Correcting inflation with financial dynamic fundamentals: which adjustments matter in Africa?

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Abstract

This paper assesses the adjustment of inflation with financial dynamic fundamentals of money (financial depth), credit (financial activity) and efficiency. Three main findings are established. (1) There are significant long-run relationships between inflation and the fundamentals. (2) The error correction mechanism is stable in all specifications but in case of any disequilibrium, only financial depth is significant in adjusting inflation to the long-run relationship. (3) In the long-run, short-term adjustments in the ability of banks to transform money into credit do not matter in correcting inflation. This is most probably due to surplus liquidity issues. Policy implications are discussed.

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1. Introduction

The positive linkage between money and prices is well established in the economic literature. A substantial consensus exists on both the direction and the dimension of the effect of an increase in monetary aggregate (irrespective of the definition adopted) on price movements (Roffia & Zaghini, 2007). The stance that, in equilibrium monetary policy is neutral hinges on the quantity equation which in turn defines a positive "one-to-one" linkage between monetary and price growth over the a long-term horizon. In other words, monetary policy is neutral over the long-run. Despite a theoretical consensus on money neutrality that

has been well documented in empirical literature (Lucas, 1980; Gerlach & Svensson, 2003), the role of money as an informational variable for money policy decision has remained opened to debate (Roffia & Zaghini, 2008; Nogueira, 2009; Bhaduri & Durai, 2012). Indeed empirical works provide mixed results and findings depend on selected countries and historical periods under consideration (Stock & Watson, 1999; Dwyer & Hafer, 1999; Trecroci & Vega-Croissier, 2000; Leeper & Roush, 2002). On a specific note, many studies have concluded that, significant money stock expansions that are not coupled with sustained credit increases are less likely to have inflationary consequences (Bordo & Jeanne, 2002; Borio & Lowe, 2002; Borio and Lowe, 2004; Detken & Smets, 2004; Van den Noord, 2006; Roffia & Zaghini, 2008; Bhaduri & Durai, 2012). This position could be particularly questionable in Africa, given the high surplus liquidity issues the financial system of the continent is facing. Simply put, while inflation has soared in many countries in recent years (Simpasa et al., 2011), surplus liquidity has remained an issue (Saxegaard, 2006).

The current paper is based on the consensus that, money stock expansions that are not coupled with sustained credit increases are less likely to have inflation consequences. Accordingly, we reframe the consensus into an important question policy makers are most likely to ask today. In the long-run, do short-term adjustments in the ability of banks to transform money into credit matter in correcting inflation?

It is important to reframe the consensus with a new question for three main reasons: recent food price hikes; inadequate monetary policy to tackle food inflation and; the debate on inherent inconsistency of monetary policy effectiveness in African countries. Firstly, with the dramatic rise in the price of stable food commodities over the past decade[1], while the literature on the causes and impacts of the crisis in global food prices in the developing world

[1] In fact during the past decade, the world has seen a dramatic rise in the price of many staple food commodities. For example, the price of maize increased by 80% between 2005-2007 and has since soared even further. Many other commodity prices also rose sharply over this period: milk powder by 90%, rice by 25% and wheat by 70%. Such large changes in prices have had tremendous impacts on the incomes of poor households in developing countries (FAO, 2007; World Bank 2008; Ivanic & Martin, 2008).

has mushroomed in recent years (Piesse & Thirtle, 2009; Wodon & Zaman, 2010; Masters & Shively, 2008), we are unaware of studies that have closely examined how financial policies affected consumer prices. Hence, correcting inflation is particularly important in fighting poverty (Funjii, 2011) on the one hand and; on the other hand directly (Ibeh et al., 2007; Acquaah et al., 2008; Musila & Al-Zyoud, 2012) or indirectly (Asongu 2012, 2013a; Bartels et al., 2009; Rolfe & Woodward, 2004; Tuomi, 2011) eases the doing of business in Africa. Secondly, consistent with Von Braum (2008), monetary and exchange rate policy responses were not effective in addressing the recent waves of food inflation. This assertion by the Director General of the International Food Policy Research Institute has also motivated us to reframe the consensus. Thirdly, the debate on the inherent ineffectiveness of monetary policy in African countries has recently gained renewed attention (Weeks, 2010)[2].

Providing an answer to the question motivating the inquiry can advance knowledge along two main avenues: the use of hitherto unemployed monetary policy aggregates and assessing how tackling African over-liquidity issues with financial allocation efficiency policies affect inflation. Firstly, we deviate from mainstream literature that is directly focused on interest rate or exchange rate (e.g Egypt manages interest rates while Lesotho puts greater emphasis on reserves) and employ financial dynamic fundamentals of monetary policy. Hence, to tackle the inquiry the long-run incidences of money (financial depth), credit (financial activity) and efficiency (of allocation) on inflation are tested and associated misalignments are derived in order to examine which short-run adjustments matter in correcting inflation. Secondly, assessment of the problem statement is carefully calibrated to incorporate the substantially documented issue of excess liquidity in African financial institutions that weakens monetary policy effectiveness (Saxegaard, 2006; Agénor et al., 2004; Nissanke & Aryeetey, 1998)[3].

[2] Please see the last paragraphs of Section 2.2.1 below for more insights into the debate.
[3] Please see last paragraph of Section 2.2.2 for more details.

The rest of the paper is structured as follows. A brief review of existing literature on inflation, monetary policy and African business is covered in Section 2. Section 3 presents the data and discusses the methodology. Empirical analysis is covered in Section 4. Section 5 concludes.

2. Inflation, monetary policy and African business

2.1 Inflation as an African business challenge

In this section we devote space to discussing inflation as a risk of doing business in Africa in three main strands. The first highlights some useful statistics. The second strand presents useful theoretical underpinnings motivating the risky character of inflation in doing business. In the third strand, we discuss complementary findings from recent African business literature.

In the first strand, according to The Economist (2012), inflation in Africa has now returned to levels recorded before the commodity price spike in 2007/2008. In sub-Saharan Africa (SSA), the average rate of inflation jumped to 11.7% in 2008 against the backdrop of soaring oil and food prices, but retreated to 8.5% in 2009 as the global downturn mitigated price pressures. The average rate was projected to hover in the horizon of 7.1% between 2010 and 2012. Consistent with The Economist, inflation will remain comparatively high in a global context and will remain vulnerable to fluctuations in commodity and product markets. Accordingly, the ongoing power crisis, severe infrastructure bottlenecks and higher tariffs will contribute to increasing the phenomenon. Data from the World Bank indicates that in Africa only 6.6% of land is irrigated compared with 33.3% in Asia and 15% in Latin America (The Economist, 2012). Recent pressures in food markets have proven inflationary in SSA, especially given the high proportion of disposable income spend on food by Africa's poorer consumers. The issue of whether Africa can become the global food basket is discussed at great length by African leaders, donors and investors.

The second strand highlights theoretical underpinnings on how inflation could help debtors like governments but hurt consumers, producers and paper assets holders. The nexus between inflation and business challenges in Africa will be discussed in three perspectives: how inflation affects businesses, inflation and cost of borrowing and, the cost of inflation on businesses that trade abroad. Firstly, we discuss how the cost of inflation affects businesses in Africa. Constantly increasing prices leads to 'menu costs', where African companies will have to spend money changing and reprinting their prices. Moreover, it also leads to uncertainty, making planning of production difficult. When prices are raised, infuriated consumers blame producers for increasing them. When businesses try to avoid raising prices, it squeezes profits margins and could cause companies to sell commodities for less in real terms than they cost to produce. A policy which may ultimately lead to bankruptcy in the long-term. When the inflation rate is soaring, employees demand higher wages from employers, who are poised to raise prices in order to maintain the profit margin. Secondly, inflation substantially increases the cost of borrowing. On the one hand, borrowing in a high inflation environment implies that businesses will have to generate profits at the height of the inflation rate just to break-even, which in itself is an additional uncertainty. On the other hand, high inflation and the idea that debts would have to be paid-off with cheaper money may encourage businesses to make unsound investments. In many cases, high inflation rates inadvertently turn normally conservative businessmen into wild speculators either based on the cost of doing their normal business or in relation to stock prices or currency fluctuations. Thirdly, inflation could significantly affect the cost of doing business for African companies that trade abroad. Since inflation does not only erode the value of money but also affects the value of a currency relative to other currencies, it is particularly relevant for companies with an export led growth model.

In the third strand, recent African business literature has substantially directly or indirectly documented the peril of inflation in the ease of doing business in Africa. Ibeh et al. (2007) have explored the key factors stimulating initial export activity among Nigerian firms against the backdrop of previous findings and found that proactive stimuli, including growth aspirations, opportunity search among others, predominantly trigger initial export activity among Nigerian firms. Based on the relevance of the theoretical underpinnings highlighted in the first view of the second strand above, it is evident that inflation would seriously deter these proactive stimuli. Acquaah et al. (2008) have examined the impact of the implementation of competitive strategy on organizational performance in response to economic liberalization and found that low-cost and integrated low-cost are positively related to performance (return on assets and return on sales). In light of the second perspective of the second strand above, soaring prices drive cost-push inflation which is inherently detrimental to a low-cost business strategy. Musila & Al-Zyoud (2012) have recently assessed the relationship between volatility in exchange rates and the volume of international trade in SSA and found a statistically significant nexus between the volatility in exchange rates and the volume of trade. Given the positive link between inflation and exchange rate volatility highlighted in the third perspective of the second strand above, less inflation will guarantee some threshold of exchange rate stability which would significantly increase the volume of bilateral trade in the SSA region. Ultimately, low inflation in Africa would improve opportunities for efficient alternative forms of investment in compensation for the failed privatization projects. Consistent with Asongu (2012, 2013a) SSA's share of Foreign Direct Investment (FDI) averages 1% of global flows (Bartels et al., 2009) and there is a pressing need for generation of private capital flows that are complementary to FDI (Rolfe & Woodward, 2004). Low inflation will ease the recommendation of Darley (2012) in the expansion of regional trade arrangements as key to looking outside traditional flows of FDI to

Africa, which have been largely limited by political economy considerations, regulatory uncertainty, skills, labor, regulation and exchange rate volatility (Bartels et al., 2009; Tuomi, 2011).

2.2 Inflation and monetary policy in Africa

2.2.1 Highlights of the debate

Consistent with Asongu (2013b), the debate over the role of money as an informational variable for monetary policy decision can be highlighted in two strands: the traditional discretionary monetary policy strand and, the second strand of non-traditional policy regimes that limit the ability of monetary authorities to use policy to offset output and price fluctuations.

In recent years, the benefits 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 covered substantially. An appealing motivation for 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 example in the former situation, a policy-controlled interest rate can be lowered in an effort to reduce commercial interest rates and stimulate aggregate spending. On the other hand, a monetary expansion that brings down the real exchange rate may improve the competitiveness of a country's products in domestic and world markets and hence, boost demand for national output (Starr, 2005; Asongu, 2013b). Consistent with the empirical literature, as a matter of principle a flexible countercyclical monetary policy can be practiced with inflation targeting (Ghironi & Rebucci, 2000; Mishkin, 2002).

In the second strand, non-traditional policy regimes restrict the ability of the monetary authorities to use policy to offset output and price fluctuations. The degree to which a given country can use monetary policy to affect output in the short-term and prices in the long-run is open to debate. For example, results for the US have shown that, a decline in the key interest rate controlled by the Federal Reserve tends to boost output over the next 2-3 years. However the impact dissipates thereafter so that the long-run effect is limited to prices (Starr, 2005). Accordingly, several studies have examined whether the short-run effects of monetary policy on output in other countries is similar to those in the US. Conflicting results have been found in seventeen industrialized countries (Hayo, 1999). Agenor et al. (2000) have studied two middle-income countries and found no evidence of Granger-causality from money to output, regardless of money used. Hafer & Kutan (2002) have established that interest rate generally plays a relatively more important role in explaining output in twenty OECD countries whereas Ganev et al. (2002) have found no such evidence in Central and Eastern Europe. The International Monetary Fund (IMF) continues to place great emphasis on monetary policy in its programs for developing countries, especially SSA. It considers such policy as crucial in stabilizing the real exchange rate and managing inflation. This IMF approach has been criticized as absurdly inappropriate since the vast majority of governments in SSA lack the instruments to make monetary policy effective (Weeks, 2010)[4].

2.2.2 Monetary policy in Africa

Borrowing from Asongu (2013b), Khan (2011) has recently assessed the relationship between the growth of GDP and different monetary aggregates in 20 SSA economies and found empirical support for the hypothesis that credit-growth is more closely linked than in money-growth to the growth of real GDP. Asongu (2013c) has recently taken a short-run trip

[4] According to Weeks, SSA lacks two main channels for implementing monetary policy: (1) influencing the creation of private credit through so-called open market operations and; (2) affecting the borrowing rates for private sector by adjusting the interest rate at which commercial banks can borrow from the central bank.

to embryonic African monetary zones to assess the Schumpeterian thesis for positive spillovers of financial services on growth. His findings suggest that, while the journey is promising for the East African Monetary (EAMZ), it is lamentable for the West African Monetary Zone (WAMZ). Hence, the results of the EAMZ are broadly consistent with the strand of traditional discretionary monetary policy arrangements whereas those of the WAMZ are in line with the non-traditional strand of regimes in which policy instruments in the short-run cannot be used to offset adverse shocks to output. Mangani (2011) has examined the effects of monetary policy on prices in Malawi and concluded on the lack of unequivocal evidence in support of the conventional channel of monetary policy transmission mechanism. The results further 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[5]. With a slight degree of contradiction, Ngalawa & Viegi (2011) have also examined 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 exclusively on South Africa. In order to demonstrate that monetary expansions and contractions may have different effects in different regions of the same country, Fielding & Shields (2005) have estimated the size of asymmetries across the nine provinces of South Africa (over the period 1997-2005) and found significant differences in the response of prices to monetary policy. Gupta et al. (2010a) have established that house price inflation was negatively related to money policy shocks. Gupta et al. (2010b) have shown that during the period of financial liberalization, interest rate shocks had relatively stronger effects on house price inflation irrespective of house sizes. Ncube & Ndou

[5] Consistent with Mangani (2011) in the short-term, 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-term, 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).

(2010) have complemented Gupta et al. (2010ab)[6] with the emphasis 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. Therefore, the inference that monetary policy tightening can marginally weaken inflationary pressures (resulting from excessive consumption) through the credit and house wealth channels.

While a key economic risk is inflation, a weak monetary policy could also seriously exacerbate economic risks (The Economist, 2012). Consistent with Saxegaard (2006), going beyond acknowledging the threat of increasing inflation, several authors have observed that the abundance of liquidity is likely to have adverse consequences for the ability of monetary policy to influence demand conditions and hence, stabilize the economy[7]. Agénor et al. (2004) for instance note that if banks already hold liquidity in excess of requirements, attempts by the monetary authorities to increase liquidity in a bid to stimulate aggregate demand will prove largely ineffective. In the same vein, Nissanke & Aryeetey (1998) argue that in the presence of excess liquidity, it becomes difficult to regulate money supply using the required reserve ratio and the money multiplier, so that the use of monetary policy for stabilization purposes is undermined. Hence, one would expect excess liquidity to weaken the monetary policy transmission mechanism.

3. Data and Methodology

3.1 Data

We examine a panel of 10 African countries with annual data from African Development Indicators (ADI) and the Financial Development and Structure Database (FDSD) of the World Bank (WB). The resulting balanced panel is restricted from 1980 to

[6] 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) have filled this gap by estimating and quantifying the role of house wealth in South Africa using disaggregated house prices.

[7] Saxegaard (2006) is the only study in the literature that is closest to the current paper. The present study steers clear of Saxegaard in the conceptual framework, methodological underpinnings and data structure.

2010 owing to constraints in data availability. While definition of the variables and corresponding sources are presented in Appendix 2, summary statistics and correlation analysis are detailed in Appendix 1 and Appendix 3 respectively. Countries included in the sample are: Algeria, Egypt, Lesotho, Morocco, Nigeria, Sudan, Tunisia, Uganda, Tanzania and Zambia[8]. Our restriction to these countries is primarily based on the fact that some African countries do not exhibit a unit root in consumer price inflation. Owing to the problem statement of the study, it is imperative to have non-stationary consumer price inflation for consistent modeling. Hence, in accordance with recent African law-finance literature (Asongu, 2011a), CFA franc[9] countries of the CEMAC[10] and UEMOA[11] zones have not been included[12]. Apart from these justifications for eliminating CFA franc countries provided by preliminary analysis and recent theoretical postulations (Asongu, 2011a), 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[13].

[8] Note should be taken of the fact that the Saxegaard (2006) dataset consists of quarterly data from Uganda, Nigeria and countries of the Economic and Monetary Union of Central African States (CEMAC).

[9]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).

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

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

[12]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 (2011a, p.1). Also, before limiting the dataset, we have found from preliminary analysis that, African CFA franc countries have a relatively very stable inflation rate.

[13] "*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).

Consistent with the literature (Bordo & Jeanne, 2002; Hendrix et al., 2009) and the problem statement, the dependent variable is measured in terms of annual percentage change in the Consumer Price Index (CPI). The CPI measures changes in the price level of a market basket of consumer goods and services purchased by households. For clarity in organization, the independent variables are presented in terms of money (financial depth), credit (financial activity) and efficiency. Firstly, from a money standpoint, we are consistent with the FDSD and recent African development literature (Asongu, 2011bc) 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. Financial system deposits are demand, savings and time deposits. These deposits are liquid liabilities of financial institutions because demand for them by depositors is on short notice. It is interesting to distinguish between these two 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 measured in terms of financial intermediary activity. 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 deposit banks and other financial institutions: *Pcrbof*" respectively. Thirdly, financial efficiency[14] measures the ability of deposits (money) to be transformed into credit (financial activity). This third measure effectively enables us to assess the hypothesis under investigation because, by investigating the inflationary incidence of the ability of banks to fulfill their fundamental role of transforming mobilized deposits into credit for economic operators, we are also directly assessing the hypothesis of whether, significant money stock expansions that are not coupled

[14] 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).

with sustained credit increases are less likely to have inflationary consequences. 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'*). The choice of the efficiency and activity indicators is consistent with recent African monetary literature (Asongu, 2013c).

3.2 Methodology

The estimation technique typically follows mainstream literature on the dynamics of inflation (Bernanke & Gertler, 1995; Detken & Smets, 2004; Goujon, 2006). The estimation approach entails the following steps: unit root tests, cointegration tests and vector error correction model (VECM) estimation. The methodology is broadly consistent with the Engle & Granger (1987) theorem. A precondition for the application of a VECM is the presence of cointegration which can be tested if the variables exhibit unit roots.

4. Empirical analysis

4.1 Unit root tests

Accordingly, first-round tests such as unit root tests are required before carrying out a panel VECM-based causality test. Most panel unit root tests are based on an augmented Dickey-Fuller (ADF) unit root test type:

$$\Delta y_{it} = \mu_i + \beta_i t + \rho y_{it-1} + \alpha_{im} \sum_{m=1}^{k_i} \Delta y_{i,t-m} + e_{it} \qquad \text{----- (1)}$$

where $\Delta y_{it} = y_{it} - y_{it-1}$, t is the time trend, k is the lag length and e is the error term. If the null hypothesis (H_0) is not rejected (i.e. H_0: $\widehat{\rho} = 0$) then the series is non-stationary. These tests in our case include Levin, Lin and Chu (2002, LLC) and Im, Pesaran, and Shin (2003, IPS).

We test for stationarity with two types of first generational panel unit root tests. When the variables exhibit unit roots in level, we proceed to test for stationarity in first difference. The application of the Vector Error Correction Model (VECM) requires that the variables

have a unit root (non stationary) in level. Two main types of panel unit root tests have been documented: first generational (that assumes cross-sectional independence) and the second generational (based on cross-sectional dependence). A precondition for employing the latter generational test is a cross-sectional dependence test which is only applicable if the number of cross-sections (N) in the panel exceeds the number of periods in the cross-sections (T). Given that we have 31 periods (T) and 10 cross-sections (N), we focus on the first generational type. To this effect, both the Levin, Lin & Chu (LLC, 2002) and Im, Pesaran & Shin (IPS, 2003) tests are applied. While the former (LLC, 2002) is a homogenous based panel unit root test (common unit as null hypothesis), the latter (IPS, 2003) is a heterogeneous oriented test (individual unit roots as null hypotheses). In case the results are different, IPS (2003) takes precedence over LLC (2002) in decision making because, according to Maddala & Wu (1999), the alternative hypothesis of LLC (2002) is too powerful. Consistent 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 panel unit root tests results. It is observed that, all the variables are non stationary in levels; that is, they exhibit a unit root. However, with regard to the IPS (2003) results, the variables are stationary in first difference. These findings indicate 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).

"Insert Table 1 here"

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-term. A distant equilibrium

indicates permanent movements of one variable(s) affect permanent movements in the other variable(s). To assess this long-turn relationship, we test for cointegration using the Engle-Granger based Pedroni test, which is a heterogeneous panel based test. While we have earlier applied 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 test because, it has less deterministic components. Accordingly, application of Kao (1999) in comparison to Pedroni (1999) presents issues in deterministic assumptions[15]. The same deterministic trend assumptions employed in the IPS (2003) unit root tests are used in the Pedroni (1999) cointegration test. Hence, optimal lag selection for goodness of fit is by the AIC. The choice of bivariate statistics has a twofold justification: on the one hand, it is in line with the problem statement and on the other hand, it mitigates misspecification issues in causality estimations[16].

"Insert Table 2 here"

Results of the cointegration test are reported in Table 2 above. Based on the findings, it is observed that, there is evidence of long-run relationships between either money, credit, or efficiency and inflation. It follows that in the distant future, long-run permanent changes in either money, credit or efficiency affect permanent changes in inflation and vice versa. Hence, the need to assess the short-term adjustments to these equilibriums with the VECM.

4.3 Vector Error Correction Model (VECM)

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

$$Inflation_{i,t} = \beta Money_{i,t} \qquad \text{----- (2)}$$

The resulting VECMs are the following:

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

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

$$\Delta Inflation_{i,t} = \partial(Inflation_{i,t-1} - \beta Money_{i,t-1}) + \varepsilon_{i,t} \quad \text{----- (3)}$$

$$\Delta Money_{i,t} = \sigma(Money_{i,t-1} - kInflation_{i,t-1}) + e_{i,t} \quad \text{----- (4)}$$

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 implies that inflation and money have deviated from the long-run equilibrium; and the ECT helps each variable to adjust and partially restore the equilibrium. The speeds of these adjustments are measured by ∂ and σ for inflation and money respectively. Hence, Eqs. (2) and (3) are replicated for the other two 'finance and inflation' pairs ('efficiency and inflation' and 'credit and inflation'). The same deterministic trend assumptions employed in the cointegration tests are used and optimal lag selection for goodness of fit is consistent with the AIC (Liew, 2004).

The cointegration relations in Panel A of Table 3 have signs that are consistent with the predictions from economic theory. This confirms the existing consensus that money, credit and the ability to transform money into credit (allocation efficiency) all have a positive long-term effect on inflation. Panel B of Table 3 shows feedbacks coefficients for the cointegrating vectors or the short-run adjustments of inflation and its financial dynamic fundamentals. Some adjustments are significantly different from zero, implying that these fundamentals are not weakly exogenous with regard to the parameters of the cointegration relationship in Panel A. In case of any deviation from the long-run equilibrium, these variables respond and adjust the system back to equilibrium. Only the fundamentals of financial depth are particularly significant in adjusting inflation to the equilibrium. The fundamentals of credit and ability of banks to transform money into credit are not significant in adjusting inflation to the equilibrium. Hence, in the long-run, short-term adjustments in the ability of banks to transform money into credit do not matter in correcting inflation. A possible explanation for this outcome is the substantially documented surplus liquidity issues in African financial institutions already discussed in Section 2 (Saxegaard, 2006). This is

confirmed by the insignificance of the credit adjusting estimates of financial activity. Hence, allocation inefficiency and correspondingly, limited financial activity (credit) partially explain these results. The ECTs have the expected signs and are in the right interval for a stable error correction mechanism (See sixth point in Section 4.4 on robustness checks for discussion).

4.4 Robustness checks

In order to ensure that our results are robust, we have performed the following. (1) For every financial dynamic (money, efficiency or credit) two indicators have been employed. Thus, the findings have encapsulated measures of financial intermediary dynamics both from banking and financial system perspectives. (2) Both homogenous and heterogeneous assumptions have been applied in the unit root tests. (3) Optimal lag selection for goodness of fit in model specifications has been consistent with the recommendations of Liew (2004)[17]. (4) By using bivariate analysis in cointegration tests and corresponding VECM estimations, we have focused on the problem statement and limited causality misspecification issues. (5) The fundamentals of money and the hypothesis (allocation efficiency) in explaining inflation adjustments to the long-run equilibrium have been checked with the effect of credit (financial activity). (6) The signs and intervals of the ECTs conform to theory. It is worthwhile laying emphasis on this sixth point. In principle, the speed of adjustment should be between zero and 'minus one' (0, -1) for stable error correction mechanism. Hence, if the ECTs are not within this interval, then the model is misspecified (and needs adjustment), the data is inadequate

[17] "*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).

(perhaps owing to issues with degrees of freedom)[18] or the error correction mechanism is unstable.

"Insert Table 3 here"

4.5 Policy implications

Based on the findings, we confirm the Saxegaard (2006) hypothesis that the presence of excess liquidity in African financial institutions restricts the effectiveness of monetary policy. The finding is also broadly consistent with earlier literature (Agénor et al., 2004; Nissanke & Aryeetey, 1998) that motivated the empirical underpinnings of Saxegaard.

The results of financial depth are consistent with the traditional strand of monetary policy in which discretionary arrangements favor the long-term effect of monetary policy on inflation. This is favorable to arrangements such as international economic integration (monetary unions and inflation targeting for example). Conversely, the findings of financial efficiency and financial activity are consistent with the non-traditional strand of policy regimes that limit the ability of monetary authorities to use policy to offset price fluctuations. Hence, the inability of aggregate financial dynamic fundamentals of efficiency and activity to affect consumer prices is in line with the stance of Week (2010) who views this International Monetary Fund (IMF) oriented approach as absurdly inappropriate because a vast majority of SSA lacks the instruments to make monetary policy effective. Accordingly, since a great chunk of the monetary base in the sampled countries does not transit through the banking system, monetary policy instruments without financial intermediation should also be considered as means of fighting consumer price inflation.

[18] "*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).

It is also interesting to discuss some measures that could be used to tackle the issue of surplus liquidity in African financial institutions. (1) 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. (2) 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[19]; 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.

5. Conclusion

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 inflationary consequences. 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 the ability of banks to transform money into credit matter in correcting inflation? To assess this concern, the long-run incidences of money (financial depth), credit (financial activity) and efficiency on inflation are tested and associated misalignments are derived in order to examine which short-run adjustments matter in correcting inflation. Three main findings have been established. (1) There are significant long-run relationships (equilibriums) between inflation and financial dynamic fundamentals (money, credit and efficiency). (2) The error correction

[19] 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.

mechanism is stable in all specifications but in case of any disequilibrium, only the fundamentals of financial depth (money) are particularly significant in adjusting inflation to the long-run relationship. (3) The fundamentals of financial activity (credit) and allocation efficiency are not significant in adjusting inflation to the equilibrium. Hence, in the long-run, short-term adjustments in the ability of banks to transform money into credit do not matter in correcting inflation. A possible explanation for this outcome is the substantially documented surplus liquidity issues in African banking institutions (Saxegard, 2006). Policy implications have been discussed.

Table 1: Panel unit root tests

		Panel A: LLC tests of homogenous panel						
		Money (Financial Depth)		Credit (Financial Activity		Hypothesis (Financial Efficiency)		Inflation
		M2	Fdgdp	Pcrb	Pcrbof	BcBd	FcFd	
Level	c	3.396	2.616	1.519	1.057	0.346	0.055	-0.271
	ct	3.138	3.820	2.887	2.644	0.701	2.230	0.264
First	c	**-2.255****	**-1.328***	0.431	-0.167	1.096	0.861	3.142
difference	ct	**-1.916****	-0.415	**-3.26*****	**-3.58*****	2.637	1.796	6.848
		Panel B: IPS tests for heterogeneous panel						
		Money (Financial Depth)		Credit (Financial Activity		Hypothesis (Financial Efficiency)		Inflation
		M2	Fdgdp	Pcrb	Pcrbof	BcBd	FcFd	
Level	c	2.926	2.764	3.099	2.279	0.088	-0.011	0.694
	ct	3.131	3.870	3.266	2.963	1.136	1.466	0.833
First	c	**-3.73*****	**-2.115****	**-1.367***	**-1.897****	**-3.24*****	**-1.357***	**-5.55*****
difference	ct	**-2.032****	**-1.367***	-1.223	**-1.947****	**-2.026****	-0.924	**-3.69*****

Notes: ***, **, *denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Maximum lag is 8 and optimal lags are chosen via HQC for LLC test and 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.

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

	Money (Depth) and Inflation				**Credit (Activity) and Inflation**				**Efficiency (Hypothesis) and Inflation**			
	M2 and Inflation		Fdgdp and Inflation		Pcrb and Inflation		Pcrbof and Inflation		BcBd and Inflation		FcFd and Inflation	
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Statistics	-0.484	-1.598	-0.712	-2.066	-0.885	-2.608	-0.639	-2.377	-0.861	-2.447	-1.160	-2.871
Panel rho-Statistics	**-1.445***	**-1.686****	**-1.677****	**-1.630***	**-2.4*****	**-2.12****	**-2.71*****	**-2.09****	**-2.8*****	**-2.9*****	**-2.62*****	**-1.89****
Panel PP-Statistics	**-1.82****	**-3.70*****	**-2.083****	**-3.4*****	**-2.7*****	**-3.6*****	**-2.94*****	**-3.7*****	**-3.1*****	**-4.2*****	**-3.19*****	**-3.7*****
Panel ADF-Statistics	-0.721	**-1.526***	-1.131	**-1.68****	0.202	0.795	-0.399	-0.074	-1.07	**-1.68****	-0.626	0.111
Group rho-Statistics	-0.373	-0.340	-0.797	-0.287	-1.120	-0.561	**-1.764****	**-1.375***	**-1.67****	**-1.525***	-1.208	-0.742
Group PP-Statistics	**-1.534***	**-4.02*****	**-2.36*****	**-4.3*****	**-2.6*****	**-4.5*****	**-3.21*****	**-5.6*****	**-1.91****	**-2.6*****	**-2.75*****	**-6.4*****
Group ADF-Statistics	-0.300	**-1.988****	**-1.313***	**-2.29****	0.703	0.697	-0.140	-0.587	0.041	0.183	0.247	0.508

Notes: ***, **, * denote significance at 1%, 5% and 10% 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. 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.

Table 3: Vector Error Correction Model (Cointegration and short-term adjustment coefficients)

Panel A: Estimates of cointegration relationships

Financial Depth (Money)	Money Supply	24.966 (1.301)	---	---	---	---	---
	Liquid Liabilities	---	25.864 (0.942)	---	---	---	---
Financial Activity (Credit)	Banking System	---	---	36.581 (1.122)	---	---	---
	Financial System	---	---	---	38.041 (1.280)	---	---
Efficiency (Hypothesis)	Banking System	---	---	---	---	23.806 (0.992)	---
	Financial System	---	---	---	---	---	9.867 (0.503)

Panel B: Estimates of short term adjustment coefficients

	D[Inflation]	**-0.213*** (-4.945)**	**-0.208*** (-4.865)**	**-0.205*** (-4.781)**	**-0.204*** (-4.851)**	**-0.163*** (-3.811)**	**-0.187*** (-4.736)**
	D[Money Supply]	**-0.0002*** (-2.563)**	**---**	**---**	**---**	**---**	**---**
Financial Depth (Money)	D[Liquid Liabilities]	---	**-0.0001* (-1.971)**	---	---	---	---
Financial Activity (Credit)	D[Banking System]	---	---	-0.000 (-0.843)	---	---	---
	D[Financial System]	---	---	---	-0.000 (-1.023)	---	---
Efficiency (Hypothesis)	D[Banking System]	---	---	---	---	-0.0001 (-0.388)	---
	D[Financial System]	---	---	---	---	---	-0.000 (-0.612)

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.

Appendices

Appendix 1: Summary Statistics

		Variables	Mean	S.D	Min.	Max.	Obser.
Financial Development	Financial Depth	Money Supply	0.397	0.246	0.001	1.141	267
		Liquid Liabilities	0.312	0.206	0.001	0.948	270
	Financial Efficiency	Banking System Efficiency	0.638	0.349	0.070	2.103	296
		Financial System Efficiency	0.645	0.337	0.139	1.669	270
	Financial Activity	Banking System Activity	0.203	0.190	0.001	0.825	265
		Financial System Activity	0.214	0.200	0.001	0.796	270
Dependent Variable		Consumer Price Index	20.524	32.416	-100.00	200.03	297

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

Appendix 2: Variable Definitions

Variables	Signs	Variable Definitions	Sources
Inflation	Infl.	The Consumer Price Index: CPI (Annual %). It measures changes in the price level of a market basket of consumer goods and services purchased by households.	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). These include demand, savings and time deposits.	World Bank (FDSD)
Banking system allocation efficiency	BcBd	Bank credit on Bank deposits (Private credit by deposit banks/ demand, savings and time deposits).	World Bank (FDSD)
Financial system allocation efficiency	FcFd	Financial system credit on Financial system deposits (Private credit by deposit banks and other financial institutions/ demand, savings and time 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)

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.

Appendix 3: Correlation Analysis

Money		**Hypothesis**		**Credit**				
Financial Depth		Financial Efficiency		Financial Activity		Inflation		
M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Infl.		
1.000	0.987	0.172	0.199	0.776	0.758	-0.357	M2	Financial
	1.000	0.171	0.193	0.779	0.762	-0.380	Fdgdp	Depth
		1.00	0.955	0.674	0.684	-0.205	BcBd	Financial
			1.00	0.697	0.736	-0.211	FcFd	Efficiency
				1.00	0.985	-0.335	Pcrb	Financial
					1.000	-0.339	Pcrbof	Activity
						1.000	Inflation	

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). Infl: Inflation.

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