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Financial Innovation and the Stability of Real Money Demand in Cameroon

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Abstract

This paper examines Financial Innovation and the Stability of Real Money Demand in Cameroon using annual secondary data from the world development indicators covering the period 1979 to 2018. Relying on the Autoregressive Distributive Lag Technique (ARDL), financial innovation signalled a negative and significant effect on real Broad money demand (M2) while real GPD had a positive and significant effect on real M2 demand. The results echoed from the stability checks using CUSUM and CUSUMQ techniques indicated that real M2 is stable despite financial innovations. With the aid of the error correction technique (ECT), the paper estimates the speed that the market may take to eliminate exogenous and endogenous shocks in real M2 demand. The study recommends that authority should use money supply as an instrument of monetary policy since the demand for real M2 is stable in Cameroon.

Keywords: Financial Innovation, Real Money Demand, stability, ARDL, Co-integration Cameroon
JEL Classification: C39, E41, E44

01. Introduction

The demand for money is an important element and prerequisite for formulating and conducting macroeconomic policy. Succinctly, the relationship between the demand for money and its main determinants is an important building block in macroeconomic theories and is a crucial component in the conduct of monetary policy (Goldfeld, 1994). Thus, understanding the robust determinants of demand for money and its stability can inform the setting of monetary policy. In this light, Tahir et al. (2018) argued that money demand is an important function of stabilization and structural adjustment policies where such policies depend on the ability to adjust money supply to its demand in order to prevent monetary disturbances from affecting real output. Conventionally, a good understanding of the stability and robust determinants of the demand for real money balances forms the core in the conduct of monetary policy as it enables a policy-driven change in monetary aggregates to have predictable influences on output, interest rate, and ultimately price through transmission mechanism (Sriram, 1999; Nachega, 2011). To this end, Poole (1970) argued that to diminish fluctuations in the level of economic activity, money supply (rate of interest) should be used as an instrument of monetary policy when the liquidity preference and money supply curve (LM) relation is stable (unstable). Since instability in the demand for money is a major factor contributing to instability in the LM, therefore it is important to test for the stability of the money demand function. Using an incorrect instrument will cause more instability in the country's output (Poole, 1970).

According to IMF (2018), the demand for broad money (M2) in Cameroon increased by about 10% between 1970 and 1980, after which it decreased to 22.9 percent in 1990. From 1990, following the devaluation of the FCFA coupled with the political crisis of 1992, M2 deceased sharply to about 12% between 1990 and 1997 before rising to 22.9 percent in 2000 and continued hovering at 13.2 percent and 36.4 percent between 2010 and 2012. In 2013, M2 increased sharply to 40.8 percent in 2015 and has been increasing steadily at 13.5 percent up to 2018. The recent financial innovations such as E-Banking have greatly impacted the shape and nature of the money demand function. Financial innovation means the inclusion of new financial instruments in financial intuitions and markets through new technologies. It includes process, product and institutional innovation (Tahir, 2018). As a result, several empirical studies have started including financial innovation in the money demand function. Exclusion of financial innovation in the money demand function could lead to misspecification of the money demand through over estimation, termed by Myint (1970) as "missing money". In the same vein, with new regulations, improved baking systems and financial markets as well as increased cell phones and Automated Teller Machine usage, there is remarkable progress in the financial landscape of Cameroon. Therefore, empirically characterizing the demand for real money demand using Cameroon data and restating the relation between money demand and its explanatory variables will enable us to better appreciate the relationship. While most research has yielded great depth to the money demand literature, a vital question that is worth investigating is whether the demand for money is still stable given the recent financial innovation that has occurred over the last decade in Cameroon. Given the limited number of studies, this paper contributes to the relevant literature by re-estimating the Cameroonian real money demand including the standard financial innovation proxies. In this light, the main objective of this paper is therefore to review and provide an empirical basis for the characterization of the demand for real money balances incorporating financial innovation using Cameroon data. The specific objectives include:

- To specify and estimate long and short-run real demand function for money in Cameroon using cointegration and error-correction techniques,
- To ascertain the sprint and duration that real money demand would take to adjust in response to any stupor and
- To examine the stability of real money demand in Cameroon despite financial innovation.

The rest of the paper is organized as follows: Section two of the paper announces the empirical literature reviews both from the theoretical and empirical fronts. The methodology of the study is formulated in Section three. Section four presents and discusses the results, and the conclusion and policy recommendations are presented in Section five.

02. Literature Review

2.1 Theoretical underpins

Money demand theories have evolved overtime. Fisher (1911) provides the earliest quantity theory of money demand through the equation of exchange. Fisher (1911) argues that the demand for money is solely a function of income. However, it is worth noting that the concept of money holdings started taking a formal shape in the quantity theory by Pigou (1917). In another development, Keynes (1936) develops the liquidity preference theory of money demand. We shall glance through the major theories with emphasis on Keyne's theory where this study is anchored.

We commence by reviewing the Neo-classical monetary theory whose main aim is to trace the nature of money, its functions, monetary policy, and the demand for real money balances. According to Adam (2000), the cornerstone of neoclassical is based on the tenets of classical theory which assumes perfect competition, use of real variables in decision making and application of representative agent models with agents that have the same preferences and act alike in every way. The starting point of the Neo-classical theory is the famous *ad-hoc* relation for quantity equation of exchange. Fisher (1911) introduced the transactions version of the equation of exchange. Also called the quantity theory of money, the theory states that the quantity of money is the main determinant of the price level or the value of money. Any change in the quantity of money produces an exactly proportionate change in the price level. The main notion of fisher's theory is that money is held simply to facilitate transactions and has no intrinsic value per se. The Fisherian quantity theory has been subjected to severe criticisms by economists. For instance, Keynes argued that the theory is a mere truism because it states that the total quantity of money (MV) paid for goods and services must equal their value (PT). But it cannot be accepted today that a certain percentage change in the quantity of money leads to the same percentage change in the price level.

Cambridge economists such as Pigou (1917) and Marshall (1920) developed a different approach to the quantity theory of money known as the Cambridge approach. In the Cambridge approach, the key determinant of people's taste for money holding is the fact that money is a convenient asset to possess as it is universally accepted in exchange for goods and services. Depending on the volume of transactions an individual is willing to conduct, the demand for money varies with the level of his wealth and with the opportunity cost of holding money. In contrast with Fisher's formulation, the velocity *(V)* is now the "income velocity of circulation" determined by technological and institutional factors and is assumed to be stable. Given that the real income *(y)* is at the full employment level and *(V)* being fixed, an increase in the quantity of money results in a proportional increase in price level *(P)*—that is, money is "neutral"—the familiar quantity theory exposition. The emphasis the Cambridge formulation places on the demand for money is remarkable because it influences both the Keynesian and the Monetarist theories.

Keynesian monetary economics revolves around the *liquidity preference theory-Keynesian demand for money*- introduced in the monetary sector (Adam, 2000). The liquidity preference explains why people individually express demands for money; i.e. the motives for money as liquid asset (Akinlo, 2006). Keynes built upon the Cambridge approach to provide a more rigorous analysis of money demand, focusing on the motives for holding money (Keynes,1936 and Ghatak, 1981). Keynes postulated three motives for holding money: transactions, precautionary and speculative purposes. He also formally introduced the interest rate as another explanatory variable influencing the demand for real cash balances. In particular, 1) individuals will demand money to finance their daily purchases of goods and services, which depends on the level of income; 2) individuals will demand money as a contingency against unforeseen expenditures, which also depends on the level of income; and 3) individuals will hold money as a store of wealth, the speculative motive, which depends on the rate of interest. The speculative or asset motive for holding money arises because people dislike risk. Economic agents may be prepared to sacrifice a high average rate of return to obtain a portfolio with a low but more predictable rate of return. Hence, individuals choose their portfolios to balance more certain but lower returns with higher but riskier ones (Hendry, 2005). The opportunity cost of holding money is the interest given up by holding money rather than financial assets. The speculative demand for money which depends on the rate of interest was the major innovation by Keynes.

Following Keynes proposition, a number of models were developed to provide alternative explanations to confirm the formulation relating real money balances with real income and interest rates. These models can be classified into three separate frameworks, namely: transactions, asset and consumer demand theories of money (Sriram, 2001). Under the transaction's theory of money demand framework, the inventory-theoretic approach (Baumol, 1952 and Tobin, 1956) and the precautionary demand for money (Tobin, 1958) models were introduced. These models were derived from the medium of exchange function of money. The asset function of money led to the asset or portfolio approach where major emphasis is placed on risk and expected returns on assets (Tobin, 1958). Alternatively, the consumer demand theory approach (Friedman, 1956 and Barnett, 1980) considers the demand for money as a direct extension of the traditional theory of demand for any durable good. According to the Modern Monetarists view (Laidler, 1993) which is essentially a mere sophisticated version of the Classical Quantity Theory, the demand for money is necessary only to finance transactions, and it is considered as being related to a few key variables in a stable manner.

They argue that the demand for money is no longer a function of solely the interest rate and income, but that the rate of return on a much wider spectrum of physical and financial assets would influence Individuals' demand for money. In this regard, money is seen as a substitute for all other assets and the demand for it is therefore a function of the rate of return on all these assets.

Despite the different angles of the approaches to money demand, it has been observed that real income and the rate of interest or return constitute the main ingredients in the analyses of both the neoclassical and variants of the neo Keynesian schools of thought (Laidler, 1993). The resulting implication of all the models is that the optimal stock of real money balances is positively related to real income and inversely related to the nominal rate of return or interest. One consensus that emerges from the literature is that most empirical works are motivated by a blend of theories (Sriram, 2001).

2.2 Empirical review

Empirical literature on the demand for money is well articulated both in the developed and developing economies. However, there are few studies in literature that augment the conventional money demand function with financial innovation. Exclusion of financial innovation in the money demand function could lead to mis-specification of the money demand through over estimation, commonly referred to as "missing money" (Arrau and De Gregorio, 1991). Empirical evidence suggests that financial innovation ought to be included in the money demand function to help solve some of the issues faced by money demand specification such as persistent over prediction and implausible parameter estimates (Arrau et al, 1995). Since measurement of financial innovation is not easy per se, a number of proxies have been used in the relevant literature such as number of ATMs, M3/M1, M1/M2, bank concentration and a dummy variable *inter alia* to capture financial innovation. One attempt by Sichei et al. (2012) to account for financial innovation in the money demand function for Kenya found that ATM proxy for financial innovation only had an impact on M1 but no evidence was found for the other measures of money. Similarly, Ndirangu and Nyamongo (2015) also found no effect of financial innovation on money demand using currency outside banks/time deposit ratio as a proxy for financial innovation. However, Weil et al (2012) who used Safaricom data to compute M-PESA velocity find that mobile money has a minor systematic effect on monetary policy in Kenya due to the fact that mobile money is sufficiently small. They however argued that this conclusion may change in the future as mobile money progresses to more than a payment platform hence increasing the number and values of mobile money. Mannah et al. (2004) for the case of Ghana find that financial innovation has a positive effect on money demand using M1. However, with the use of M2, their results indicate a negative relationship. Trying to justify their results, the authors claim that with improved innovation in the payments systems, money demand is likely to be higher for more liquid monetary aggregates compared to the less liquid ones. Safdar and Khan (2014) used a single Co-integration technique to investigate the stability of money demand function in Turkey from 1950 to 2002. The result of their first model announced that both the numbers of ATM and cards are negatively related to the demand for money.

In an attempt to re-estimates the relationship between financial innovation and money demand in Kenya with a focus on mobile money, Kasekende (2016) employed quarterly data from 2000Q1 to 2014Q2. Adopting the ARDL approach, the results suggest that money demand is stable. However, this was only evident with inclusion of mobile money which is not only positively related to money demand but also leads to a decrease in the interest rate elasticity of demand

Quantifying the impact of innovative methods of payments on the efficiency ratio (ER) in Pakistan, Tahir et al. (2018) used annual Secondary data issued by the State Bank of Pakistan for the period 2007-2016. Their result signalled a significant positive relation of transactions on the Web/Internet on ER. But the results for Automated Teller Machines (ATM), Point of Sale (POS), and Mobile Banking (MOB), were found to be statistically non-significant.

Therefore, findings on money demand with the inclusion of financial innovation have mixed results. This further warrants us to verify the direction of this relationship using Cameroon data. Empirical literature, which is policy oriented, on the demand for money in Cameroon is scarce. Moreover, no study, at least to the best of my knowledge has augmented the money demand function for Cameroon with financial innovation. It is one of our goals to further reduce the extent of this scarcity. The next section examines the methodology used in our study.

03. Methodology

3.1 Data Collection

The study employs annual secondary data sourced from the world development indicators (WDI, 2018) whose individual data are extracted from international financial statistics, the International Monetary Fund and the World Bank. The study period is from 1979 to 2018 representing a sample size of 40 annual observations**.**

3.2 Economic Model

The theoretical models reviewed in sub-section 3.1 forms the basis for the model adopted in the current study. Unlike the general specification of money demand in most macroeconomic literature which postulates money demand as a function of income and interest rate, we extend Keyne's initial demand function by introducing degree of credit restraint and financial innovation. Gaining inspiration from the Keynesians doctrine, we augment our economic model with financial innovation (FINOV) and credit restraint (DCR) to the conventional money demand function as seen below:

$$\frac{M^d}{P} = f\ (\text{real GDP}_t, \text{RER}_t, \text{DR}_t, \text{DCR}_t, \text{FIN}_t) \qquad \textbf{(1)}$$

Equation **(1)** implies that Real money demand is a function of Real Income as captured real Gross Domestic Product (GDP), Real exchange rate, real interest rate (DR), degree of credit restraint and financial Innovation. Where, $\frac{M^d}{P}$ is the logarithm of real M2 (proxy for money demand). We employ M2 because it is a broader definition of money which captures asset substitution. However, it could have been better to use M3 or M4 but for the fact that it is not a good measure of money demand in a developing economy like Cameroon. **See Table 1** for detail explanation of variables.

3.3 Long Run Econometric Model

Drawing inspiration from Baye (2011), we augment his money demand function as follows:

$$\begin{aligned}\boldsymbol{\Delta LM_t} = {} & \boldsymbol{\Psi_0 + \Psi_1 LM_{t-1} + \Psi_2 FINOV_{t-1} + \Psi_3 LY_{t-1} + \Psi_4 RER_{t-1} + \Psi_5 CRD_{t-1}} \\ & \boldsymbol{+ \Psi_6 DR_{t-1}} + \sum_{i=1}^{k} я_1\ \boldsymbol{i\Delta\, LM_{t-1}} + \sum_{i=1}^{k} я_2\ \boldsymbol{i\Delta\, FINOV_{t-1}} + \sum_{i=1}^{k} я_3\ \boldsymbol{i\Delta\, LY_{t-1}} \\ & + \sum_{i=1}^{k} я_4\ \boldsymbol{i\Delta\, RER_{t-1}} + \sum_{i=1}^{k} я_5\ \boldsymbol{i\Delta\, CRD_{t-1}} + \sum_{i=1}^{k} я_6\ \boldsymbol{i\Delta\, DR_{t-1}} \\ & + ц_{\boldsymbol{t}} \qquad (2)\end{aligned}$$

Where all variables are defined in table-

Variable	Definition
Mt	Desired stock of real money demand given as (M2/P)
P	General price level captured by the consumer price index (1979= 100)
Y	Nominal income represented by the GDP
DR	Domestic interest rate represented by the discount rate of BEAC. We employed the discount rate due to the absence of sufficient time series data on the lending and borrowing rates of interest
RER	A vector of real exchange rates. The real exchange rates were computed as: [nominal exchange rate with country i]*[(consumer price index of country i)/(consumer price index of Cameroon)]. Baye (2011) used a similar measure. An increase in the index implies depreciation and a decrease an appreciation. The nominal exchange rate used is the period average, (line rf) in the International Financial Statistics. Most of Cameroon's exports are quoted in $US, and France and Nigeria are Cameroon's major Suppliers—France, by virtue of its economic and political affiliations and Nigeria by virtue of its neighbourliness.
FINOV	Financial innovation captured by the ratio of M1 to M2 (M1/M2)
CRD	Degree of credit restraint captured by the ratio of GDP to domestic credit. Wong (1977) suggested a similar measure for the degree of credit restraint and Baye (2011) used the same measure.
Mt	A stochastic disturbance term
Ψj(j=1,2,3,4,5)	Parameters to be estimated

Table 1: Definition of variables

Source: *Author*

Following Arango and Nadiri (1981) money demand theories serve as a guide for our a priori expectations of the signs of ψ_j. Money demand increases with increases in real income and exchange rate, while it decreases with increasing interest rate and the inflation rate. Most studies on money demand and supply do not often include exchange rate as one of the variables for consideration in stability analysis. Since BEAC target exchange rate as one of its major rate in accordance to the BEAC's monetary approach the expected signs and magnitude of the coefficient of real income (income elasticity of money demand) has a very interesting meaning. If ψ_1=1, then the quality theory of money applies; if ψ_1=0.5, the Baumol-Tobin inventory theoretical approach is applicable; and if ψ_1 >1, money may be considered as a luxury (Valadkhani, 2008). A prior, we expect the sign of real income to be positive because as real income increases, people demand more money for their transactional and precautionary motives.

The coefficient on interest rate is expected to be negative because it measures the real cost of holding money. If interest rate on lending increase, people will demand fewer loans hence fall in the demand for money. The magnitude of the coefficient of interest rates which is the interest elasticity of money demand is also very central in the debate over whether fiscal or monetary policy is a more powerful policy option in an economy. A low coefficient implies that monetary policy has a greater effect on output than fiscal policy while a high coefficient implies that fiscal policy has a larger effect on output than monetary policy. Following Chow (1981), we use the real exchange rate as a proxy for expected currency depreciation. The coefficient of ψ_5 which represents the effect of financial innovation on money demand is expected to be negative according to most of the literature on financial innovation (see Arrau et al (1995), Attanasio et al. (2002) and Lippi and Secchi (2009)) although a few studies such as Mannah-Blankson and Belyne (2004) and Hye (2009) do indicate a positive relationship. In this light, financial innovation is also an important issue to be investigated. Since Equation (3.3) is expressed in log-linear functional form, the parameters ψj (j= 1…5) are elasticity of real cash balances with respect to the corresponding variables. The constant term ψ_0 captures the effects of changing transactions costs.

3.4 The Short Run Error Correction Econometric Model

The error correction mechanism (ECM) has proved to be one of the most successful tools in applied money demand research. This type of formulation is a dynamic error-correction representation in which the long-run equilibrium relationship between money and its determinants is embedded in an equation that captures short-run variation and dynamics. The impetus came from the findings that in modelling the demand for money due consideration be given not only in selecting appropriate theoretical set up and the empirical make up, but also in specifying the proper dynamic structure of the model (Paunescu, 2002). After testing for co-integration between money demand and its determinants, the ECM will enable us to reconcile the short run behaviour of money demand with its long-run behaviour. The ECT of the ARDL equation is specified as:

$$\begin{aligned} \Delta LM_t = \dot{\omega}_0 &+ \sum_{j=0}^{l} \dot{\omega}_1 \, i\Delta \, LM_{t-1} + \sum_{j=0}^{l} \dot{\omega}_2 \, i\Delta \, FINOV_{t-1} + \sum_{j=0}^{l} \dot{\omega}_3 \, i\Delta \, LY_{t-1} \\ &+ \sum_{j=0}^{l} \dot{\omega}_4 \, i\Delta \, RER_{t-1} + \sum_{j=0}^{l} \dot{\omega}_5 \, i\Delta \, DRC_{t-1} + \sum_{j=0}^{l} \dot{\omega}_6 \, i\Delta \, DR_{t-1} \\ &+ \dot{\omega}_7 ECT_{t-1} + \mathfrak{Z}_t \qquad (3) \end{aligned}$$

Our interest in the short run dynamic model is the Error correction term (ECT). The parameters of the difference lagged variables are short-run elasticity of respective variables. These parameters can be explained if short-run relationship is proved with a negative and statistically significant parameter of ECT_{t-1}. ECT is the error correction term. It is the predicted residual term from a cointegration relationship estimated from the long run model (equation 3.3). it is given as:

$$ECT_{t-1} = \Delta LM_t - \Psi_0 - \Psi_1 LM_{t-1} - \Psi_2 FINOV_{t-1} - \Psi_3 LY_{t-1} - \Psi_4 RER_{t-1} - \Psi_5 CRD_{t-1} - \Psi_6 DR_{t-1}$$

From equation (3) $\dot{\omega}_7$ is the coefficient of the error-correction term, Δ is the difference operator and $\mathfrak{Z}_t$ is the usual white nose. This procedure, due to (Engle and Granger, 1987) is valid if, at least, a co-integrating relation exists among the variables. The error correction coefficient works to push short-run money demand disequilibrium back towards its long-run equilibrium and its shows the speed of the adjustment.

3.5 Estimation and Validation Techniques

The first step in co-integration analysis is to establish the order of integration of the series under consideration. The study employs the conventional Unit Root tests as established by the Dickey Fuller (ADF) and Phillips-Perron (PP) and also the structural break unit root test of Zivot and Andrews (1992) (not reported here). To test for cointergration, we adopt the Autoregressive Distributed Lag technique or the Bounds test technique as justified by the mix order of integration.

The current study employs the ARDL technique. The choice of this technique is due to the mix integration of variables making it difficult for us to apply VECM or E-G procedure. El-Rasheed et al., (2017) used the same approach to test the stability of money demand in Nigeria. The stability check is verified using the conventional CUSUM and CUSUMQ stability tests.

04. Results and Discussion of Results

4.1. Unit Root Test

The results of the Unit Root tests as established by the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) are summarized in **Table 2** below.

VARIABLES	ADF		PP		Order of integration
	Level STATS (prob)	Difference STATS (prob)	Level STATS (prob)	Difference STATS (prob)	
lnM2_real	-0.072 (0.952)	-3.253** (0.017)	0.066 -0.963	-4.044 -0.001	I(1)
lnGDP_real	-1.534 (0.516)	-4.375*** -	-1.556 -0.505	-6.437 -	I(1)
LnRER	-1.508 (0.529)	-4.444*** -	-1.474 -0.546	-5.822 -	I(1)
LnDR	-0.478 (0.896)	-3.544*** (0.006)	-0.308 -0.924	-5.02 0	I(1)
lnCRD_C	-1.848 (0.356)	-3.495*** (0.008)	-1.385 -0.589	-4.201 0	I(1)
LnCPI	-3.024 (0.033)	-	-3.596 (0.006)	-	I(0)
lnFINOV	-1.667 (0.448)	-7.388*** -	-2.301 -0.172	-7.946 0	I(1)

Table 2: Unit Root Testing using ADF and PP

Source: Author's computation using STATA 16

Note: interpolated Dickey-Fuller critical value from the McKinnon table is set as: 1% critical value= -3.662 , 5% critical value= -2.964 , 10% critical value= -2.614 (***) and (**) indicate significance at 1% and 5% respectively

Our results as indicated by ADF and confirmed by PP shows that all but the consumer price index (CPI) are non-stationary at level form I(0) but stationary at first difference I(1). Hence the risk of using Engle- Granger formulation is maximal reason why we employ the ARDL estimation technique since it is useful even in mix order of integration. Also, the structural break unit root test (see appendix 5) of Zivot and Andrews, (1992) echoed that variables exert a structural break at different years except for the CPI.

4.2 Bound Test for Cointegration (Pesaran et al., 2001)

The result of the Bound test is reported in Table 3.

Particulars	Lag structure	F statistics	Critical value			
			5%		1%	
			LOWER	UPPER	LOWER	UPPER
ARDL1	(2 1)	8.420***	4.94	5.73	6.84	7.84
ARDL2	(2 0 0)	9. 217***	3.79	4.85	5.15	6.36
ARDL3	(2 0 2 3)	7.479***	3.23	4.35	4.29	5.61
ARDL4	(1 0 0 4)	5. 921***	3.23	4.35	4.29	5.61
ARDL5	(1 3)	8.174***	3.23	4.35	4.29	5.61

Table 3: Bound Test for Co-integration (Pesaran et al., 2001)

Source: Authors' Computation

Table 3 shows that the F-statistics is greater than the upper boundary for all variables at 1%. The result is highly significance hence the null hypothesis of no co-integration is rejected for all variables. However, with the presence of structural breaks due to economic and political shocks, intuition suggests that the null hypothesis of no co-integration may not be rejected under such scenario. This intimates us to test for co-integration in the other two models separately as illustrated in the next two sub-sections below.

4.3 Co-integrated Long Run Estimates

The LR results are reported in table 4.

Lag order	ARDL(1)	ARDL(2)	ARDL(3)	ARDL(4)	ARDL(5)	ARDL(6)
	(2 1)	(2 0 0)	(2 0 2 3)	(1 0 0 4)	(1 3)	(4 2 0 3)
lnFINOV	-4.113** (1.898)	-2.514*** (0.787)	-1.335** (0.530)	-2.377** (0.861)		
lnGDP_real		0.615** (0.261)	0.985*** (0.240)	0.374 (0.421)		0.330** (0.149)
lnRER			-1.005* (0.501)			
lnCRD_C				0.062 (0.202)		-0.164** (0.069)
lnDR					-1.272*** (0.249)	-0.759*** (0.124)
Constant	1.591 (0.997)	1.895* (0.935)	2.120** (0.888)	2.576** (1.232)	4.110*** (1.371)	10.059*** (2.511)
Observations	38	38	37	36	37	36
R-squared	0.526	0.527	0.694	0.635	0.445	0.654
F Stats	243.6	243.4	126.1	126.1	85.53	142.5
Durbin Watson	1.99	1.77	1.82	2.18	2.27	1.82
ARCH LM	0.45	0.835	0.263	0.365	0.757	0.263
White IM test	0.114	0.832	0.421	0.423	0.382	0.421
RESET test	0	0.01	0.01	0.391	0.01	0.086
JB Normality test	0.395	0.976	0.849	0.841	0.976	0.856
Standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1			

Table 4: LR results ARDL Technique

Source: Author's computation using STATA 16

We estimate different ARDL equations to minimize the problem of multicollinearity. Our main variable of interest is financial innovation (FINOV). The long-run elasticity of FINOV is significant and lower than unity with coefficients of -4.3, -2.5, and 1.4 respectively. This suggests that a 10% rise in FINOV results to a decrease in the domestic real demand for money by 43, 25 and 14 percent respectively. This is in line with the findings of Ndirangu and Nyamongo (2015) who found a negative relationship between financial innovation and money demand using currency outside banks/time deposit ratio as a proxy for financial development. Kamanu (2012) also find a negative relationship using the number of Automated Teller Machines (ATMs) to capture financial innovations. Result in Table 4 shows that real GDP commands a significant positive influence in explaining the long run demand for real money function in Cameroon while the discount rate has a negative influence on real money demand in Cameroon. This is in line with both the classical and Keynesian doctrines of money demand. Real exchange rate exerts a negative effect on real money demand while credit restraint is insignificant in explaining variation in real money balances. Series of diagnostic tests were conducted on the estimated model to measure how adequate the model is specified. The result is presented in the bottom of Table 4. From the table, there is no evidence of serial correlation as depicted by the Durbin Watson statistics. The fit of the model (R-squared) is equally good. The Ramsey Reset Test for model mis-specification also performs well as the value increase with the addition of each important variable. The performance of the other diagnostic statistics also responded favourably as reported in Table 4. We now turn to what happens in the short-run (SR) as deduced from the LR.

4.4 Dynamic Adjustments short Run Error Correction Estimates

The SR results are illustrated in table 5.

Lag order	ARDL(1) (2 1)	ARDL(2) (2 0 0)	ARDL(3) (2 0 2 3)	ARDL(4) (1 0 0 4)	ARDL(5) (1 3)	ARDL(6) (4 2 0 3)
ECT(-1)	-0.075*	-0.184***	-0.244***	-0.172**	-0.203***	-0.648***
	(0.044)	(0.065)	(0.086)	(0.078)	(0.064)	(0.173)
LD.lnM2_real	0.302*	0.254*	0.373**		0.241	0.352*
	(0.153)	(0.139)	(0.142)		(0.150)	(0.189)
D.lnFINOV	-0.196					
	(0.128)					
D.lnGDP_real			-0.057			-0.154
			(0.132)			(0.132)
LD.lnGDP_real			-0.447***			-0.259**
			(0.144)			(0.123)
D.lnRER			-0.068			
			(0.260)			
LD.lnRER			0.865***			
			(0.261)			
L2D.lnRER			0.496***			
			(0.177)			
D.lnCRD_C				-0.105		
				(0.086)		
LD.lnCRD_C				-0.045		
				(0.099)		
L2D.lnCRD_C				-0.198**		
				(0.091)		
L3D.lnCRD_C				-0.127		
				(0.094)		
D.lnDR					0.249	0.362**
					(0.150)	(0.174)
LD.lnDR					0.424**	0.673***
					(0.157)	(0.191)
L2D.lnDR					0.326*	0.536**
					(0.181)	(0.199)
L2D.lnM2_real						0.209
						(0.173)
L3D.lnM2_real						0.453**
						(0.165)
Observations	38	38	37	36	37	36
R-squared	0.526	0.527	0.694	0.635	0.445	0.654
Standard errors in parentheses				***** p<0.01, ** p<0.05, * p<0.1**		

Table 5: SR results of the Determinants of Real Money Demand using ARDL Technique

Source: Author's computation using STATA 16

After estimating the long run model for real money demand, we move on to estimate the short run dynamic model. As depicted in Table 5, our main interest in the SR model is the error correction term (ECT (-1)). From the table, the lagged error correction term (ECT (−1)) is significant and bears a negative sign. According to Kremers and Lane (1992), a negative and statistically significant ECT (-1) is ultimately a better and more efficient approach to proof the existence of co-integration. The value is negative for all the ARDL equations and significant at 1, 5 or 10%. For instance, in ARDL6, The ECT (-1) of −0.64 show that 64 percent of the previous year`s difference between realized and the actual equilibrium figure for real money demand is adjusted to the equilibrium level every year. This is an indication that about 64% of shocks on the demand for real M2 balances are corrected by the "feed-back" effect annually. This is consistent with Baye (2011) investigations. The error correction coefficient can be manipulated, in the context of the error-correction specification, to derive the corresponding adjustment speed in terms of the number of time periods required to eliminate a given exogenous shock (Baye, 2011). From our computations, in order to eliminate 95% of the effects of a shock on real M2 in Cameroon, it would take about 3 years. Having estimated the elasticities of LR and SR determinants or real money balances (M2) in Cameroon, our nest assignment is to examine whether money demand is still stable amidst these financial innovations.

4.5 Results of the stability of the real money demand function

One of the objectives of this work was to investigate whether the demand for real money balance in Cameroon is still stable despite the financial innovation. We investigated this objective for both the short and the long run using CUSUM and CUSUMQ techniques proposed by Brown et al. (1975). In this sphere, we plot the CUSUM and CUSUMQ for the four equations from ARDL1 to ARDL4 featuring FINOV. For all the equations, the CUSUM and CUSUMQ statistics lies within the critical bounds showing the stability in the money demand function (see appendices 1 to 4). This finding justifies the incorporation of financial innovation into the real money demand function model.

05. Conclusion and Policy Recommendations

The purpose of this study was to examine Financial Innovation and the Stability of Real Money Demand in Cameroon using annual secondary data from the world development indicators covering the period 1979 to 2018. After checking the stationarity of variables using the ADF, PP and the ZA structural break unit root tests, the cointegration was gauged using the Bound test. The results from the ARDL technique reveals the presence of long-run stable association between real broad money (M2) and real income (real GDP), financial innovation, real interest rate (captured by discount rate), real exchange rate and degree of credit restraint. Our main variable of interest- financial innovation had a significant long-run elasticity which was lower than unity with coefficients of -4.3, -2.5, and -1.4 respectively in the three ARDL equations which it featured. This suggests that a 10% rise in FINOV results to a decrease in the domestic real demand for money by 43, 25 and 14 percent respectively. Real income had a positive and significant influence on real money demand while real exchange rate, credit restraint and discount rate all had a negative and significant effect on real money demand. The magnitudes of the income elasticities of demand for both the short run and long run for real M2 demand suggest that asset holders in Cameroon consider money as a normal good. The error correction specification suggested an adjustment speed to long run equilibrium of about 64% annually indicating that about 90% of both endogenous and exogenous shocks in real M2 balances would take an average of 3 years to be eliminated.

Since the overall assessment of our study showed that the real money demand function is stable in Cameroon, the following policy implications emanated: First, BEAC should use money supply as a main instrument of monetary in Cameroon in order to foster growth and enhance economic stability. Utilizing the rate of interest as the main instrument may have the reverse effect; Second, if the government aimed at sustainably enhancing the demand for real M2 balances, then narrowing the gap between growth in GDP and that of domestic credit to the economy, and vice versa, is worthwhile; Thirdly, monetary authorities should know that monetary targeting alone is not necessarily an optimal choice to conduct monetary policy for countries even if the demand for money is stable. Though the demand for broad money is stable in Cameroon, monetary targeting using only broad money supply target to control inflation may not translate into changes in interest rates due to weak adjustment in the short-run. BEAC should therefore be aware that there is no straight-jacket policy instrument to control inflation and effective demand and should use a mixture of policy options; Finally, a policy of attracting more participants (non-government) and private sector funds to the money market is necessary as this will deepen the market and make the market more dynamic and amenable to monetary policy. This will further reduce the present long time lags associated with monetary policy in Cameroon in particular and the CEMAC zone in general.

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Appendices

Appendix 1: Stability assessment using CUSUM and CUSUMQ for ARDL1.

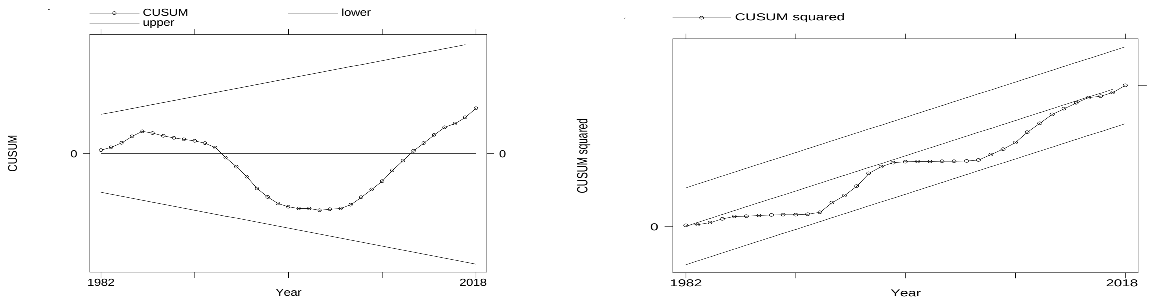

Figure 1: CUSUM and CUSUMQ for ARDL1

Source: Author's Computation using STATA 16

Appendix 2: Stability assessment using CUSUM and CUSUMQ for ARDL2.

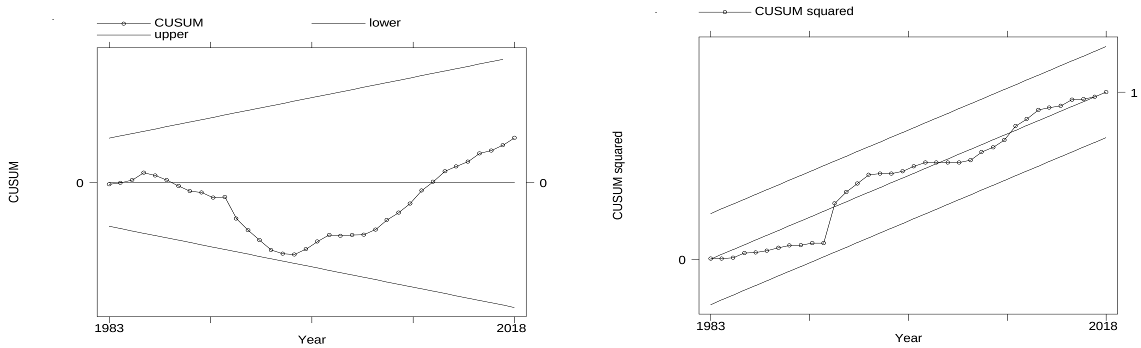

Figure 2: CUSUM and CUSUMQ for ARDL2

Source: Author's Computation using STATA 16

Appendix 3: Stability assessment using CUSUM and CUSUMQ for ARDL3.

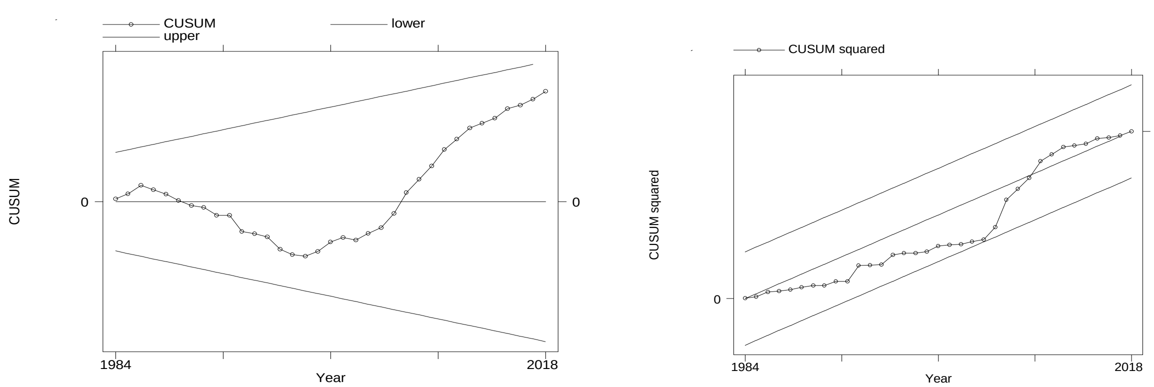

Figure 3: CUSUM and CUSUMQ for ARDL3

Source: Author's Computation using STATA 16

Appendix 4: Stability assessment using CUSUM and CUSUMQ for ARDL4.

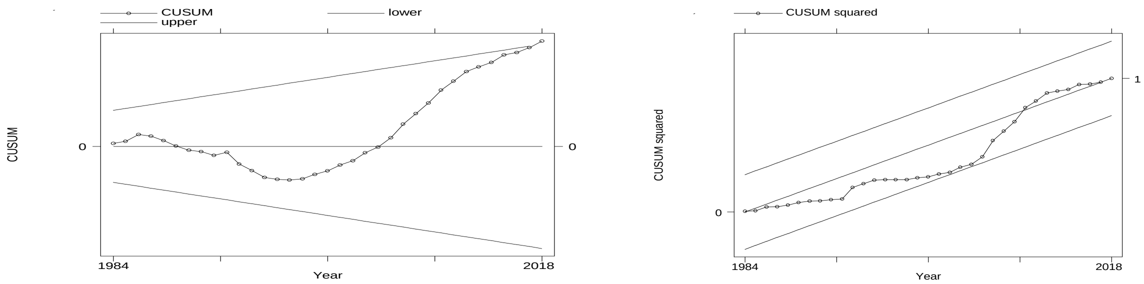

Figure 1: CUSUM and CUSUMQ for ARDL1

Source: Author's Computation using STATA 16

Appendix 5: Structural Break Unit Root test (Zivot and Andrew, 1992)

VARIABLE	YEAR	CRITICAL VALUE			STATISTICS	Is there a structural break?
		1%	5%	10%		
lnM2_real	1995	-5.57	-5.08	-4.82	-5.304	Yes
lnGDP_real	1994	-5.57	-5.08	-4.82	-6.173	Yes
lnRER	1994	-5.57	-5.08	-4.82	-6.7	Yes
lnCRED	1992	-5.57	-5.08	-4.82	-10.736	Yes
lnCPI	1994	-5.57	-5.08	-4.82	-3.243	No
lnFINOV	1986	-5.57	-5.08	-4.82	-5.104	Yes

Table 6: Test for the existence of Structural Breaks (Zivot and Andrews, 1992)

Note: Zivot-Andrews unit root test for variables allows for break in both intercept and trend

Source: *Author's computation using STATA 16*. The results show that all the variables exert a structural break at different years except for the CPI.