Financial Innovation and Money Demand: Evidence from Sub-Saharan Africa

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Abstract

While the effect of financial innovation on money demand has been widely researched in industrialised countries, because of its major role in monetary policy, few studies have focussed on developing countries. This is surprising as there has been a considerable growth in financial innovation in Sub-Saharan Africa in recent years, which could have important implications for developing country macroeconomic policy. This paper investigates the development of financial innovation and its impact on money demand in the region using panel data estimation techniques for 34 countries between 1980 and 2013. The results indicate that there is a negative relationship between financial innovation and money demand. This implies that financial innovation plays a crucial role in explaining money demand in Sub-Saharan Africa and given innovations such as mobile money in the region this can have important implications for future policy design.

Keywords: Money demand, financial innovation

JEL Classification: E41

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"Preliminary draft, comments are welcome. Please do not quote"

1. Introduction

The relationship between money demand and its determinants has been widely researched mainly because of its role in monetary policy. Countries that conduct monetary policy through monetary aggregate targeting need money demand to be stable[1]. However, money demand may not necessarily be stable in some countries. There is a growing debate on the breakdown of the traditional money demand with money demand instability an important reason leading to the failure in the monetary aggregate targeting, leading to a number of countries such as New Zealand, United Kingdom, Canada, and Sweden among others moving to inflation targeting (Mishkin, 1999). In addition to money demand instability, the traditional money demand is affected by highly auto correlated errors, implausible parameter estimates and persistent over prediction (Arrau et al, 1995).

Exclusion of an essential variable such as financial innovation could help explain the misspecification of the money demand function (Lieberman, 1977 and Arrau and De Gregorio, 1991). This may be true especially in industrialised countries where financial innovation has been growing rapidly and more recently in developing countries and its inclusion in the money demand specification could be essential in understanding money demand. Indeed, studies based on industrialised countries such as Lippi and Secchi (2009), Attanasio et al (2002) Arrau and De Gregorio (1993) and Alvarez and Lippi (2009) all capture the effect of financial innovation on money demand.

However, few studies have analysed this relationship in developing countries and specifically, Sub-Saharan Africa except for a few country case studies.[2] Moreover Sub-Saharan Africa has seen growth in financial innovations, particularly in the last decade. The financial reforms and liberalization of exchange rate and interest rates in the 1980s and 1990s could have enhanced the financial innovations such as the introduction of ATMs, Debit cards and more recently mobile money that started in Kenya in 2007 and quickly spread to other countries.[3] This growth in financial innovation could have implications for monetary policy especially because most countries in Africa still use monetary aggregate targeting to control inflation except for a few countries such as South Africa, Ghana and Uganda that moved to inflation targeting.

Given the new financial innovations in Sub-Saharan Africa, it is important to revisit the money demand equation not only to determine the effect of these innovations on money demand but to investigate whether exclusion of financial innovation leads to misspecification of the money demand equation. This paper hopes to contribute to existing literature by shedding some light on the relationship between financial innovation and money demand in Sub-Saharan Africa. We explore this important relationship by providing empirical evidence on 34 Sub-Saharan African countries between 1980 and 2013 using panel data estimation techniques and comparing the results with inclusion of financial innovation to those without these innovations. The results have relevant implications for monetary policy in the region. The rest of the paper

[1] This means that money should be predictable and have few explanatory variables that are related to spending and economic activity in the real sector of the economy (Judd and Scadding 1982 and serletis 2007)

[2] These include Kararach(2002), Ndirangu and Nyamongo(2015) and Augustina et al(2010).

[3] Mobile Money provides transactions using cell phone technology to make payments save, pay bills and purchase goods and without necessarily using a bank account(See Jack and Suri, 2011)

is structured as follows. A review of the literature in section 2 followed by the data, model specification and estimation method in section 3. The results and conclusions are discussed in sections 4 and 5 respectively.

2. Literature Review

A stable money demand plays an important role in the conduct of monetary policy and there is a wide range of money demand theories, which share common variables that link the quantity of money demand to the real sector of the economy (Sriram, 2000). Classical economists argued that money is a medium of exchange and developed the transaction demand for money which depicts the relationship between the quantity of money in circulation and the volumes of transactions and price. This was improved upon with the quantity theory of money that relates money to nominal income where income is the primary determinant of money (Serletis 2007).

The second set of theories involves the Keynesians who made a major contribution to the quantity theory of money to include interest rates. Keynesians argued that individuals hold money for three reasons the transaction/business motive, the precautionary motive, and the speculative motive. These motives were based on the role of money for example, the transaction demand and precautionary demand were based on money as the medium of exchange with income playing a major role in determining money demand while the speculative demand was based on the assumption that money is a store of value and that individuals could decide to hold money or bonds. The speculative motive emphasized the role of interest rates in the money demand specification. Most importantly, Keynes argued that the speculative demand assumed that interest rates are negatively related to money demand (Serletis, 2007 and Sriram1999).

A third set of theories, are an extension of the Keynesian theory and are commonly referred to as the post-Keynesian theories of money demand. They are often grouped based on whether money is used as a medium of exchange or a store of value (Sriram, 1999). The theories that are grouped under money as medium of exchange are referred to as transactions theories and these include the Baumol-Tobin model, the shopping time model and the cash in advance models. The portfolio theories assume that money serves as a store of value and these include the overlapping generation models and the Tobin's theory of liquidity preference (Serletis, 2007).

The traditional theories of money demand often include income and interest rates as the main determinants of money demand. However, financial innovation which is often excluded, seems to play a role in explaining money demand especially because there has been growth in financial innovations worldwide. Financial innovation can be grouped into new products, new services, new production processes or new organisational forms (Frame and White 2004)[4].

[4] Other definitions of financial innovation include Arrau and De Gregorio (1991) who define financial innovation to include both technological processes and financial regulation or deregulation. Melnik and Yashiv (1994) who refer to financial innovation as "introduction of new liquid assets that partially replace traditional money in agent's portfolios, technological progress in banking services that reduces the costs of transactions and changes in the

These new innovations could lead to misspecification of the money demand (Arrau et al, 1995). They could also lead to unstable money demand despite its benefits to the economy such as efficiency and low transaction costs(Goldfeld and Sichel, 1990). These undesirable results could be produced by policy makers' decisions if there are unpredictable changes in the money demand due to financial innovation (Hafer and Kutan, 2003).

To solve the problem of shift in the money demand as a result of financial innovation, earlier literature recommended redefining money or including a proxy for reduced transaction costs as a result of financial innovation in the money demand specification (See Judd and Scadding, 1982). This would suggest that excluding this technical change would result in biased money demand results (Lieberman, 1977). This further clarifies the necessity to capture financial innovation in the money demand specification. Inclusion of financial innovation in the money demand specification could help solve issues such as autocorrelated errors, persistent over prediction and implausible parameter estimates (Arrau *et al*, 1995). The relationship between financial innovation and money demand is expected to be negative, because as individuals get more accessibility to money substitutes, they tend to move away from the use of narrow money such as M1, to broad money which results in a decrease in the demand for money. Empirical studies often find a negative relationship between financial innovation and money demand.[5] This has implications for the conduct of monetary policy and strengthens the argument that financial innovation is a vital variable in analysing money demand.

It is not easy to measure financial innovation per se, capturing financial innovation using direct measures such as volume of credit cards may be difficult due to the various forms of innovation that exist such as structural, technological, and social (Lieberman, 1977). Various proxies have been used to measure financial innovation in both industrialised and developing countries for example, ATM concentration, Bank concentration, dummy variables capturing periods of innovation, growth rate in private sector credit, M2/M1 and M3/M1. Studies that have attempted to use ATM concentration include Lippi and Secchi (2009), Fischer (2007), Sichei and Kamau (2012) and Attanansio *et al* (2002). Hafer and Kutan (2003) and Augustina *et al* (2010) use a dummy variable to account for shifts in money demand while Nagayasu (2011) considered bank concentration. Michalopoulos *et al* (2009) capture financial innovation using growth in private sector credit as a percent of GDP, while Arrau *et al* (1995) use a time trend and a stochastic trend that follows a random walk to capture financial innovation.[6] Hye (2009) and Mannah-Blankson and Belyne (2004) use M2/M1 as a proxy of financial innovation.[7] All these studies have used various proxies of financial innovation which further clarifies the difficulty in choosing the appropriate measure for financial innovation.

regulatory environment that facilitate transactions." And, Arrau et al (1995) who refers to financial innovation as permanent changes to the money demand that are not caused by opportunity cost i.e. interest rates and scale variables such as GDP or consumption for the case of a household money demand.

[5] Except a few studies such as Hye (2009) for Pakistan and Mannah-Blankson and Belyne(2004) for Ghana find a positive relationship between financial innovation and Money demand while Augustina et al (2010) find no significant relationship.

[6] Michalopoulos et al (2009) investigate the relationship between financial innovation and endogenous growth.

[7] Mannah-Blankson and Belyne (2004) also use volume of cash cards in addition to M2/M1.

In addition to financial innovation, variables such as income, interest rates and exchange rates are often included in the money demand equations. Income plays an important role in explaining money demand and is often captured using Gross Domestic Product(GDP) or Gross National Product(GNP).The results often follow the money demand theory that predicts a positive relationship between income and money demand, however, the results tend to be mixed when it comes to the magnitude predicted by theory.[8] The coefficients of these studies vary while some have a coefficient of GDP less than 1(see Hamori 2008 and Salisu 2013 for Sub-Saharan Africa; Kumar *et al* 2013 for OECD countries; Fidrmuc 2009 for Central and Eastern European countries; and Hamdi *et al* 2014 for Gulf cooperation council countries), others have a coefficient either equal to 1 or higher than 1(See Mark and Sul 2003 for OECD countries; and Hamori and Hamori 2013, Nautz and Rondorf 2010, and Arnold and Roelands 2010 for EU countries).

As for the opportunity cost of holding money, interest rates are often used to capture the effect of the opportunity cost of holding money on money demand. According to the literature on money demand, this relationship is expected to be negative. Although most studies indicate the correct sign, the coefficient varies but mainly lower than 1[9]. To capture the opportunity cost of holding money in both developed and developing countries, various measures have been used such as the Treasury Bill rate (See Hafer and Kutan 2003; Sichei and Kamau 2012; Kiptui 2014 and Hamdi *et al*, 2014), the long term government bond yield (see Bahmani-Oskooee and Bohl 2000; Nautz and Rondorf 2010; and Arnold and Roelands 2010), and Inflation. Inflation is often used as a proxy for the opportunity cost of holding money because of limited financial markets, lack of well-regulated interest rates and shortage of data on interest rates (See Tahir 1995; Sriram 1999; and Bahmani-Oskooee and Gelan, 2009). This is particularly true in African countries, and recent studies by Suliman and Dafaalla (2011) for Sudan and Bahmani-Oskooee and Gelan (2009) for several African countries and Salisu *et al*(2013) all used inflation as a proxy for opportunity cost of holding money. [10]

The exchange rate is also an important variable in determining the demand for money specifically in open economies. The sign of the exchange rate coefficient is ambiguous with studies such as Narayan *et al* (2009) on South Asian countries finding a positive relationship between the exchange rate and money demand while other studies such as Kumar et al (2013) and Dobnik (2013) for OECD countries, Dreger *et al* (2007) for EU countries, and Salisu *et al* (2013) for Sub-Saharan Africa finding a negative relationship. The sign of the exchange rate is dependent on whether wealth effects or substitution effects are greater. For example if there is evidence of a wealth effect, the sign of the exchange rate is positive implying that a depreciation of the exchange rate leads to an increase in money demand. Put differently, a depreciation in the exchange rate leads to an increase in foreign assets by domestic residents and thus a rise in wealth (Dobson and Ramlogan, 2001). However, if the sign of the exchange rate is negative, then money demand is expected to decline due to the substitutability of domestic currency for

[8] The quantity theory of money predicts that income coefficient is approximately 1 while the Baumol-Tobin model predicts it to be 0.5 (Serletis, 2007).
[9] This is in line with the Bahmol-Tobin model which assumes the coefficient to be negative and equal to 0.5(Serletis, 2007)
[10] Salisu *et al* (2013) use both interest rates and inflation.

foreign currency or bonds since there are higher returns from holding foreign money (Sriram,2000).

To fully comprehend the money demand theory on a regional level, panel data estimation techniques such as the Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS), Dynamic Fixed Effects (DFE), Pooled Mean group (PMG) and Mean group (MG) procedures have been used in the literature. The Pooled Mean group (PMG) estimator by Pesaran *et al* (1999) is often used to generate long run and short run estimates for data with large time series and cross sections where non stationarity may be an issue (Pesaran *et al*, 1999). Unlike the FMOLS and DOLS, no integration test was formally proposed by Pesaran et al (1999), however, the asymptotic properties of the estimator for both stationary and non-stationary regressors was derived (Roudet *et al*, 2007). In addition, Pesaran *et al* (1999) do not exclusively test for cointegration but they do make assumptions for the existence of cointegration. The PMG allows for the identical long run coefficients while the short run coefficients and error variances are allowed to differ across groups. This defers from the Mean group (MG) estimator which is derived by estimating separate equations and calculating their coefficient means (Pesaran *et al*, 1999).

When it comes to panel data with long time dimension, the PMG and MG estimators are often preferred to the traditional panel data methods such as GMM. This is because traditional panel data methods yield inconsistent estimates while MG and PMG estimators yield consistent parameters with long time series and large cross sections .The PMG estimator may also be preferred to the MG with shorter time series since MG estimates tend to be biased with smaller time dimensions (See Asteriou and Hall 2007; and Pesaran *et al* 1999). The main advantage of the PMG over the DOLS and FMOLS is that it is more flexible since it allows for homogeneity in the long run coefficients and heterogeneity only in the short run (Roudet *et al*, 2007). The PMG also allows for the adjustment dynamic between the long run and short run that other panel data methods such as the DOLS and FMOLS do not account for (Bangake and Eggoh, 2012). Studies on money demand that have used the PMG to analyse the long run relationship include Nautz and Rondolf (2010) who investigate the instability of money demand in the Euro Area while Hamdi *et al* (2014) investigates the long run money demand function for the Gulf Cooperation Council countries.[11]

Although panel data estimation techniques have been used widely to analyse money demand particularly in OECD and EU studies, few studies have been done in Africa with exception of Hamori (2008) and Salisu (2013).They investigate the money demand equation with exclusion of financial innovation and yet there has been growth in financial innovations in the last decade that could have an impact on money demand and thus monetary policy. Further investigation is needed to capture the recent financial innovations in Sub-Saharan Africa. The details of the data, model specification and estimation method used are discussed in the following section.

[11] Hamdi et al (2014) also use the DOLS and FMOLS in addition to the PMG to generate estimates.

3. Data, Model Specification and Estimation

3.1 Data

Annual data between 1980 and 2013 for 34 countries was considered for this study. The choice of frequency of the data and the number of countries chosen were all based on the data availability for the Sub-Saharan African countries. We considered the full sample that comprises of the unbalanced panel and the limited sample that comprises of the balanced panel for this study to get a clear understanding of the relationship between financial innovation and money demand. Due to limited data, the balanced panel is only comprised of 17 countries over a period of 34 years (1980-2013). A list of countries with the time period are shown in the Appendix, Table 1. All the variables used in this study were retrieved from the World Bank databank (2015) and a detailed table of the variable description can be found in the Appendix, Table 2.

The choice of the dependent variable, real M1, is based on the money demand theory and empirical literature. M1 is defined by the World Bank databank (2015) as the sum of currency outside banks and demand deposits other than those of the central government. M1 is the most dominant component of money supply in developing countries (Rao and Kumar, 2009). There are some studies that have used M1 to capture money demand such as Rao and Kumar (2009) for Asian countries, and Mark and Sul (2003) for OECD countries. For Sub-Saharan Africa, Hamori et al (2008) employed both M1 and M2 while Salisu *et al* (2013) only considered M1. We capture real M1 by dividing M1 by the consumer price index and then taking the log of the real money variable (LRM1).

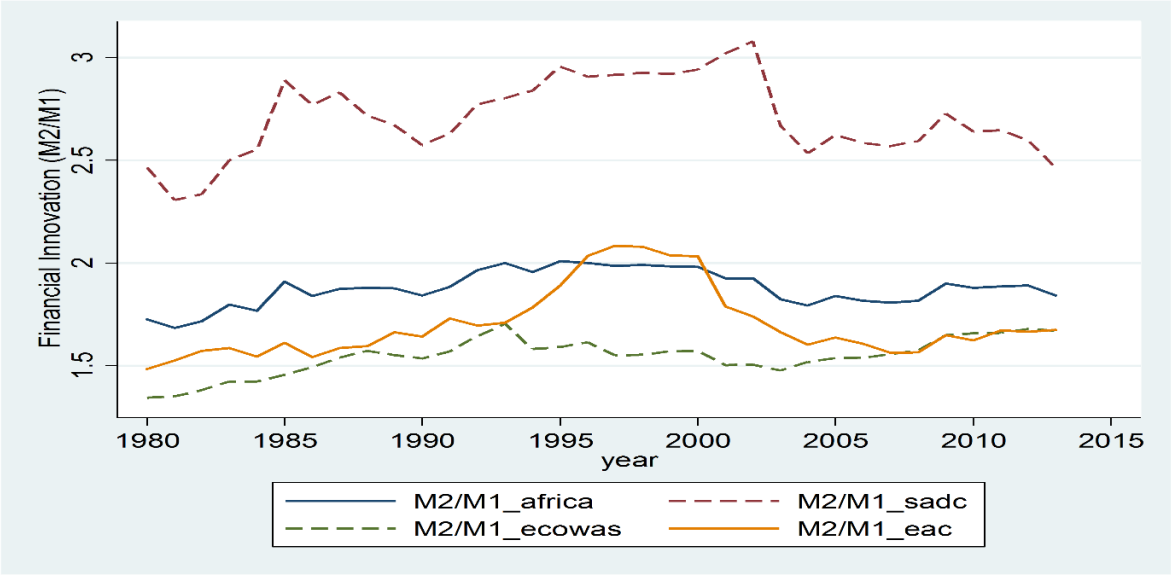
Financial innovation, the main variable of interest is difficult to measure and as mentioned earlier, several proxies are often used to measure financial innovation.[12] We attempt to measure financial innovation using a broader measure (M2/M1) that is readily available for most Sub-Saharan African countries. The motivation for using this measure is that as financial innovations grow, individuals tend to move away from more liquid assets such as M1 to less liquid assets such as M2. The ATMs concentration, bank concentration and private sector credit as a percent of GDP were also considered as alternative proxies for measuring financial innovation. However, the (M3/M1) proxy for financial innovation was not used in this analysis due to the limited data availability.

The increase in financial innovation (M2/M1) started in the 1980s and 1990s during the period of major financial reforms is the region as depicted in Figure I. In addition, there was a rise in innovations in the mid-2000s specifically in the East African region probably reflecting the growth in new technologies such as mobile money. The South African Development Community (SADC) has continuously dominated the region in terms of growth in financial innovation with countries such as Mauritius registering the highest financial innovation

[12] For example Hye(2009) and Mannah-Blankson and Belyne (2004) use (M2/M1) , Michalopoulos *et al* (2009) capture financial innovation using growth in private sector credit as a percent of GDP and Lippi and Secchi (2009), Fischer (2007) use ATMs

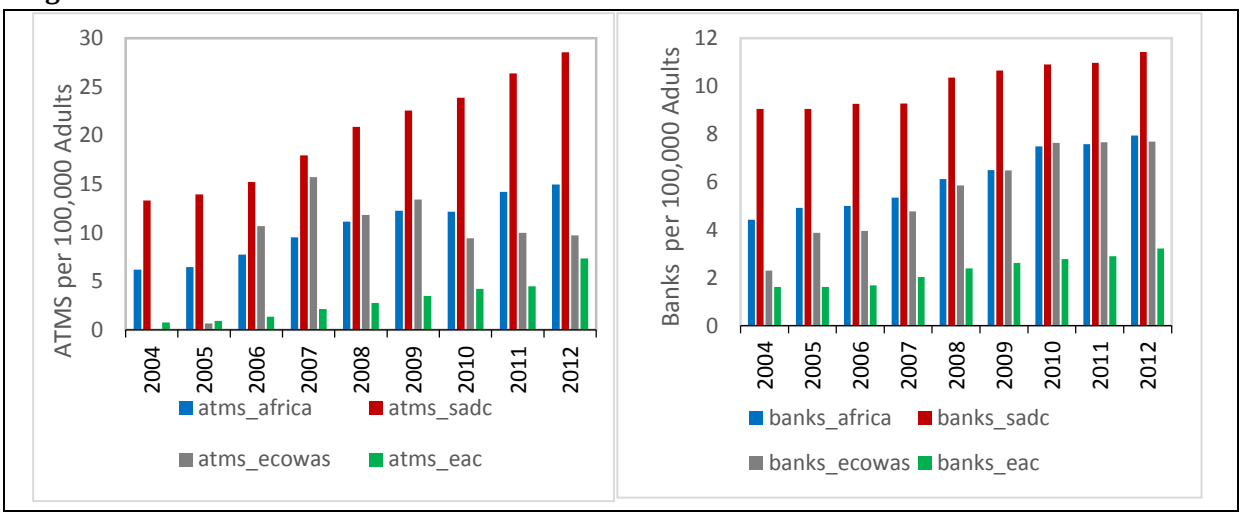
(M2/M1) of 7.3 compared to an average of 1.88 for Sub-Saharan Africa. (See Summary Statistics in Table I)

Figure I: Financial Innovation in Sub-Saharan Africa



Source: Calculated using World Bank Databank (2015). ECOWAS stands for Economic Community of West African States, SADC is the South African Development Community while EAC is the East African Community. All data was based on the 34 countries used in this study

Figure II: Banks and ATM concentration in Sub-Saharan Africa



Source: Calculated using World Bank Databank (2015). ECOWAS stands for Economic Community of West African States, SADC is the South African Development Community while EAC is the East African Community. All data was based on the 34 countries used in this study

The ATM and Bank concentration also depicts a similar picture capturing growth in financial innovation over time highly driven by SADC countries (See Figure II). However, other regions also show an increase in innovation in 2012 compared to 2004. Despite the data limitations especially in terms of the time series available for ATM and Bank concentration, we still use these measures for robustness checks.

Table I: Summary Statistics

	Summary Statistics- Unbalanced Panel				Summary Statistics -Balanced Panel			
	mean	sd	min	max	mean	sd	min	max
Real M1	20.72	2.38	15.2	25.0	20.30	2.65	15.2	24.9
Inflation	10.58	15.21	-17.6	132.8	11.20	16.49	-7.8	132.8
Real GDP	22.12	1.51	18.5	26.5	22.50	1.58	19.4	26.5
Exchange Rate	4.23	2.81	-8.2	9.9	3.29	3.02	-8.2	7.3
Financial Innovation(M2/M1)	1.88	0.94	1.0	7.3	2.17	1.10	1.0	7.3
No. of Countries	34				17			
No. of Obs	993				578			

Source: World Bank Databank (2015).

As for the income variable, it is measured using the log of real GDP captured as the log of GDP at constant 2005 US$(LRGDP) and the log of the nominal exchange rate (LNER) is measured as the average local currency per US$. We use the inflation rate to capture the opportunity cost of holding money rather than the interest rates partly because of the limited data on interest rates for Sub-Saharan African countries and also due to the fact that some of these countries do not have well developed financial markets. The motivation for using inflation is also based on literature on developing countries such as Bahmani-Oskooee and Gelan (2009) and Suliman and Dafaalla (2011) who incorporate inflation. The inflation rate (INF) is based on consumer price index but unlike the other variables used in the study, no logs were taken. Table (I) depicts the detailed summary statistics of all the variables used in the analysis for both the balanced and unbalanced data.

3.2 Model Specification and Estimation

The paper follows a traditional money demand specification by Hamori (2008) as shown in equation (1), where money demand is a function of income, the opportunity cost of holding money and the exchange rate. We also extend it to include financial innovation and consider inflation as the opportunity cost of holding money.

$$\mathrm{LRM1_{it}} = \beta_{0i} + \beta_{1i}\,\mathrm{INF_{it}} + \beta_{2i}\mathrm{LRGDP_{it}} + \beta_{3i}\mathrm{LNER_{it}} + \beta_{4i}\mathrm{FINOV_{it}} + \mu_{it}$$
$$i = 1,2,\ldots,N, \quad t = 1,2,\ldots,T \qquad (1)$$

Where LRM1 represents the log of real money M1, INF represents inflation rate, LRGDP represents the log of real GDP, LNER represents the log of nominal exchange rate and FINOV captures the financial innovation (M2/M1). Based on the money demand theory, we would expect $\beta_{1i} < 0$, $\beta_{2i} > 0$, $\beta_{3i} > or < 0$ and $\beta_{4i} < 0$.

To fully comprehend the effect of financial innovation on money demand, we use three panel data estimation techniques following, the Mean Group (MG), the Dynamic Fixed Effects (DFE) and the Pooled Mean Group (PMG) estimation techniques. Using the MG, DFE and PMG allows us to compare results from the Mean group estimator (MG) estimator that involves estimating separate equations and taking the means of the estimates using ARDL models, the Dynamic Fixed effects estimators (DFE) that allow intercepts to vary while all coefficients are fixed and the Pooled Mean Group (PMG) estimator that restricts all coefficients in the long run

to be equal while allowing for the short run coefficients and error variances for each cross section to vary.

The justification for using alternative estimation techniques such as PMG and MG for data with large time dimensions is that traditional panel data estimation techniques such as the generalized method of moments (GMM) may yield inconsistent results with misleading coefficients with large time series data while PMG and MG are consistent with large cross section and large time series (Pesaran et al, 1999). Similarly, the traditional fixed effects models could produce inconsistent parameters because of the endogeneity between the lagged dependent variable and the error term. However, if the time series component is large, the issue of inconsistent parameters appears to be less of a problem (Pesaran and Smith, 1995).

The pooled mean group estimator is based on a maximum likelihood estimation procedure and it assumes that all the variables are either I (1) or I (0). Assuming the long run money demand function is equation 1, it is necessary to first determine the appropriate lag length using the Akaike Information Criteria (AIC) and the Bayesian Information Criterion (BIC). For example, if the lag length is found to be 1 with an ARDL(1,1,1,1,1) for equation 1, then, the money demand equation can be re-written in equation(2) as follows:

$$\begin{aligned} LRM1_{it} = {} & \alpha_i + \delta_{10i} INF_{it} + \delta_{11i} INF_{i,t-1} + \delta_{20i} LRGDP_{it} + \delta_{21i} LRGDP_{i,t-1} \\ & + \delta_{30i} LNER_{it} + \delta_{31i} LNER_{i,t-1} + \delta_{40i} FINOV_{it} + \delta_{41i} FINOV_{i,t-1} \\ & + \lambda_i LRM1_{i,t-1} + \varepsilon_{it} \end{aligned} \quad (2)$$

And the error correction equation derived from (2) is as follows

$$\begin{aligned} \Delta LRM1_{it} = {} & \phi_i \left(LRM1_{i,t-1} - \beta_{0i} - \beta_{1i} INF_{it} - \beta_{2i} LRGDP_{it} - \beta_{3i} LNER_{it} - \beta_{4i} FINOV_{it} \right) \\ & - \delta_{11i} \Delta INF_{it} - \delta_{21i} \Delta LRGDP_{it} - \delta_{31i} \Delta LNER_{it} - \delta_{41i} \Delta FINOV_{it} \\ & + \varepsilon_{it} \end{aligned} \quad (3)$$

Where,

$$\beta_{0i} = \frac{\alpha_i}{1-\lambda_i} \qquad \beta_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1-\lambda_i}$$
$$\beta_{2i} = \frac{\delta_{20i} + \delta_{21i}}{1-\lambda_i} \qquad \beta_{3i} = \frac{\delta_{30i} + \delta_{31i}}{1-\lambda_i}$$
$$\beta_{4i} = \frac{\delta_{40i} + \delta_{41i}}{1-\lambda_i} \qquad \phi_i = -(1-\lambda_i)$$

Δ Represents first differences while the error term is represented by ε_{it}. Although Pesaran *et al* (1999) do not exclusively test for cointegration they do make some assumptions for the existence of cointegration. They argue that for a long run relationship to exist, ϕ_i should not be equal to zero.

We also compare the PMG results to the DFE and MG. Although the MG estimator is consistent, it can be biased with misleading coefficient estimates in small samples and PMG estimates may appear more efficient if the parameters are homogeneous (Asteriou and Hall, 2007). To determine the most efficient model, a Hausman test is used. If the null hypothesis of

no difference between MG and PMG estimators is rejected, then the PMG estimates are inconsistent and MG estimates are preferred. However, if we fail to reject the null hypothesis then PMG is preferred (Pesaran *et al*, 1999).

Starting with the dynamic fixed effects estimation procedure for the unbalanced panel, a comparison is made between money demand without financial innovation and with financial innovation. The rationale for this is to fully understand the effect financial innovation has on money demand and the implications it would have if it is excluded from the equations. We also account for the exchange rate as indicated in equation 1.

This is followed by the investigation of the effect of financial innovation on money demand using the balanced panel. We repeat the process used from the unbalanced panel but with all the three methods, the DFE, PMG and MG estimators. At this stage we exclude the exchange rate however, it is added in the next set of models comparing the results with and without financial innovation. Using both the full sample and limited sample and three different estimation techniques allows us to investigate the sensitivity of the estimates to fully understand the relationship between financial innovation and money demand. We discuss the results of the regression analysis in the next section.

4. Results

Three sets of results are discussed in this section starting with the results for the full sample (unbalanced data) using the Dynamic Fixed Effects (DFE) estimation procedure depicted in Table (II). This is followed by the limited sample (balanced data) results using the pooled mean group (PMG), Mean Group (MG) and DFE estimation procedures. Table (III) and Table (IV) depict the results without and with exchange rates respectively. We start by assessing the optimum lag length. Using the AIC and BIC lag length criteria tests, we determine that a maximum lag length of 1 has the smallest AIC and BIC values implying that it is the optimum lag length for the regressions. The detailed lag length criteria tests can be found in Appendix, Table 3.

The first set of results depicted in Table (II) compare the models without financial innovation in columns (1) and (2) to those that include financial innovation (M2/M1) in columns (3) and (4). In addition, the exchange rate, one of the determinants of money demand, is included in columns (2) and (4). We also correct for heteroscedasticity by adjusting the DFE standard errors with robust standard errors. The specifications for the models seem appropriate and in line with the money demand theory. The variables are statistically significant except for the exchange rate that is insignificant in the long run and the inflation rate that is insignificant in the short run. The exchange rate could be insignificant in the long run suggesting it does not have a significant impact on money demand. This could be due to the different exchange rate regimes in Sub-Saharan Africa such as the flexible exchange rate regimes in some countries and the fixed exchange rate regimes in others.

The findings indicate that financial innovation plays a crucial role in determining money demand in both the long run and the short run regardless of whether the exchange rate is

accounted for or not. Financial innovation is significant at a 1 percent level in both the long run and the short run. As depicted in columns(3) and (4), a percentage point increase in financial innovation leads to a decline 26.6 percent decline in money demand in the long run. Similarly, the short run results depict a negative relationship between financial innovation and money demand of 26.7 percent and 27.2 percent for columns (3) and (4) respectively. The results are not surprising because they are in line with literature and as financial innovation increases, individuals are likely to move away from more liquid assets to less liquid assets thus leading to a decline in the demand for money.[13]

Table II: Financial Innovation (M2/M1) and Money Demand (Unbalanced Panel Data 1980-2013)

	Dynamic Fixed Effects(DFE)			
	Without (M2/M1)		With (M2/M1)	
	(1)	(2)	(3)	(4)
Long Run Estimates				
Inflation	-0.026***	-0.035***	-0.027***	-0.036***
	(0.009)	(0.012)	(0.009)	(0.012)
Real GDP	1.460***	1.527***	1.433***	1.493***
	(0.162)	(0.205)	(0.119)	(0.159)
Exchange Rate		-0.017		-0.006
		(0.088)		(0.086)
Financial Innovation(M2/M1)			-0.266***	-0.266***
			(0.068)	(0.072)
Short Run Estimates				
D.inflation	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
D.Real GDP	0.281**	0.290**	0.253**	0.262**
	(0.123)	(0.127)	(0.107)	(0.111)
D.Exchange Rate		0.124***		0.138***
		(0.034)		(0.029)
D.Financial Innovation(M2/M1)			-0.267***	-0.272***
			(0.069)	(0.069)
Constant	-1.434***	-1.564***	-1.296***	-1.403***
	(0.317)	(0.331)	(0.267)	(0.260)
Error correction term	-0.130***	-0.126***	-0.131***	-0.125***
	(0.041)	(0.040)	(0.040)	(0.039)
N	993	993	993	993
Number of Countries	34	34	34	34

**p-value<0.10, **p-value<0.05, ***p-value<0.01 (.) represent the standard errors*

Although M2/M1 appears to be the most appropriate broad measure for the proxy of financial innovation in Sub-Saharan Africa, we also investigate the effect of potential measures of financial innovation on money demand such as ATM concentration, Bank concentration and private sector credit as a percent of GDP. The results as depicted in Appendix, Table 4 indicate that Bank and ATM concentration affect money demand positively in the long run and are

[13] The results are similar to Nagayasu (2012) who finds that financial innovation leads to lower money demand in Japan.

insignificant in the short run. This is contrary to our expectations and this could be due to the fact that the results may be inconsistent. As earlier mentioned, fixed effects parameter estimates with lagged dependent variable for a small time series are likely to be inconsistent even with large cross sections though the problem subsides with longer time series (Pesaran and Smith, 1995). The Bank and ATM data is only available annually for a maximum of 9 years between 2004 and 2012 which is a short time period to determine a long run relationship. However, the results could improve with the use of quarterly data. As for private sector credit as a percentage of GDP, it is insignificant in the long run and this could suggest that it may not be a good proxy for capturing these new financial innovations thus it has no effect on money demand.

The findings for inflation indicate that it is significant at a 1 percent level and negatively related to money demand in the long run while income captured by the real GDP has a positive impact on money demand in both the short run and long run.[14] Although the signs and levels of significance are similar between the models with financial innovation (columns 1 and 2) and those without (columns 3 and 4), the coefficients appear to be slightly lower for those with financial innovation. For example, column (1) depicts an inflation coefficient of -2.6 percent compared to -2.7 percent in column (3). Similar to inflation, income coefficients also appear to be lower as a one percent increase in GDP leads to a 1.46 percent increase in money demand as indicated in column (1) while column (3) indicates a 1.43 percent increase.

Similarly, the short run results that capture financial innovation for columns (3) and (4) also appear to be smaller. The difference between the long run and short run results is that the exchange rate is not only significant in the short run but it is also positive. This suggests that there is evidence of wealth effects since a depreciation in the exchange rate leads to an increase in money demand in the short run.

All the models indicate that the error correction term is negative and significant at a 1 percent level. This confirms that there is cointegration and money demand appears to be stable for Sub-Saharan Africa. All the models i.e. columns (1) to (4) indicate that 13 percent of the disequilibrium is eliminated in each short run period. In other words, the speed of adjustment would take approximately 8 years to return to equilibrium.

For the second set of results depicted in Table (III), a limited sample (balanced panel) is used with and without financial innovation. The exchange rate is excluded for all the three estimation techniques earlier mentioned, PMG, MG and DFE. To reduce on the inconsistency between the lagged dependent variable and the error term for the DFE, we used the longest time series data available reducing the number of countries to 17. We also correct for heteroscedasticity by adjusting the standard errors using robust standard errors for the DFE estimator.

The findings in the long run for the models without financial innovation in columns (5), (6) and (7) are similar to the results in Table (I). Inflation and Real GDP are both significant at a 1 percent level, with inflation having a negative effect on money demand while income a

[14] The results are in line with money demand theory and studies such as Hamori(2008) and Salisu et al(2013) find a positive and significant effect relationship between income and money demand in Sub-Saharan Africa while Suliman and Dafaalla (2011) for Sudan and Bahmani-Oskooee and Gelan(2009) for several African countries find a negative relationship between inflation and money demand.

positive effect. The results for the models with financial innovation in columns (8), (9) and (10) also indicate that income is positive and significant in all three models however, inflation is only significant with the PMG and DFE estimators.

Similarly, financial innovation is only significant with the PMG and DFE models. The short run results are also similar to Table (II) results with real GDP positive and significant in all the models while inflation was insignificant in all the models except for column(9) with inclusion of financial innovation. Financial innovation enters negatively into the short run money demand equation with a significance level of 1 percent.

Table III: Financial Innovation (M2/M1) and Money Demand Excluding Exchange Rate (Balanced Panel Data 1980-2013)

	Without (M2/M1)			With (M2/M1)		
	(5)	(6)	(7)	(8)	(9)	(10)
	PMG	MG	DFE	PMG	MG	DFE
Long Run Estimates						
inflation	-0.088***	-0.051***	-0.053***	-0.116***	-0.052	-0.062***
	(0.026)	(0.014)	(0.015)	(0.031)	(0.098)	(0.014)
Real GDP	1.700***	1.995***	1.782***	1.107***	2.492***	1.567***
	(0.242)	(0.308)	(0.344)	(0.167)	(0.882)	(0.214)
Financial Innovation(M2/M1)				-0.148***	-4.078	-0.187*
				(0.053)	(2.742)	(0.100)
Short Run Estimates						
D.inflation	0.000	0.001	0.001	0.001	0.002**	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
D.Real GDP	0.721***	0.473***	0.600***	0.595***	0.366***	0.534***
	(0.154)	(0.136)	(0.119)	(0.117)	(0.127)	(0.118)
D.Financial Innovation(M2/M1)				-0.575***	-0.514***	-0.230***
				(0.113)	(0.109)	(0.060)
Constant	-0.972***	-2.686***	-1.312***	-0.169***	-1.210*	-0.862**
	(0.161)	(0.694)	(0.467)	(0.057)	(0.690)	(0.366)
Error correction term	-0.059***	-0.169***	-0.069***	-0.058***	-0.137***	-0.064***
	(0.010)	(0.027)	(0.022)	(0.009)	(0.046)	(0.020)
N	578	578	578	578	578	578
Number of Countries	17	17	17	17	17	17
Hausman Test	2.23 [a]	0.00 [a]		0.62 [b]	0.00 [b]	
Log-Likelihood	430.520	462.600		646.271	708.795	

**p-value<0.10, **p-value<0.05, ***p-value<0.01 (.) represent the standard errors* . [a] *represents the Hausman Test* $\chi^2_{(2)}$ *between PMG and MG and* [b] *represents the Hausman test* $\chi^2_{(3)}$.

The error correction terms are all significant and negative implying that cointegration indeed exists and money demand appears to be stable as well. However, the error correction terms vary among all the three estimation methods with MG having the fastest speed of adjustment of 14 -17 percent which implies it takes about 6-7 years to return to equilibrium. This is followed by the DFE with an ECM term of 6-7 percent and PMG with 6 percent, implying that it takes about 17-25 years and 17 years respectively for the disequilibrium to be eliminated from the DFE and PMG estimators.

Unlike the MG estimation results, the PMG and DFE results i.e. columns(5) and (7) respectively show that the coefficients are smaller with inclusion of financial innovation compared to the results without financial innovation i.e columns (8) and (10) , this is similar to the full sample results in Table(II). Further investigation was done to determine the most efficient model due to the difference in results between PMG, MG and DFE especially with the inclusion of financial innovation. This is reflected in the fact that PMG and DFE have higher precision and coefficients of similar magnitude while the MG differs somewhat with less precision and a higher speed of adjustment.

The Hausman test was implemented and it indicates that the PMG for this case is more efficient than MG. We fail to reject the null hypothesis of no difference between the MG and PMG estimators for the models with financial innovation and those without. An explanation for this result could be that MG estimators are biased in small samples especially because we use a limited sample. It could also be explained by the fact that PMG is often preferred if the parameters are homogenous despite the fact that MG is consistent (Asteriou and Hall, 2007 and Pesaran et al, 1999).The results also suggest that DFE results are preferred to MG results. Since fixed effects models are likely to have simultaneous bias due to the relationship between the error term and the lagged dependent variable, we tested for the extent of this bias using the hausman test between MG and DFE. We fail to reject the null at a 1 percent level of significance implying that there is indeed minimum bias and the DFE results are preferred to the MG results (Blackburne III and Frank,2007).

The final set of results depicted in Table (IV) follow similar regression specifications as in Table (III) but with addition of the exchange rate. We also correct for heteroscedasticity by using robust standard errors for the DFE results. The long run results do not seem to be as robust as the previous results, however, the inflation rate and Real GDP are significant and with the appropriate negative and positive signs respectively in the long run for all the models. Similar to the Table (II) results, the exchange rate is insignificant in almost all the regressions except for the PMG results in column (11) where it is positive and significant. Financial innovation, the variable of interest, just like the rest of the results, it is negative and highly significant. However, the coefficients are much larger than those in Tables (II) and (III). In contrast to Tables (II) and (III) results, the coefficients between the models with inclusion of financial innovation do not appear to have a clear pattern of slightly lower coefficients than the models without financial innovation. However, what is clear is that the coefficients are rather different between the models with financial inclusion in columns (14), (15) and (16) and those without in columns (11), (12) and (13).

In terms of the short run results, financial innovation and the real GDP are statistically significant at a 1 percent level and are negatively and positively related to money demand respectively as economic theory predicts. However, inflation is insignificant and the exchange rate is only significant and positive with the use of DFE estimation, findings that are similar to the results in Table (II). The error correction terms are also significant and negative with the fastest speed of adjustment recorded by the MG models with 16- 18 percent per year followed by MG and PMG at 7 percent and 2-4 percent respectively.

We checked for the most preferred model using the Hauman test. PMG is preferred to MG while DFE is preferred to MG regardless of whether financial innovation was included or not. Although the results are not as robust in terms of the level of significance in comparison to Table (III) results, the MG results with financial innovation seem to have improved with inclusion of the exchange rate.

Table IV: Financial Innovation (M2/M1) and Money Demand Including Exchange Rate (Balanced Panel Data 1980-2013)

	Without (M2/M1)			With (M2/M1)		
	(11) PMG	(12) MG	(13) DFE	(14) PMG	(15) MG	(16) DFE
Long Run Estimates						
inflation	-0.140***	-0.050***	-0.058***	-0.209**	-0.140*	-0.072***
	(0.051)	(0.017)	(0.014)	(0.103)	(0.079)	(0.015)
Real GDP	0.720*	1.239***	2.036***	2.611***	2.818**	1.768***
	(0.408)	(0.421)	(0.439)	(0.702)	(1.385)	(0.319)
Exchange Rate	0.462**	0.291	-0.108	0.268	-2.082	-0.054
	(0.213)	(0.257)	(0.112)	(0.265)	(1.914)	(0.106)
Financial Innovation(M2/M1)				-3.851**	-3.877*	-0.187**
				(1.852)	(2.318)	(0.093)
Short Run Estimates						
D.inflation	0.000	-0.000	0.001	-0.000	0.001	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
D.Real GDP	0.688***	0.451***	0.630***	0.554***	0.346***	0.557***
	(0.195)	(0.147)	(0.111)	(0.149)	(0.115)	(0.110)
D.Exchange rate	-0.014	-0.017	0.086***	0.008	-0.017	0.100***
	(0.062)	(0.069)	(0.024)	(0.058)	(0.056)	(0.019)
D.Financial Innovation(M2/M1)				-0.570***	-0.517***	-0.231***
				(0.106)	(0.112)	(0.060)
Constant	0.177***	-1.980**	-1.810***	-0.639***	-1.186*	-1.163***
	(0.040)	(0.962)	(0.586)	(0.136)	(0.716)	(0.428)
Error correction term	-0.040***	-0.180***	-0.074***	-0.022***	-0.156***	-0.065***
	(0.010)	(0.025)	(0.016)	(0.005)	(0.047)	(0.015)
N	578	578	578	578	578	578
Number of Countries	17	17	17	17	17	17
Hausman Test	0.92 [c]	0.01 [c]		1.78 [d]	0.01 [d]	
Log-Likelihood	443.352	487.180		658.715	740.656	

**p-value<0.10, **p-value<0.05, ***p-value<0.01 (.) represent the standard errors..* [c] *represents the Hausman Test* $\chi^2_{(3)}$ *between PMG and MG and* [d] *represents the Hausman test* $\chi^2_{(4)}$.

Comparison between Tables (II), (III) and (IV) shows that the PMG and DFE results appear more robust than the MG results. The overrall results do confirm that financial innnovation has an effect on demand for money in Sub-Saharan Africa in addition to the traditional money demand determinants such as income and opportunity cost of holding money. It is negatively related to money demand in both the long run and the short run regardless of the estimation method used. Most importantly, the coefficients of the traditional money demand determinates appear to be sensisitive to the addition of financial innovation, with most results showing a decline in coefficients. This may imply that the exclusion of this variable could indeed lead to biased or misleading estimates of the money demand equation.

5. Conclusions

The relationship between financial innovation and money demand is important especially in the implementation of monetary policy and it has been widely researched. However, few studies have focused on Sub-Saharan African countries, and those that have are generally country case studies. This paper investigates the relationship between financial innovation and money demand in 35 Sub-Saharan African countries between 1980 and 2013, using panel data estimation techniques.

The findings suggest that financial innovation is not only an important variable in determining money demand but that it has a negative effect on the demand for money in both the long run and the short run. These results are not surprising as we would expect individuals to move away from more liquid assets to less liquid assets with growth in new financial innovations and thus lower demand for money. The traditional determinants for money demand such as the opportunity cost of holding money and income were negatively and positively related to money demand respectively as expected. When these results were compared to the models without financial innovation, the coefficients of inflation and income differed somewhat from the models with financial innovation. This could suggest that exclusion of financial innovation, an important variable in determining money demand, may lead to biased estimates specifically because it is highly significant.

The exchange rate does not seem to play a major role in determining money demand in the long run. However this could be due to the fact that countries with different exchange rate regimes were included in the sample. Country case studies could produce results with better precision. It is important for the money demand function to be stable for monetary policy to be carried out effectively. There was evidence of stability of the money demand with all the error correction terms negative and significant. However, the degree of the speed of adjustment varied across the different methods. Although there is evidence of cointegration for Sub-Saharan countries as a region, it is not necessarily true for particular country case studies.

These findings have important policy implications for future policy design given new innovations such as mobile money in the region. Exclusion of financial innovation means that it is more difficult to conduct monetary policy. The money demand specification may not be well specified with biased estimates due to the removal of a relevant variable. Although, Sub-Saharan African countries such as Ghana, Uganda and South Africa have moved towards inflation targeting, monetary aggregates still remain relevant in guiding policy makers.

There are limitations to this analysis such as the differences in the types of financial innovations across African countries. Using general proxies to measure financial innovation such as M2/M1 may not bring out the true impact of a particular country's effect of financial innovation on money demand. In other words, what is true for the region, may not necessarily be true for a particular country especially in light of the new country specific financial innovations such as mobile money for Kenya. In addition to the different types of financial innovations in each country, another drawback in this study is that evidence of an effect of financial innovation on Sub-Saharan Africa does not necessarily imply evidence of this effect for each particular country in the region. Further work may need to be done using country case studies to

investigate the effect of a specific type of financial innovation on money demand rather than relying on the broader measures of financial innovation.

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Appendix

Table 1: Sub-Saharan African Countries

Unbalanced Panel :		Balanced Panel: (1980-2013)
Benin (1993-2013)	Mali (1989-2013)	Botswana
Botswana (1980-2013)	Mauritius (1980-2013)	Burkina Faso
Burkina Faso (1980-2013)	Mozambique(1989-2013)	Burundi
Burundi (1980-2013)	Namibia (2003-2013)	Cameroon
Cabo Verde (1984-2013)	Niger (1980-2013)	Cote d'Ivoire
Cameroon (1980-2013)	Nigeria (1980-2013)	Gambia, The
Central African Republic (1981-2013)	Sao Tome and Principe (2000-2013)	Ghana
Chad (1984-2013)	Senegal (1980-2013)	Kenya
Comoros (2001-2013)	Seychelles (1980-2013)	Mauritius
Cote d'Ivoire (1980-2013)	South Africa (1980-2013)	Niger
Equatorial Guinea (1986-2013)	Sudan (1980-2013)	Nigeria
Gabon (1980-2013)	Swaziland (1980-2013)	Senegal
Gambia, The (1980-2013)	Tanzania(1988-2013)	Seychelles
Ghana (1980-2013)	Togo (1980-2013)	South Africa
Guinea-Bissau (1988-2013)	Uganda (1994-2013)	Sudan
Kenya (1980-2013)		Swaziland
Liberia (2002-2013)		Togo
Madagascar (1980-2013)		
Malawi (1981-2013)		

Table 2: Variable Description

Variable Name	Description	Abbreviation
Real M1	log of (M1/CPI)	LRM1
Inflation	Inflation based on CPI	INF
Real GDP	log of GDP at constant 2005 US$	LGDP
Nominal Exchange Rate	log of the average local currency per US$	LNER
Financial Innovation(M2/M1)	M2/M1	FINOV
Financial Innovation(psc)	domestic credit to private sector by banks as a percentage of GDP	PSC
Financial Innovation(M3/M1)	M3/M1	M3/M1
Financial Innovation(ATMs)	Log of Automated Teller Machines per 100,000 adults	LATMS
Financial Innovation(Banks)	Log of commercial bank branches per 100,000 adults	LBANKS

Source: World Bank Data Bank (2015)

Table 3: ARDL Lag Selection

		Without (M2/M1)				With (M2/M1)		
		N	AIC	BIC		N	AIC	BIC
ARDL	**Lag Selection Including exchange rates**							
PMG	ARDL(1,1,1,1)	561	-870.703	-836.066	ARDL(1,1,1,1,1)	561	-1297.431	-1254.134
	ARDL(2,2,2,2)	544	-489.273	-454.881	ARDL(2,2,2,2,2)	544	-1030.594	-987.604
	ARDL(3,3,3,3)	527	155.608	189.745	ARDL(3,3,3,3,3)	527	-447.963	-405.291
MG	ARDL(1,1,1,1)	561	-958.360	923.722	ARDL(1,1,1,1,1)	561	-1461.312	-1418.015
	ARDL(2,2,2,2)	544	-547.136	-512.744	ARDL(2,2,2,2,2)	544	-1144.239	-1101.250
	ARDL(3,3,3,3)	527	106.302	140.439	ARDL(3,3,3,3,3)	527	-524.531	-481.859
ARDL	**Lag Selection Excluding Exchange rates**							
PMG	ARDL(1,1,1)	561	-849.041	-823.062	ARDL(1,1,1,1)	561	-1276.541	-1241.903
	ARDL(2,2,2)	544	-466.395	-440.601	ARDL(2,2,2,2)	544	-976.414	-942.023
	ARDL(3,3,3)	527	171.249	196.852	ARDL(3,3,3,3)	527	-377.944	-343.806
MG	ARDL(1,1,1)	561	-913.201	-887.222	ARDL(1,1,1,1)	561	-1401.589	-1366.951
	ARDL(2,2,2)	544	-498.789	-472.995	ARDL(2,2,2,2)	544	-1063.540	-1029.149
	ARDL(3,3,3)	527	153.417	179.020	ARDL(3,3,3,3)	527	-423.049	-388.911

Table 4: Results using Alternative Measures for Financial Innovation

	ATMS(2004-2012)		Banks(2004-2012)		Psc(1980-2013)	
	(1)	(2)	(3)	(4)	(5)	(6)
Long Run Estimates						
Inflation	-0.013**	-0.014	-0.026*	-0.025*	-0.033***	-0.045***
	(0.006)	(0.009)	(0.014)	(0.014)	(0.009)	(0.015)
Real GDP	0.885***	0.771**	0.961***	0.956***	1.502***	1.560***
	(0.278)	(0.370)	(0.270)	(0.333)	(0.195)	(0.270)
Exchange Rate		0.086		0.025		0.028
		(0.215)		(0.280)		(0.101)
ATMs Concentration	0.134***	0.151***				
	(0.052)	(0.055)				
Bank Concentration			0.229***	0.241***		
			(0.064)	(0.069)		
Private Sector Credit growth					-0.008	-0.010
					(0.009)	(0.010)
Short Run Estimates						
D.inflation	0.003**	0.003**	0.002*	0.002*	0.001*	0.001**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
D.Real GDP	0.356	0.404	0.364	0.347	0.285**	0.292**
	(0.252)	(0.290)	(0.244)	(0.242)	(0.120)	(0.127)
D.Exchange Rate		-0.071		-0.069		0.143***
		(0.108)		(0.084)		(0.033)
D.ATMs concentration	-0.024	-0.025				
	(0.033)	(0.034)				
Banks concentration			0.019	0.021		
			(0.062)	(0.062)		
Private Sector Credit growth					0.006***	0.007***
					(0.002)	(0.002)
Constant	0.558	1.639	-0.112	-0.116	-1.313***	-1.367***
	(3.303)	(3.924)	(1.802)	(1.983)	(0.230)	(0.204)
Error correction term	-0.526***	-0.506***	-0.294***	-0.291***	-0.113***	-0.105***
	(0.096)	(0.104)	(0.107)	(0.104)	(0.039)	(0.038)
N	193	193	267	267	945	945
Number of Countries	27	27	30	30	32	32

**p-value<0.10, **p-value<0.05, ***p-value<0.01 (.) represent the standard errors*