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INVESTIGATING THE STABILITY OF MONEY DEMAND IN GHANA

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Abstract

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The study examined the demand for broad money and its stability in Ghana. Johansen's cointegration approach reveals that the variables were non stationary and cointegrated, therefore, an error correction model, ECM was used to determine the factors that influence real money aggregate in Ghana from 1990 to 2014. The study estimated the results using two set of variables for real demand for money: M1 and M2+. This was done given the assumption that the demand for money was equal to the supply of money. The results show that, GDP affects the level of demand for money in the long run while the interest rate affects it in the short run. The error correction term in each of the cases shows that, 18 % of deviations in the real demand for money is corrected annually. The CUSUM tests of parameter stability showed that, the money demand function was stable over the period and the Chow test indicated that there were no structural breaks.

Keywords: money demand; cointegration; error correction model, stability; money supply

INTRODUCTION

Ghana's financial sector has changed substantially over the last few years which reflects determined efforts by Ghanaian authorities to move forward with financial market reforms and allow prices and resources to be determined through market forces. Interest rate and credit controls were eliminated during the 1980s. In Ghana, the money markets dominate the financial markets. Moreover, prices of goods and services, interest rates, inflation and foreign exchange rates are all not stable.

New developments in payment instruments such as credit and debit cards have aided in the reduction of the demand for cash in daily transactions, while modern payment technology and electronic banking have also aided in the expansion of banking services to rural communities.

Money market instruments are used by the Bank of Ghana to manage liquidity in the financial system as a whole while ensuring stability in the banking system. Instability in the money market has often been caused by several factors which include excess money in circulation.

A thorough understanding of money, reasons for its demand and most importantly factors influencing their stability, will provide an insight into whether money demand is stable. In the analysis of Keynes (1930 & 1936), the demand for money focused on the motives that prompted people to hold cash balances. Three motives were identified: transactionary, precautionary and speculative motives. Keynes argued that cash balances are held in order to bridge the gap between receipts and payments as well as for precautionary purposes. He specified that both transactionary and precautionary demands for money are functions of income. Other researchers who agree with the assertion of Keynes analysis on the role of income in money demand include Adekunle (1968) and Sowa (1993).

Baumol (1952) and Tobin (1956) introduced interest rate as one of the explanatory variables in the transactions demand for money. Interest rate measures the opportunity cost of holding money (Gujarati, 1968; Adenkule, 1968). Intuitively, if interest rates rise the opportunity cost of holding money increases therefore money demand falls.

Several factors affect the stability of money demand in a given country. The income velocity of money changes in response to fluctuations in interest rates as well as to movements in other

arguments of the money demand function which are not related to income. Velocity changes can also be observed because of lags in the adjustment of money demand to income. Such changes are however sometimes transitory and are sometimes interpreted as movements along an otherwise stable money demand function with constant lag structures.

The demand for money at a given period can be affected by the process of financial innovation and deregulation. These affect both the interest elasticity of different monetary aggregates and the balances held at each level of interest rates. Another source of instability may be shifts in the precautionary demand for money, related to changes in confidence, and institutional changes.

Kogar (1995) tried to test whether there exists a stable long run money demand function for Turkey and Israel. For the Turkish case, it was found that there exists a long run relationship between real money (M1 and M2) demand, real income, inflation and exchange rate with an elasticity of income slightly lower than unity and also an elasticity of exchange rate significantly low.

Similarly, Mutluer and Barlas (2002) analysed broad money demand in Turkey between 1987 and 2001 using various structural reforms and deregulations. Their results indicate the existence of long run relationship for real broad money in Turkey, with a unitary income elasticity estimated.

Amoako-Adu (1991) found that income and inflation were very important determinants of the money demand function in Ghana. In Kallon's (1992) empirical work, he studied the demand for money function in Ghana using both M1 and M2 as his regressands. He concluded that income, proxied by gross national product (GNP) and interest rate adjusted for inflation were statistically significant.

Finally, Halicioglu and Ugur (2005) analyse the stability of the narrow money demand function (M1) in Turkey for the period 1950–2002. They estimated and tested for the stability of Turkish M1 by procedure proposed by Pesaran et al, (2001) alongside CUSUM and CUSUMSQ stability tests. They demonstrate that there is a stable money demand function and it could be used as an intermediate target of monetary policy in Turkey.

This paper seeks to assess the stability of the demand for real money in Ghana. It achieves this through the use of an Error Correction Model. The main variables of the model include the real demand for money, the real interest rates and income.

EMPERICAL METHODS

The data for this study is yearly and ranges from 1990–2014. Two definitions of money were examined in this paper, namely narrow money (M1) and broad money (M2+). The income variable was defined as real GDP at constant 2005 US$. The opportunity cost was represented by the 91-day Treasury bill rate and the GDP deflator was used to derive real money balances. The study assumed that in equilibrium the demand for real money balances is equal to the supply of real balances. Thus M1 and M2+ adjusted for inflation were used as dependent variables to represent the demand for real money balances.

Previous studies have evidenced that majority of time series data are non-stationary at levels but turn to become stationary after differencing (Engle and Granger, 1987). It was therefore necessary to check for the stationarity properties of the dataset. A stationary time series process is one which has a constant first and second moments and whose probability distribution is stable over time. Stationarity in the data series needed to be ascertained because our estimation technique for the analysis was an error correction model. Therefore, to avoid spurious results and to ensure that the variables fit into the estimation techniques, the study conducted unit root test using the KPSS test where KPSS represents, Kwiatkowski, Phillips, Schmidt, and Shin (1992).

If the unit root test established that the variables were non stationary, then test of cointegration and the possible number of cointegrating relationships was done using the Johansen test of cointegration (see Johansen, 1988). The presence of cointegration meant that the variables had a long run relationship. It was therefore possible to estimate them using an error correction model. The other method for testing for cointegration was running an Ordinary Least Squares with M1 and M2+ as the dependent variables. The residuals from those models were saved and tested for stationarity. A stationary residual in each of the two models indicated that the variables were cointegrated. In each of the cases, the p values obtained from the tests of residual stationarity showed that the residuals were stationarity thus confirming coingtegration. The residuals from these models were also used in the estimation of the error correction model but in their lagged state. If the lagged residuals prove statistically significant in the error correction models and with negative signs, then they validate the presence of a long run relationship among the variables.

The optimum number of lags was decided using information criteria: Akaike Information Criteria (AIC), Schwartz Information Criteria (SIC) and Hannan-Quinn Criteria (HQC). See (Hannan-Quinn, 1979; Akaike, 1974; Schwartz, 1978).

It was necessary to test for parameter stability over the period of investigation. This was made imminent by the fact that the study was investigating the stability of the money demand function. The fundamental motive was to know whether the regression model has remained unchanged over the period of the study. Chow test was therefore carried out to check for structural breaks and the results were complemented with another recursive test, CUSUM test.

Model specification

The long-run money demand function was written as in equation (1):

$$M = \alpha + \beta_0 \log y_t + \beta_1 r_t + \varepsilon_t \quad (1)$$

where M represents either M1 or M2+ and is the real money balances created by taking a monetary aggregate deflated by the GDP deflator; is real income measured via real GDP; is an opportunity cost measure proxied via the 91-Day Treasury bill rate, and is a residual term. The coefficients and are expected to enter with positive and negative signs, respectively.

The error correction model used to estimate the money demand function is given in equation (2).

$$\Delta Md_t = \alpha + \beta_0 \Delta \log y_t + \beta_1 \Delta r_t + e_{t-1} + \mu_t \quad (2)$$

where is the first-difference operator, is the lagged residual from the OLS models and is an error term satisfying white noise.

RESULTS

Variables were tested for unit roots using the KPSS (Kwiatkowski, Phillips, Schmidt, and Shin) test. The results show that, the null hypothesis of no unit roots for all variables was rejected at levels. Variables were however stationary after first order differences (FOD). See Tab. I for the detailed results.

The study proceeded to estimate an Ordinary Least Squares models 1 and 2 (see Tab. II) with M2+ as the dependent variable in Model 1 and M1 as the dependent variable in Model 2. log GDP and interest rates as the independent variables. The results show that log of GDP is statistically significant in both models. The residuals from these models were saved and tested for stationarity using the KPSS test. The p values (0.09) and (0.10) are greater than 0.05 indicating that the null hypotheses of cointegration were not rejected. The variables were therefore stationary and cointegrated. Error Correction models could therefore be used to estimate the short run dynamics.

Lag order selection

The study proceeded to investigate the optimum lag length required for the estimation of the ECMs using various information criteria: AIC, SIC and HQC. Lag order 2 (See Tab. III) was chosen based on AIC and HQC.

The estimation of the Error Correction Models 1 and 2 (see Tab. IV) shows that interest rate was significant in affecting the level of real money demand in the short run in both models. A percentage increase in the level of interest rate leads to a 1.1 cedi decrease in real money demand in the case of M2+. The error correction term () is also statistically significant and negative which validates the fact that there exist a long run relationship between the variables. It shows that about 18 % of the deviation in demand for money is restored annually. The overall model is also statistically significant given the size of the p value ($P < 0.001$) from the F test.

Interest rate was also statistically significant in the case of M1 in ECM2 (See Tab. IV). A percentage point increase in the level of interest rates leads to a decline in the demand for money by about 1.2 cedis. The error correction term is negative and statistically significant indicating that 18 % of the deviation in the demand for money is restored annually[1].

Diagnostic test for ECM 1and 2 (see Tab. V) shows that the models meet the basic classical requirements and could therefore be interpreted as such.

1 Standard errors in parenthesis, the asteriks (*) indicates the level of significance at 1 %(***), 5 % (**) and 10 % (*). P value of overall model significance < 0.001.

I: *Unit root test for all variables*

Variable	Test statistic Level	Critical value 5 %	Test statistic FOD	Critical value 5 %	Decision
M1	0.869	0.481	0.048	0.482	I(1)
M2+	0.868	0.481	0.053	0.482	I(1)
Interest rate	0.503	0.480	0.110	0.480	I(1)
Log GDP	0.783	0.480	0.188	0.480	I(1)

II: *OLS Models 1 and 2*

	OLS models	
	1	**2**
Constant	–49.61(15.221)***	–46.503(14.460)***
Log GDP	2.433(0.574)***	2.284(0.545)***
Interest rate	–0.812(0.661)	–0.911(0.631)
Observations	24	24
R squared	0.75	0.759

III: *Lag selection*

Lags	loglikelihood	p(LR)	AIC	SIC	HQC
		M2+			
1	–771.715		71.247	71.842*	71.387
2	–760.348	0.007	71.032*	72.073	71.277*
		M1			
1	–764.641		70.604	71.199*	70.744
2	–751.126	0.0014	70.193*	71.235	70.439*

IV: *ECM 1 and 2*

	ECM	
	1	**2**
Constant	0.355 (0.070)***	0.336 (0.073)***
Interest rate	–1.138 (0.302)***	–1.222 (0.320)***
$\mathbf{e_{t-1}}$	–0.176 (0.042)***	–0.176 (0.044)***
Observations	21	21
R squared	0.543	0.551

V: *Diagnostic test for ECM 1 and 2*

		1	2
Test	**Test statistic**	**P values**	**P values**
Model specification	Lagrange Multiplier	0.098	0.068
Model specification	RESET test	0.081	0.15
Heteroskedasticity	White test	0.281	0.268
Normality	Shapiro Wilk test	0.357	0.325
Autocorrelation	LMF	0.499	0.443
Parameter stability	CUSUM test	0.126	0.174
Structural breaks	Chow test	0.835	0.872

CONCLUSION

The study sought to examine the demand for broad money and its stability in Ghana. This was done using an econometric technique such as an error correction model. This model was chosen after series of time series data checks. A test of stationarity showed that, the variables were integrated of order one. Johansen's cointegration approach revealed that the variables were cointegrated. An error correction model, ECM was therefore used to determine the factors that influence real money aggregate in

Ghana from 1990 to 2014. The study estimated the results using two set of variables for real demand for money: M1 and M2+. The results showed that, GDP affects the level of demand for money in the long run while the interest rate affects it in the short run. The results obtained from this study were in line with conclusions by Amoako-Adu (1991) on the Ghanaian economy, Kogar (1995) and Mutluer and Barlas (2002). The error correction term in each of the cases shows that, 18 % of deviation in the real demand for money is corrected annually. The test of parameter stability using the CUSUM test showed that, the money demand function was stable over the period. The Chow test was also employed to test whether structural breaks occurred over the period covered by the study. This was necessary due to the fact that, the study was investigating stability of the money demand function over a sampled period. The results showed that, there were no structural breaks over the period covered.

This study thus recommends that the Bank of Ghana should continue to implement policies that enhance macroeconomic stability and economic growth. Money demand matters for the design of a stabilizing monetary policy in the case where the outstanding stock of money effectively restricts households' consumption decisions. Price level will then not be neutral with regard to real activity and the inflation rate. In other words, the classical mechanism fails and purely nominal changes have real effects. In this case, moderate changes or adjustment in interest rates by the Bank of Ghana should be made depending on the state of the economy. This is because interest rate changes do not only affect households' savings and consumption expenditures but also due to changes in cash holdings due to rise in cost under high interest rates.

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