in the assessment of unit root properties. Accordingly, in event of conflict of interests in the results we base our decision on Predroni (1999) because Kao (1999) has less deterministic assumptions[6]. The same deterministic trend assumptions employed in the IPS (2003) unit root tests are used in the Pedroni (1999) cointegration tests. Optimal lag selection for goodness of fit is by the AIC (Liew, 2004; Asongu, 2013d). The choice of bivariate statistics has a twofold

[6] Whereas Pedroni (1999) is applied in the presence of both 'constant' and 'constant and trend', Kao (1999) is based only on the former (constant).

justification: on the one hand, it is in line with the problem statement and on the other hand, it mitigates misspecification issues in long-run equilibrium estimations[7].

Table 2 below presents the cointegration results. No cointegration test for financial system efficiency and real output is carried out because the former does not exhibit a unit root in levels. Broadly, the results demonstrate the absence of a long-run relationship between monetary policy and real output in terms of GDP. Hence, financial depth (both from money supply and liquid liabilities perspectives), financial allocation efficiency (at banking and financial system levels), banking system activity and financial size do not have a long-run relationship with real output. It follows that, permanent changes in these financial intermediary dynamics (exogenous to monetary policy) do not affect permanent changes in real GDP output in the long-run. Hence, the long-run neutrality of money. The findings are broadly consistent with recent African monetary literature (Asongu, 2014d).

Table 2 – Bivariate panel cointegration tests (Pedroni and Kao Engle-Granger based tests)

	Panel A: Depth, Efficiency and Real Output							
	Financial Depth and Output				Financial Efficiency and Output			
	M2 and Output		Fdgdp and Output		BcBd and Output		FcFd and Output	
	c	ct	c	ct	c	ct	c	ct
	Engle-Granger based Pedroni test for heterogeneous panel							
Panel v-Statistics	-0.791	3.21***	-0.127	3.42***	-1.615	3.62***	n.a	n.a
Panel rho-Statistics	2.544	-0.067	1.832	-0.371	2.432	0.620	n.a	n.a
Panel PP-Statistics	3.391	-1.64*	2.578	-2.39***	3.086	-0.667	n.a	n.a
Panel ADF-Statistics	2.941	-2.95***	2.209	-3.72***	2.058	-2.02**	n.a	n.a
Group rho-Statistics	3.974	2.215	3.463	1.985	4.521	2.808	n.a	n.a
Group PP-Statistics	4.930	-0.377	4.124	-1.198	5.531	0.904	n.a	n.a
Group ADF-Statistics	3.822	-3.11***	3.164	-4.51***	4.218	-2.48***	n.a	n.a
	Engle-Granger based Kao test for homogenous panel							
-ADF t statistics	0.716	n.a	-0.084	n.a	0.541	n.a	n.a	n.a

[7] For instance, multivariate cointegration may involve variables that are stationary in levels (See Gries et al., 2009).

	Panel B: Activity, Size and Real Output					
	Financial Activity and Output				Financial Size and Output	
	Pcrb and Output		Pcrbof and Output		Dbacba and Output	
	c	ct	c	ct	c	ct
	Engle-Granger based Pedroni test for heterogeneous panel					
Panel v-Statistics	-1.045	3.64***	-0.831	3.99***	-1.288	6.04***
Panel rho-Statistics	3.046	0.154	2.843	0.207	1.200	-0.260
Panel PP-Statistics	4.387	-1.554*	4.117	-1.66**	0.865	-1.75**
Panel ADF-Statistics	2.323	-3.70***	2.152	-3.07***	0.376	-5.64***
Group rho-Statistics	4.606	2.567	4.371	2.579	2.433	1.887
Group PP-Statistics	6.245	-0.160	5.941	-0.647	1.377	-1.268
Group ADF-Statistics	2.225	-3.76***	2.240	-3.41***	0.732	-6.55***
	Engle-Granger based Kao test for homogenous panel					
	1.309*	n.a	1.135	n.a	-0.707	n.a

Notes: *, **, *** denote significance at 10%, 5% and 1% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. M2: Money Supply. Fdgdp: Liquid Liabilities. BcBd: Banking System Efficiency. FcFd: Financial System Efficiency. Pcrb: Banking System Activity. Pcrbof: Financial System Activity. Dabcba: Financial Size. PP: Phillips-Peron. ADF: Augmented Dickey Fuller. No deterministic trend assumption. Maximum lags is 8 and optimal lags are chosen via AIC. Optimal lags for the most part is 1, with exceptions of tests for financial system efficiency and financial system activity where 3 and 2 lags are used respectively.

3.3 Robustness checks

In order to ensure that our results are robust, the following checks and observations have been carried out. (1) With the exception of financial size, for every financial dynamic (money, efficiency or credit) two indicators have been employed. Thus, the findings have overwhelmingly encapsulated measures of banking and financial systems. (2) Both homogenous and heterogeneous assumptions have been considered in the unit root and cointegration tests. (3) Optimal lag selection for goodness of fit in the specification of the models has been consistent with the recommendations of Liew (2004)[8]. (4) By employing bivariate analysis in cointegration tests, we have focused on the problem statement and limited cointegration misspecification issues.

[8] "*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).

4. Conclusion

This paper has addressed two substantial challenges to this debate: the neglect of developing countries in the literature and the use of new financial dynamic fundamentals that broadly reflect monetary policy. The empirics are based on annual data from 34 African countries for the period 1980 to 2010. Using a battery of tests for integration and long-run equilibrium properties, results offer overall support for the traditional economic theory of the long-run neutrality of money.

Appendices

Appendix 1 – Summary Statistics and Presentation of Countries

Panel A : Summary Statistics

		Variables	Mean	S.D	Min.	Max.	Obser.
Financial Dynamics	Financial Depth	Money Supply	0.299	0.190	0.001	1.141	938
		Liquid Liabilities	0.228	0.174	0.001	0.948	942
	Financial Efficiency	Banking System Efficiency	0.856	0.517	0.070	5.411	1003
		Financial System Efficiency	0.897	0.505	0.139	3.979	942
	Financial Activity	Banking System Activity	0.176	0.155	0.001	0.869	937
		Financial System Activity	0.200	0.211	0.001	1.739	944
	Fin. Size	Financial System Size	0.686	0.235	0.017	1.609	971
Real Output		Real GDP	9.679	0.667	7.900	11.456	962

Panel B : Presentation of Countries (34)

Algeria, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Ivory Coast, Egypt, Equatorial Guinea, Ethiopia, Gabon, The Gambia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Morocco, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Togo, 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
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)
Financial system size	Dbacba	Deposit bank assets / (Deposit bank assets plus Central bank assets)	World Bank (FDSD)

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		Financial Efficiency		Financial Activity		Fin. Size.	Real	
M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	Output	
1.000	0.972	-0.114	-0.075	0.743	0.627	0.403	0.472	M2
	1.000	-0.129	-0.058	0.789	0.705	0.459	0.492	Fdgdp
		1.000	0.897	0.358	0.298	0.242	-0.119	BcBd
			1.000	0.449	0.507	0.269	0.005	FcFd
				1.000	0.926	0.542	0.469	Pcrb
					1.000	0.479	0.507	Pcrbof
						1.000	0.266	Dbacba
							1.000	Output

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

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