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Demand for Money in Namibia: An ARDL Bounds Testing Approach

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ABSTRACT— ***This paper examines the demand for money in Namibia. Time series techniques such as unit root test, cointegration and Autoregressive Distributed Lag (ARDL) approach were utilized on quarterly data for the period 2000:Q1 to 2012:Q4. The results based on the unit root test shows that the variables are integrated of order one. The bound testing approach to cointegration reveal that there is no cointegration among real money aggregates (M1 and M2), real income, inflation and interest rate. Therefore, the stability of demand for money function could not be established.***

Keywords— Money Demand, unit root, cointegration, Bounds test, stability, real income, inflation, Namibia.

1. INTRODUCTION

It is generally acknowledged that demand for money is critical in monetary policy formulation and implementation both theoretically and empirically. Hence, a stable money demand function is fundamental to the conduct of monetary policy. Budha (2012) put it well by stating that the stability of the money demand function infers stability in money multiplier and, thus, ensures the changes in the monetary aggregates to have a specific predictable impact on the real variables. It is for this reason that money demand is also used to gauge the success or failure of monetary policy and its effectiveness (Bose and Rahman, 1996).

The transmission mechanism by which money supply growth is transformed into inflation is made up of two processes: the direct process and the indirect process. The direct process involves increases in money supply finding their way into the pockets of economic agents (consumers, producers and suppliers of factors of production), who spend the money on goods and services. The resulting upward pressures on aggregate demand then lead to inflation. The indirect process involves the new money being deposited by economic agents with commercial banks and other financial institutions. These deposits provide a basis for further increases in money supply; they increase the capacities of these institutions to extend credit to economic agents. Monetarists, therefore, offer a reduction in the rate of growth in money supply as the only remedy for inflation, on the assumption that money supply is exogenously determined by the monetary authorities.In the Introduction section, present clearly and briefly the problem investigated, with relevant references.

In the context of Namibia, monetary policy had to be implemented in order to maintain the pegged exchange rate. A commitment to maintain the peg involves an obligation of the Central Bank to limit money creation to levels comparable to those of the country to whose its domestic currency is pegged. The pegged exchange rate becomes useful because money creation is associated with domestic inflation pressures. Therefore, the money stock growth rate in Namibia had to be maintained at a similar growth rate as in SA (BON, 1996:21-23). Namibian authorities would then be required to correct the money stock growth rate if there is deviation. This is a challenge in a sense that the money stock is influenced by various factors, including open market operations of the central bank and financial flows into and out of the country. However, monetary policy is precisely about how the central bank responds to these financial flows through its open market operations in order to achieve the money stock that its policy objective requires.

Given the importance of money supply, it is important to have knowledge about it, as it provides useful insights into the transmission mechanism of monetary policy actions. Therefore, this paper aims to examine the empirical relationship between the real monetary aggregates, real income, inflation rate and the interest rate. Furthermore, it attempts to determine the stability of the estimated money demand function. The article is organized as follows: the next section presents a literature review. Section 3 discusses the methodology. The empirical analysis and results are presented in section 4. Section 5 concludes the study.

2. LITERATURE REVIEW

2.1 Theoretical Literature

Theoretical propositions for demand for money that craft macroeconomic policy concur that demand for money is in the first place determined by real cash balances (Lungu, Simwaka, Palamuleni and Jombo, 2012). However, there are three dominant views in this respect, namely the classical, the Keynesian and the post-Keynesian view as discussed in Telyukova (2008) and Gaurisankar and Kwie-Jurgens (2012).

The classical school is based on Friedman's quantity theory of money which is based on the equation of exchange. This equation expresses the relationship by stating that the quantity of money (M) multiplied by the number of times (V) that this money spent in a given year must equal nominal income (PY) denoting price level (P) and level of output (Q). In other words, it demonstrates an equilibrium condition in which money is held to facilitate transactions (Mishkin, 2007). Fisher's is also a herald of this view in the sense that his analysis on the transactions velocity of circulation of money simply refers to the rate at which money passes from hand to hand. For example, there are always two parties to a transaction, represented by a seller and a buyer. Hence, the value of sales must equal the value of receipts for the aggregate economy. This further implies that the value of sales must be equal to the number of transactions conducted over a period of time multiplied by the average price (Mabuku, 2009). The underlying theory supposes that economic agents hold money only for transactions' purposes, therefore ignoring the sensitivity of interest rate to money demand (Gaurisankar and Kwie-Jurgens, 2012).

The Cambridge School of Economics tried to augment the classical theory approach to demand for money by consenting that there is flexibility to the decisions of individuals to hold money. They are of the opinion that individuals hold money for two reasons, namely for transactions' purposes and for enhancing their wealth (Keynes, 1936). Nevertheless, the decision to reserve money for wealth purposes is dictated by the gains and expected returns on other assets that also function as stores of wealth (Mishkin, 2009).The Cambridge approach places its emphasis on the rate of interest and expectations because these variables are expected to vary significantly in the short-run (Laidler, 1985).

Another theoretical approach is that of the liquidity preference theory which places emphasis on the significance of the interest rate as determinant of the money demand function. This view takes the position that the velocity of money is not constant as postulated and argued for by the classical school of thought but rather interest rate is a compensation for the renouncing of liquidity. The theory further states the three motives for holding money, namely the transaction, precautionary and speculative motive. (Sahadudheen, 2012) indicate that the first two proportionally depend on income. For example, an increase in income translates into more money being reserved for transaction and precautionary measures. This reflects the medium of exchange function of money. Thus, there exists a positive correlation between money demand and income. Speculative demand for money has been found to have a negative relation with interest rate. Keynes used the assets' theory, which hypothesizes that if the expected return of holding bonds is greater than the return on holding money, individuals will opt to hold bonds as a store of wealth rather than money (Mankiw, 2010).

Finally, the post-Keynesian theory is of view that money is a type of asset and its demand must also be influenced by the same factors affecting the demand of any other assets. Hence, bonds, equity and goods are types of assets that form part of wealth. This view contest Keynes by hypothesizing that money demand function is determined by the expected return on money and permanent income. Moreover, permanent income is positive correlated with the demand for money while all other variables are negatively correlated (Mishkin, 2009). This theory asserts that the incentive to hold money does not change very much. Hence, the impact of interest on the demand for money is very meager.

2.2 Empirical Literature

There is voluminous empirical literature on the theoretical arguments in previous discussions. Khatiwada (1997) studied the stability of money demand function in Nepal. In this study, ordinary least squares (OLS) and stability tests like the Chow test and cumulative sum (CUSUM) tests were used on Nepalese macroeconomic data from 1976 to 1996. The results show that the demand for money in Nepal is a stable and predictable function of real income and interest rate.

Hamori and Hamori (1999) examined the demand for money function for Germany over the period 1969:Q1 to 1996:Q3. This study used the Chow test to test for the stability of the money demand function. The results show that the demand function is unstable.

Bahmani-Oskooee (2001) analysed the stability of money demand in Japan for the period 1964:Q1 to 1996:Q4. An Autoregressive Distributed Lag (ARDL) approach to cointegration as well as the CUSUM and CUSUMSQ tests was used in the analysis. The results revealed that there is a stable relationship in the demand money function.

Bahmani-Oskooee and Chi Wing Ng (2002) assessed a long-run relationship for demand for money in Hong Kong using the ARDL cointegration, CUSUM and CUSUMSQ on the period 1985:Q1 to 1999:Q4. The results show cointegration among the variable and stability of the money demand function.

In a study for Turkey, Halicioglu and Ugur (2005) analysed the stability of the narrow money demand function (M1) in Turkey for the period 1950-2002. By employing an autoregression distributive lag model (ADRL) single cointegration procedure along with the CUSUM and cumulative sum of squares (CUSUMSQ) stability tests. The results show that there is a stable money demand function in Turkey.

Akinlo (2006) studied employed an ARDL modelling to test the stability for demand for money in Nigeria over the period 1970:Q1 to 2002:Q4. The results indicate that the variables are cointegrated. The CUSUM and CUSUMSQ tests reveal that a stable relationship exists in Nigeria's demand for money function.

In a study for China, Bahmani-Oskooee and Wang (2007) empirically tested for the stability for China's money demand function for the period 1983:Q1 to 2002:Q2. Utilizing the ARDL modelling to cointegration, the results show that M1 money demand function is table while M2 money demand function is not.

In a study for Tonga, Kumar and Manoka (2008) investigated the stability for narrow demand for money function for Tonga from 1978 - 2004. Employing alternative time series approaches of least squares estimates (LSE) - Hendry's General to Specific (GETS) and Johansen's Maximum Likelihood (JML), the results show that there is a unique cointegrated and stable long run relationship between real narrow money, real income and nominal rate of interest. Furthermore, the demand for money function for Tonga is stable.

In a study for Nepal, Kharel and Koirala (2010) employed the cointegration technique on the sample period of 1974/75-2009/10 and found similar result as in Khatiwada (1997) that money demand function for both narrow and broad money is a stable and predictable function of real income and interest rate. The disequilibrium, according to the study, corrects more rapidly in narrow money than the broad money.

Bashier and Dahlan (2011) examined the money demand function and its stability for Jordan over the period 1975-1990. The CUSUM and CUSUMSQ test provided evidence of a stable money demand function. The empirical results showed that real money balances had a positive relationship with real income and a negative relationship with interest rate and exchange rate.

Budha (2012) assessed the demand for money function in Nepal using ARDL approach for the period of 1975 – 2011. The results based on the bounds testing procedure reveal that there exist the cointegration among real money aggregates (M1 and M2), real income, inflation and interest rate. Furthermore, the CUSUM and CUSUMSQ tests reveal that the M1 money demand function is stable, but M2 money demand function is not stable.

In a study for Nigeria, Iyoboyi and Pedro (2013) estimated a narrow money demand function of Nigeria from 1970 to 2010. The study employed unit root, cointegration, autoregressive distributed lag bounds test approach, Chow breakpoint test, cumulative sum of recursive and cumulative sum of squares of recursive residuals tests were used. The study revealed that the narrow money demand function for Nigeria is stable over the study period.

Finally, in Namibia, Ikhide and Katjomuise (1999) estimate a demand for money function in Namibia by employing cointegration and error correction methodology using quarterly data for the period 1990 to 1998. The results show that real money balances, income and interest rates have stable relationships in the economy and among others income and interest rates are important determinants of money holding. M2 was found to exhibit greater stability relative to M1.

Based on the afore-mentioned literature, one can safely say the following. There are mixed findings with regard to the stability of demand for money function hypothesis ranging from those stable, instable and inconclusive. There is also variation in the methodological approaches whether it is cross-country or individual country's studies. There is variation in terms of data frequency used ranging from monthly, quarterly and annually. There only seem to be one study on this subject in Namibia by Ikhide and Katjomuise (1999), leaving a gap of 13 years of possible development in this regard. It is against this background this study intends to fill a gap and add to empirical literature for Namibia.

3. METHODOLOGY

3.1 Econometric Framework and Model Specification

In examining the demand for money in Namibia, this study follows Iyoboyi and Pedro (2013) and Budha (2012), but slightly modified. Specifically, this study uses an autoregressive distributed lag (ADL) specification reparameterized as an ECM.

From literature, the theoretical basis for the demand for money function follows the Keynesian model of money demand and the basic model is defined as:

$$m = f(y, cpi, r) \quad \ldots 1$$

Where m is real money demand, y is real output, cpi is the rate of inflation and r is the real rate of interest. This is the model adopted in this study, which in log linear form can be stated in equation 2 as follows:

$$\ln M_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 CPI_t + \beta_3 R_t + \varepsilon_t \qquad \ldots 2$$

Conventional economic theory hypothesize that the income elasticity coefficient β_1 is expected to be positive and the coefficient of the inflation β_2 is expected to have negative sign. This is because the opportunity cost of holding money (i.e. inflation rate) relative to the real value of physical assets exerts negative effects on money demand as the increase in expected inflation lead to substitution away from money to real assets. Literature on the speculative demand for money suggests that, the coefficient of the interest rate β_3 is expected to have negative sign. ε_t denotes the disturbance term

Equation (1) may be estimated using the Engle-Granger 2 step procedure. However, since most financial data are trended, they are potentially non-stationary. Granger and Newbold (1974), has established that regression analysis from non-stationary variables yield spurious (nonsensical) results. Hence, the first step is to investigate the unit root properties of the variables in question. This suggests that the econometric technique to be used for estimating Equation 1 will be dictated by the properties of time series data. There are numerous tests for unit root namely, tests devised by Augmented Dickey - Fuller (ADF), Philips and Peron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), modified Dickey-Fuller (DF) test, based on generalised least squares (GLS) detrending series (commonly called the DF-GLS test) and the Ng and Perron tests for unit root.

If it is established that the series are stationary at levels, Equation 1 will be estimated using Ordinary Least Squares (OLS) technique. But should the series be found non stationary at level, but stationary at first difference, the test of cointegration will be conducted to establish whether or not the pair of the series is cointegrated. If the pair of the first differenced stationary series is not cointegrated, then Equation 1 will be estimated with the first differenced series to avoid the problem of spurious regression. There are various tests for co-integration, among them are: the Johansen maximum likelihood approach, the Engle-Granger approach, the cointegrating regression Durbin-Watson (CRDW) test, the error-correction based test and ARDL Bound test for cointegration. If there is cointegration relationship among the variables it can re-parameterised as an Error-Correction Model (ECM) which will contain both short and long-run effects.

In order to examine the long- and short-term dynamics, equation (2) is transformed into an ADL specification reparameterized as an ECM. The ADL model is specified as:

$$\Delta \ln M_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta \ln M_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta \ln Y_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta \ln CPI_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta \ln R_{t-i} + \alpha_1 \ln M_{t-1} + \alpha_2 \ln Y_{t-1} + \alpha_3 \ln CPI_{t-1} + \alpha_4 \ln R_{t-1} + \varepsilon_t \ldots 3$$

Where, Δ is the first-difference operator, β_0 and ε_t is a white-noise disturbance term. The coefficients $(\alpha_1 - \alpha_4)$ represent the long-run relationship whereas the expressions with the summation operators $(\beta_1 - \beta_4)$ represent the short-run dynamics of the model. Following Hendry (1995), equation (3) is reparameterized as an ECM to yield:

$$\Delta \ln M_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta \ln M_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta \ln Y_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta \ln CPI_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta \ln R_{t-i} + \lambda EC_{t-1} + \varepsilon_t .4$$

Where λ the speed of adjustment parameter and EC is the residuals that are obtained from the estimated cointegration model of equation (3). The error correction term (EC) is, thus, defined as: $EC_t = \ln M_t - \gamma_1 \ln Y_t - \gamma_2 CPI_t - \gamma_3 R_t$. Where, $\gamma_1 = -(\alpha_2 / \alpha_1)$, $\gamma_2 = -(\alpha_3 / \alpha_1)$ and $\gamma_3 = -(\alpha_3 / \alpha_1)$ are OLS estimators obtained from equation (3). The coefficients of the lagged variables provide the short run dynamics of the model covering to the equilibrium path. The error correction coefficient (λ) is expected to be less than zero, which implies cointegration relation. The model will be tested for robustness by employing various diagnostic tests such as serial correlation, functional form and heteroscedasticity. The CUSUM and CUSUMSQ tests to the residuals of equation will be applied in order to test the model stability. For the stability of the long-run and short-run coefficients, the plot of the two statistics must stay within the 5 % significant level.

3.2 Data and Data Sources

This study used quarterly time-series data covering the period 1998:01-2012:12. The variables included are narrow money (M1) and (M2) as monetary aggregates. The proxy for price level is the consumer price index (CPI), whereas real gross domestic product (GDP) represents real income (Y). The proxy for interest rates is the bank rate, which is the rate at which Bank of Namibia lends money to the commercial banks when temporarily short of cash. The data series were obtained from various issues of Bank of Namibia's Quarterly Bulletins and Annual Reports.

4. EMPIRICAL ANALYSIS AND RESULTS

4.1 Unit Root Tests

The first step is to determine the order of integration by conducting the unit root test. This is due to the fact that ARDL technique cannot be used if the order of integration is two or greater. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used in this regard.

Table 1: Unit root tests: ADF and PP in levels and first differences

Variable	Model Specification	ADF Levels	PP Levels	ADF First Difference	PP First Difference	Order of integration
$\ln M_1$	Intercept and trend	-1.24	-1.26	-6.99**	-6.99**	1
	Intercept	-1.38	-1.38	-6.94**	-6.94**	1
$\ln M_2$	Intercept and trend	-1.97	-2.04	-7.02**	-7.02**	1
	Intercept	-0.89	-0.88	-7.07**	-7.07**	1
lnY	Intercept and trend	-1.24	-1.24	-7.50**	-7.65**	1
	Intercept	-0.32	-0.81	-7.27**	-7.28**	1
CPI	Intercept and trend	-2.51	-2.18	-5.02**	-5.04**	1
	Intercept	-2.55	-2.12	-5.06**	-5.04**	1
R	Intercept and trend	-3.19	-1.38	-3.76**	-3.77**	1
	Intercept	-2.04	-2.22	-3.80**	-3.81**	1

*Source: author's compilation and values obtained from Eviews. Notes: (a)** means the rejection of the null hypothesis at 5%.*

Table 1 shows the results of the unit root test. Both the ADF and PP tests show that the series are non-stationary in level form. After differencing data the unit root test shows that the series became stationary and integrated of integrated of order 1.

At the initial stage of the ARDL procedure, a number of lags on each first differenced variable in equation (3) have to be imposed and carry out F-test. The results depend on the choice of the lag length (Budha, 2012). This is dictated by the Akaike's and Schwarz's Baysian Information Criteria. Furthermore, the Langrange Multiplier (LM) test has been used to test the serial correlation in residuals.

4.2 Testing for Cointegration

The existence of cointegration or the long-run relationship between money demand (real money balance) and its regressors has been tested by calculating F-statistics with one lag. The F-statistics is computed and obtained by applying Wald tests that impose zero value restriction to only one period lagged level coefficient value of the variables. These test results are reported in table 2 with new critical values as suggested by Pesaran *et al.* (2001) and Narayan (2004) for bounds test procedure.

Table 2: Bound tests for Cointegration Analysis

Order of Lag	1
M1	1.50
M2	1.10

Notes: (a). The relevant critical value bounds are in Pesaran et al. (2001). These are 2.97- 3.74 at 90 %, 3.38-4.23 at 95% and 4.30-5.23 at 99%, obtained from Table C1. iv (with an unrestricted intercept and restricted trend; with three regressors k=3).

(b). The critical values presented in Pesaran et al. (2001) are based on large samples (Narayan, 2004). For small sample sizes ranging from 30 to 80 observations, Narayan (2004) provides a set of critical values, which are 2.496-3.346 at 90%, 2.962-3.910 at 95% and 4.068-5.250 at 99%.

The computed F-statistics in table 2 was compared with the critical values provided by Narayan (2004) for small samples. The results show that the calculated F-statistic is smaller than critical values. This implies that there is no cointegration between real money balances, real income, inflation rate and interest rate. Since there is no cointegration there is no need to proceed with the error correction model. Hence, the stability of the long run model for demand for money function in Namibia for the period 2000 to 2012 cannot be tested.

5. CONCLUSIONS

This study looked at the relationship between real money balances, real income, inflation rate and interest rate in Namibia. This was done in order to establish whether the function for demand for money is stable in Namibia for that period. The study employed time series techniques such as unit root, cointegration test and ARDL. The results of this study shows that the variables are integrated of order one. However, the cointegration test shows that there is no long run relationship over that period among the variables. Hence, the stability for real money balances (both narrow and broad money) for that period could not be tested.

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