FOREIGN CURRENCY RESERVES, MONEY SUPPLY, AND INFLATION IN THE GAMBIA

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Abstract

The paper examines the effect of foreign currency reserve and money supply on inflation in The Gambia. The study used monthly data (2005M1-2019M12) and employed the Autoregressive Distributed Lag model (ARDL) and Fully Modified Ordinary Least Squares (FMOLS) techniques to evaluate the short run and long run relationships. The outcome of the short run estimation suggests that foreign reserves have a positive impact on inflation while the impact of money supply on inflation is neutral. However, both were shown to increase inflation in the long run with higher impacts from foreign reserves. The findings, therefore, indicate that the monetary authority in The Gambia is faced with a tricky situation of either accumulating reserves to protect against external shocks facing the economy or maintaining price stability.

Keywords: Foreign Currency Reserve, Money Supply, Inflation, The Gambia, ARDL, FMOLS

JEL codes: C32, C51

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Disclaimer: The views expressed in this paper are solely those of the Authors, and not that of the Central Bank of The Gambia or its Management.
1.0 INTRODUCTION

Inflation is an unavoidable phenomenon of any economy in the world. Inflation has been a subject of considerable theoretical and empirical research since the early 1970s during the surge in oil prices. However, since then controlling the inflation rate has been a high priority for many Central Banks especially those with small open economies. In 2008, come a resurgence of high inflation; advance countries recorded an average rate of 3.6%, emerging economies 7.3% and 10.2% for Africa. In The Gambia an annual average inflation of 15.3% was recorded, between 1977 and 1990, which further accelerated to 17.0% and 14.2% percent in 2003 and 2004 respectively. Since then, inflation has been decelerating and recorded 7.1% in 2019. However, this figure is higher than the 5% inflation target set by the government, and this poses a threat of not meeting regional convergence criterion.

In practice, central banks follow supplementary short-run goals such as exchange rate stabilization (Ghosh et al., 2016). Furthermore, central banks in most emerging economies became vigorously engaged in “foreign exchange intervention (FXI)” within a “monetary targeting regime” (Svensson, 2009). In this perspective, a fundamental question confronted by monetary authorities is: to what degree does active utilization of foreign exchange reserves appropriate in achieving the objective of price stability? In this regard, scholars have tried to answer this question by analyzing the pros and cons of reserve holding. Aizenman & Lee (2007) stated that reserves buildup might be inspired by a mercantilist motive: reserves buildup allows sustaining an undervalued exchange rate, which tends to foster exports. However, the most apparent advantage is that foreign currency reserves assist nations to hedge (self-insure) against potential swift stops in capital inflows (Jeanne and Rancière, 2011). According to Bussière et al. (2014), a reduction in capital flows arising from financial crises is less likely to affect countries with substantial reserves holding. Aizenman and Marion (2004) further highlighted that high foreign currency reserves has a positive signaling effect, as foreign investors regard it as an advantage in terms of market accessibility, minimal borrowing margin, and good fundamentals.

Conversely, researchers have argued that extreme reserves holding can create costs for currency reserve-hoarding states with regards to opportunity (sterilization) costs of stockpiling reserves, and that large reserves stockpiling has contributed to high inflation rate and global imbalances (Chițu, 2016). Given these conflicting views, policymakers attempt to attain and maintain the appropriate balance “foreign reserves and money supply” at a level that is consistent with the objective of achieving inflation targets.

In The Gambia, the two main channels through which foreign reserves may increase inflation are: first, the money supply channel—when the Central Bank of The Gambia (CBG) increases its reserves holding, the broad money supply will rise and, if not properly sterilized, it results in inflation (Joof & Tursoy, 2020). The second channel is the moral hazard channel, which posits that an increase in foreign reserves tends to trigger inflation since the monetary authority (Central Bank of The Gambia) may be incentivized and become more contented to follow expansionary and less cautious policies because of the perceived safety of holding high reserves (Aizenmann and Marion, 2004; Chițu, 2016). The practical and conceptual challenge on the relationship between foreign reserves and inflation is the difficulty in separating the effect of the two channels, and the endogenous relationship between macroeconomic development and foreign reserves. This paper focuses on the first channel (money supply or sterilization) by examining the effect of foreign currency reserves and M2 (money supply) on inflation in The Gambia.

The paper contributes to the literature in twofold. First, to the best of the author’s knowledge, the impact of foreign reserves and money supply on inflation in The Gambia have not been studied. The few existing studies are: Nguyen, 2015; Chițu, 2016; Ditimi et al., 2017; Amassoma et al., 2018;
Abdullah et al., 2020; Tursoy and Mar’i, 2020) were not conducted on The Gambia, besides Joof and Tursoy (2020) that examined the effect of foreign reserves on M2 and disregarding inflation rate. Secondly, I included foreign reserves to examine the extent to which foreign reserves can have an impact on inflation in The Gambia, both in the short and long-term by means of the Autoregressive distributed lag (ARDL) and long run estimations using the fully modified ordinary least squares (FMOLS) techniques.

Although The Gambia is considered to be among the countries with the lowest inflation rate within the West Africa Monetary Zone (WAMZ), however, due to recent the steady increasing inflation, The Gambia may be exposure to the risk of being unable to comply with the WAMZ single digit convergence criterion on inflation, Economic Community of West Africa States (ECOWAS) 5% inflation target, and the 5% inflation target set by Ministry of Finance and Economic Affairs of The Gambia. Due this fact, the author is motivated to investigate the dynamic impact of foreign reserves and money supply on inflation to provide substantial assistance to the monetary authorities towards policy formulation. The paper is, thus, important for the purposes of monetary and economic policy. The rest of the article is arranged as follows: section two overview developments in foreign reserves, inflation, money supply, and the monetary policy rate during the period covered by the study. Section three undertakes the literature review, part four discusses the estimation method. The analysis, conclusion, and recommendations are taken up in section five.

2.0 OVERVIEW OF INFLATION, FOREIGN CURRENCY RESERVES, AND MONEY SUPPLY IN THE GAMBIA.

Figures 1, 2 & 3 represent the foreign reserve, money supply, and consumer price index. The graphs show that these variables have been moving in the same direction from 2005-2019, indicating a
continuous rise in Foreign Currency Reserves, Money supply, and Consumer Price Index. In 2005, foreign reserves amounted to Dalasi (GMD) 2.3 billion; this value rose to GMD 13.9 billion in 2019 indicating a growth of more than 500%. Likewise, between 2018 and 2019 the reserves rose from GMD11.8 to GMD13.9 billion, signifying a 17% increment. “This reflects the large/ significant amount of budget and balance of payments support from development partners and the intermittent intervention in the foreign exchange market” (CBG, 2019). The intervention committee only intervenes in the purchase of forex to boost the reserves and not otherwise. Money supply reached its peak in 2019 with GMD 42.9 billion. The annual growth rate in 2019 rose to 27.06% compared to 20.04% growth in 2018. The M2 in 2005 stood at GMD 5.6 billion compared to the GMD 42.9 billion in 2019, depicting a growth of 664%. This surge has been attributed to the rise in net external inflows to the banking sector (Joof and Tursoy, 2020). Money supply expansion continues throughout, reflecting the accommodative monetary policy stance. Furthermore, according to WAMA (2009), the increment in M2 in The Gambia is attributed to these drivers: “net foreign assets and net domestic assets connected to the banking systems, Net claims on the government, Claims on the private sector, Claims on public enterprises, and claims on the rest of the economy”. Inflation rate represented in figure 3 as the Consumer Price Index (CPI) with a base year 2010, attained its highest point at 99.91 in 2019. In 2018, the CPI was recorded at a value of 92.75; this evidenced an annual growth rate of 7.8% between 2018 and 2019. Furthermore, from 2005 to 2019 the CPI was observed to have increased by 125%. The monetary policy rates have been fluctuating during the period understudy. This suggests that the CBG have adjusted the policy rates to counter the soaring inflation, hence an increase in the policy rate reduces the impact of monetary expansion.

3.0 LITERATURE REVIEW

3.1 Theoretical Review on Money Supply
The traditional quantity theory of money (QTM) propounded by Fisher (1922) with the underlining assumptions that money and output have a static velocity and transactions are as a result of full employment and money. Furthermore, an increase in money supply triggers high level of prices vice versa. Conversely, Keynes (1956) posited that aggregate demand or purchasing power is the only determinant of the quantity of money. He further highlighted that output and velocity varies, implying that the quantity of money has less impact on prices. Nevertheless, Marx (2000) suggested that the quantity of money remains a function of the aggregate volume of commodities produced. Thus, Keynes, Marx and Fischer identified various determinants of prices as income, production, and demand, respectively.

3.2 Nexus between Foreign Currency Reserves and Inflation
Zhou (2014) tested the impact of foreign reserves on inflation in China, employing the VAR model from 2008:M1-2011:M12. He highlighted that foreign exchange reserves contribute more than 20% of the inflation in China and triggers money supply. Lin and Wang (2009) use the time consistency model on five Asian nations from the period 1981Q1- 2003Q4, beside Hong Kong whose data was from 1994Q1 - 2003Q4 to examine the link between foreign exchange reserves and inflation. They found foreign exchange reserves accumulation to increase inflation. Chițu (2016) assesses “whether international reserves accumulation can be inflationary because of moral hazard and incentive effects” using the natural experiment for the period 2009:M4-2011:M12 and 2009: M9- 2013:M12 for 186 IMF member states. The analysis posits that an upsurge in foreign reserves increases inflation because these nations are incentivized; therefore, they have become more unworried to follow less cautious policies due to the perceived safety of holding high reserves. Joof and Tursoy (2020) investigated “the mystery behind foreign reserves sterilization in the Gambia” using the ARDL and FMOLS on monthly data from 2002-2019. The study found that foreign reserves and M2 are positively related. The findings further explain that the Central Bank of The Gambia should endeavor in developing
proper financial infrastructures, rather than focusing on open market operations because these places considerable burden of debt on the government. This finding is also supported by Joof (2021) in the case of WAMZ countries.

3.3 Nexus among Money Growth and Inflation

Inflation is said to occur when excess money is actually paid for equal quantity of products or services. Even though there is capacity to ascertain if an economy is experiencing inflation, however, presently there is no unanimity concerning what triggers it. The Monetarist propounded that inflation is triggered by an upsurge in M2 (when supply is higher than demand), while money supply influences income and price fluctuations. Friedman (1968) claims that inflation is fiscal, and that fiscal policy should gear towards decreasing inflation. Therefore, the Monetarists highlights that inflation arises due to growth in the M2 (Abdullah et al., 2020). Central banks have concentrated on ensuring stable prices and neglected that money supply and inflation are complementary in maintaining low and steady inflation (King, 2001). On the other hand, the Keynesian economists propounded that the association between inflation and money supply can be best explained via demand-pull and cost-push inflation. The results from empirical studies are controversial, potentially due to differences in methodologies, sample size, country, etc. (Vladova & Yanchev, 2015).

Abdullah et al. (2020) posits that inflation growth is positively connected to an increase in money supply in the case of Kuwait using a multiple regression analysis for the period 1979-2015. Similarly, Samour et al. (2020) investigated the effect of monetary policy on Turkish stock market from 1993Q4-2016Q4 by means of an ARDL technique. The outcomes showed that there is a positive influence of monetary policy on stock prices. Similarly, Nguyen (2015) in the case of 9 Asian nations uses the “pooled mean group” approach to scrutinize the implications of M2 and fiscal deficit on inflation from 1985-2012. He highlighted that M2 has a positive impact on inflation. Isiksal et al. (2019) examined the impact of monetary policy on exchange rate in Turkey from 2001-2016 using the ARDL technique. They highlighted that monetary policy has a significant influence on exchange rate.

In Africa, Ofori et al., (2017) employs the OLS technique to analyze the consequences of money supply on inflation using data from 1967 to 2015 in Ghana. They establish a positive long-term association among the variables. Ozekhome (2017) in the case of WAMZ nations uses a panel OLS and Fixed Effect model from 2000-2015. He found that money growth has a positive impact on inflation. Canetti and Greene (2000) used the Vector Auto Regression on a sample of 10 African nations to examine the effect of monetary expansion on inflation. The outcome illustrates that monetary dynamics dictate the level of inflation in 4 countries. Bakare (2011) in the case of Nigeria used “cointegration and error correction techniques” to investigate the drivers of money supply and their consequences on inflation. The outcome revealed a positive connection among money supply and inflation. This discovery diverges from the established negative association between M2 and inflation in Nigeria, based on regional study by WAMA (WAMA, 2009). Likewise, Akinbobola (2012) utilizes the VECM on a quarterly data from 1986q1-2008q4 on Nigeria, to investigate the dynamic relationships among money supply, inflation, and exchange rate. The analysis revealed that both M2 and exchange rate have an inverse influence on inflation. He assumes that this negative association might be associated with the setbacks in the supply chain of commodities from both the national and foreign supply channels. Kiganda (2017) examined the relationship between inflation and money supply in Kenya between 1284 to 2012, using the VECM. The analysis showed a positive relationship between inflation and money supply in the long run.

In contrast, Tursoy and Mar’i (2020) employed the Wavelet analyses from 1987-2019 on Turkey to elucidate on the relationship between M2 and inflation. They found feedback relationship among inflation and money supply. Likewise, Vladova and Yanchev (2015) suggested a feedback association between money supply (M1 and M2) and inflation, using a VAR model in Bulgaria from 1998-2012.
Sasongko and Huruta (2018) on the other hand, used the Granger causality technique in the case of Indonesia for the period 2007-2017. They found a unidirectional causation from money supply to inflation. In Turkey, Koyuncu (2014) used the Granger causality test for the period 1987-2013 and found a unidirectional causality from M2 to inflation. Similarly, Wolde-Rufael (2008) explores the link among M2 and inflation employing the Toda and Yamamoto model and granger causality test on Ethiopia. The analysis revealed a unidirectional causation from M2 to inflation, thereby suggesting that monitoring the money supply is a paramount policy imperative to protect the long-run economic stability of Ethiopia. The analysis further confirms the quantity theory of money. Alimi (2012) used the Granger causality analysis to establish a one-way causation from M2 to inflation, which supports the view of the monetarists.

However, using the “co-integration autoregressive dynamic error correction model approach” on Nigerian data from 1970-2016, Ditimi et al. (2017) highlights a neutral causal association between money supply and inflation. Amassoma et al. (2018) apply the “Autoregressive Dynamic Error Correction Model (ADLEC) approach” on Nigerian data from 1970-2016 and show that inflation is not significantly affected by money supply in the short- and long-run; they suggested that this finding is due to probable economic recession.

Based on the literature review it is evident that the findings on the association among inflation and money supply are inconclusive. Furthermore, there was no study conducted specifically in The Gambia. Therefore, this study tries to fill the gap by investigating the role of foreign reserves and money supply on inflation in The Gambia.

4.0 DATA AND METHODOLOGY

4.1 Data
To scrutinize the impact of foreign currency reserves (log FCR), broad money supply (log M2), and monetary policy rate (MPR) on inflation (log CPI), we use monthly data obtained from the “Central Bank of The Gambia” spanning the period 2005M1-2019M12. Inflation is employed as the dependent variable and is proxied as log of consumer price index while LFCR and LM2 are the independent variables, and the monetary policy rate (MPR) as the control variable. I transformed the variables into logarithms except for the MPR. The log transformation is used to ensure that all the variables are in percentage and to ease interpretation of the results.

To achieve the objective of the study, a revised form of the conceptual framework employed by Joof and Tursoy (2020) who used foreign reserves, money supply and monetary policy rate is adopted. The adjustment of adding inflation in the model becomes crucial; thus, there is a need to model inflation in the framework of foreign reserves and money base in The Gambia. Hence, I specify the equations in the following general and functional forms, respectively:

\[
LCPI_t = \beta_0 + \beta_1 LFCR + \beta_2 LM2 + \beta_3 MPR + \epsilon_t
\]  
(1.0)

Where LCPI is log of consumer price index, LFCR is the log of foreign currency reserves, LM2 is the log of money supply, MPR is the monetary policy rate and \(\epsilon_t\) is the disturbance error term.
### Indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Procedure</th>
<th>Unit</th>
<th>Source</th>
</tr>
</thead>
</table>

**Source**: WAMI Compilation

### 4.2.2 Bound Test of Cointegration

After applying the unit, the bound test of cointegration is applied to confirm the long run cointegration between the variables. According to De Vita et al., (2006) to the each must be I(0) or I(1) in order to satisfy the assumption of the ARDL bound test of cointegration, and that under no conditions, should a variable be I(2) and that the dependent variable should be I(1).

The hypotheses tests are: \( H_0: \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = 0 \) and \( H_1: \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq 0 \) for the null and alternative, respectively, in equation (1.1) below. The presence (or absence) of cointegration is confirmed once the “F-statistic \( F_{pss} \)” is higher than the “critical values” at the upper bound. Equally, if the F-statistic is in the middle of the lower and upper bounds, it implies an indecisive outcome of cointegration. The ARDL equation:

\[
\Delta \text{LCPI}_t = \gamma_0 + \sum_{i=1}^n \gamma_i \Delta \text{LCPI}_{t-i} + \sum_{i=1}^n \gamma_i \Delta \text{LFCR}_{t-i} + \sum_{i=1}^n \gamma_i \Delta \text{LM}_2_{t-i} + \gamma_1 \Delta \text{MPR}_{t-i} + \gamma_2 \Delta \text{LCPI}_{t-i} + \gamma_3 \Delta \text{LFCR}_{t-i} + \gamma_4 \Delta \text{LM}_2_{t-i} + \gamma_5 \Delta \text{MPR}_{t-i} + \varepsilon_t
\]

(1.1)

### 4.2.3 Short Run Estimation

Following the existence of stationarity and cointegration, the ECM (error correction model) is used to estimate the short run dynamic equation which incorporates the speed of adjustment as shown below:

\[
\Delta \text{LCPI}_t = \beta_0 + \sum_{i=1}^n \beta_i \Delta \text{LCPI}_{t-i} + \sum_{i=1}^n \beta_i \Delta \text{LFCR}_{t-i} + \sum_{i=1}^n \beta_i \Delta \text{LM}_2_{t-i} + \sum_{i=1}^n \beta_i \Delta \text{MPR}_{t-i} + \text{ECM}_{t-1} + \mu_t
\]

(1.2)

Where:
- \( \Delta = \) change in the variables
- \( n = \) optimal lag number, the lag selection is based on the Akaike Information Criterion (AIC) (See Appendix at the end of the paper).
- LCPI = log of Consumer Price Index
- LFCR = log of foreign currency reserves
- LM2 = log of money supply
- MPR = monetary policy rate
- ECM = one period lagged error correction term of the long run estimate”, predicted by Gujarati (2003) to be negative and significant.
- \( \varepsilon_t = \) error condition.
4.3 The Long Run Equation (FMOLS and DOLS)

The precondition to employ the FMOLS is for all the series to be stationary at first at I(1) cointegrated. The “Fully Modified Ordinary Least Squares” propounded by Phillips and Hansen (1990) is employed in this paper to examine the long run impact of foreign currency reserves and money supply on inflation. The FMOLS is able to settle endogeneity concerns, serial correlation, omitted variable bias, and specification errors in a model. To assess the robustness of the study, the “Dynamic Ordinary Least Squares” (DOLS) proposed by Stock and Watson (1993) is applied. This technique is proficient to adjust possible endogeneity problems occurring between explanatory variables.

The dynamic model (FMOLS and DOLS) automatically generates the optimum lags and leads for a regression, thus, resolving the endogeneity and heteroskedasticity issues in as opposed to the ARDL. Furthermore, Fereidouni et al., (2014) stated that the FMOLS is more effective when dealing with it small sample size relative to the ARDL, in which numerous observations are lost as a result of the lag selection procedure in the ARDL. Similarly, the FMOLS adjusts the inference problem occur in the Eagle Granger cointegration technique, and this makes the t-statistic of long-run coefficient found in the FMOLS valid (Amarawickrama and Hunt, 2007).

The FMOLS estimator is as follows:

$$ O_{FME} = \left( \sum_{t=2}^{T} Z_i Z'_i \right)^{-1} \left( \sum_{t=2}^{T} Z_i Y_i^+ - T \left[ \lambda_i z_{1}^+ \right] \right) $$

(1.3)

The $Y_i^+$ and $\lambda_i z_{1}^+$ terms in equation 1.3, helps in the correction of the endogeneity and autocorrelation. The FMOLS technique is “asymptotically unbiased” and permits for standard Wald analysis based on the chi-square statistical inference. This is possible because it possesses efficient mixture –normal asymptotic distribution (Adom et al., 2015).

The DOLS estimation equation is given as:

$$ y_t = a + bx_t + \sum_{i=k}^{i=k} \phi_i \Delta x_{t+i} + \epsilon_t $$

(1.4)

The term $\phi_i$’s in the DOLS are the parameters of the leads and lags differences of I(1) regressors. These parameters can adjust for potential endogeneity, serial correlation, and abnormal residuals (Herzer and Nowak-Lemann, 2006).

5.0 DATA PRESENTATION

5.1 Descriptive Statistics

Table 1 shows the descriptive statistics of the sample raw data from 2005M1-2019M12 of the variables employed for the analysis. Average inflation proxied as CPI during the period was recorded at 65.1 and a median value of 61.1. The maximum and minimum values stood at 99.9 and 44.1, respectively. This indicates that during the period CPI was fluctuating. The foreign reserves have a mean value of GMD 5.4 billion with a median value of GMD 3.9 billion. It further recorded maximum and minimum values of GMD 13.9 and 2.0 billion, respectively. This suggests that at some point The Gambia’s foreign reserves were more than the 3 months of import cover. The mean of M2 stood at GMD 16.9 billion, and a median of GMD 15 billion with a maximum of GMD 42 billion and a minimum of GMD 5.6 billion. Thus, The Gambia’s monetary expansion is high due to the monetary targeting regime, which probably had been responsible for the increase in inflation. MPR (monetary policy rate) has a mean value 11.1 percent and median value of 10.4 percent. The maximum and minimum values are 27.5 percent and 1.8 percent, respectively.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>CPI</th>
<th>FCR</th>
<th>M2</th>
<th>MPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>65.13422</td>
<td>5423.808</td>
<td>16866.24</td>
<td>11.14783</td>
</tr>
<tr>
<td>Median</td>
<td>61.08500</td>
<td>3965.955</td>
<td>14990.48</td>
<td>10.38000</td>
</tr>
<tr>
<td>Maximum</td>
<td>99.91000</td>
<td>13887.67</td>
<td>42874.90</td>
<td>27.53000</td>
</tr>
<tr>
<td>Minimum</td>
<td>44.31000</td>
<td>2039.390</td>
<td>5606.430</td>
<td>1.880000</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>15.92513</td>
<td>3269.861</td>
<td>9050.847</td>
<td>4.598754</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.569435</td>
<td>1.065619</td>
<td>0.905273</td>
<td>0.847619</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.143292</td>
<td>3.004115</td>
<td>3.150719</td>
<td>4.824673</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>15.23230</td>
<td>34.06644</td>
<td>24.75595</td>
<td>46.52446</td>
</tr>
<tr>
<td>Probability</td>
<td>0.000492</td>
<td>0.000000</td>
<td>0.000004</td>
<td>0.000000</td>
</tr>
<tr>
<td>Sum</td>
<td>11724.16</td>
<td>976285.4</td>
<td>3035923.</td>
<td>2006.610</td>
</tr>
<tr>
<td>Sum Sq. Dev.</td>
<td>45396.14</td>
<td>1.91E+09</td>
<td>1.47E+10</td>
<td>3785.588</td>
</tr>
</tbody>
</table>

Observations: 180 180 180 180

Note: CPI is consumer price index, FCR is foreign currency reserves, M2 is money supply, and MPR is monetary policy rate.

5.2 Unit Root Test

Table 2 reports the ZA unit root test and PV unit root test results for the considered variables. These unit root tests suggest one and two structural breaks in the variables. These break dates were taken into account, and it was revealed by these unit root tests that all the series are non-stationary at their levels; hence, the minimum t-statistics are greater than the critical values, but they are stationary at their first differences. Thus, the null hypothesis of the unit root is rejected for all the variables; LCPI, LFCR, LM2, and MPR variables, because the minimum t-statistics are less than the corresponding critical values. Hence, all the variables are integrated of order one (that is, I(1)).

Table 2: Unit Root Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Zivot-Andrews unit root test</th>
<th>Perron-Vogelsang unit root test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BD</td>
<td>BD</td>
</tr>
<tr>
<td>LCPI</td>
<td>-2.891268</td>
<td>2013M08</td>
</tr>
<tr>
<td>LFCR</td>
<td>-4.755952</td>
<td>2012M04</td>
</tr>
<tr>
<td>LM2</td>
<td>-3.981381</td>
<td>2015M05</td>
</tr>
<tr>
<td>MPR</td>
<td>-5.512068</td>
<td>2015M05</td>
</tr>
<tr>
<td>ΔLCPI</td>
<td>-11.07246**</td>
<td>2012M01</td>
</tr>
<tr>
<td>ΔLFCR</td>
<td>-16.95566**</td>
<td>2012M10</td>
</tr>
<tr>
<td>ΔLM2</td>
<td>-15.11441**</td>
<td>2015M05</td>
</tr>
<tr>
<td>ΔMPR</td>
<td>-0.074586**</td>
<td>2016M07</td>
</tr>
</tbody>
</table>

Note: BD is break date, LCPI is log of consumer price index, LFCR is log foreign currency reserves, LM2 is log money supply, and MPR is monetary policy rate, while ***, **, * represent 1%, 5%, and 10% significance level, respectively.”
5.3 **Bound Cointegration Test**

The bound cointegration test results presented on Table 3 indicated the occurrence of long-term cointegration among LCPI, LFCR, LM2 and MPR. Hence, the null postulate of absence of cointegration is rejected, given that the F-statistic is more than the “bound critical value” at 5% level.

**Table 3: Bound Cointegration Test**

<table>
<thead>
<tr>
<th>Function</th>
<th>ARDL Model</th>
<th>F-stat.</th>
<th>CV at 5% (**)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_{LCPI}(LCPI/LFCR, LM2, MPR)$</td>
<td>LM2, (1,0,0,0)</td>
<td>4.94*</td>
<td>3.23 4.35</td>
</tr>
<tr>
<td>$F_{LFCR}(LFCR/LCPI, LM2, MPR)$</td>
<td>LM2, (1,0,0,0)</td>
<td>5.29*</td>
<td>3.23 4.35</td>
</tr>
<tr>
<td>$F_{LM2}(LM2/LCPI, LFCR, MPR)$</td>
<td>LFCR, (1,0,0,0)</td>
<td>7.06*</td>
<td>3.23 4.35</td>
</tr>
<tr>
<td>$F_{MPR}(MPR/LCPI, LM2)$</td>
<td>LFCR, (1,0,0)</td>
<td>6.07*</td>
<td>3.79 4.85</td>
</tr>
</tbody>
</table>

*Note:* "*indicates rejection of the null hypothesis of no cointegration at 5%. ** The bounds critical values are taken from Pesaran, Shin, and Smith (2001) with unrestricted intercept and no trend”.

5.4 **Short Run Estimation Results**

**Table 4: ARDL Technique Short-Run coefficients. Dependent variable: inflation ($\Delta LCPI$)**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Coefficients</th>
<th>t-Statistics</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta LCPI(-1)$</td>
<td>1.319733***</td>
<td>7.720730</td>
<td>0.170 934</td>
</tr>
<tr>
<td>$\Delta LCPI(-2)$</td>
<td>-0.281633***</td>
<td>-2.561786</td>
<td>0.109 936</td>
</tr>
<tr>
<td>$\Delta LFCR(-1)$</td>
<td>0.224687</td>
<td>0.571670</td>
<td>0.393 035</td>
</tr>
<tr>
<td>$\Delta LFCR(-2)$</td>
<td>-1.202409**</td>
<td>-3.384151</td>
<td>0.384 151</td>
</tr>
<tr>
<td>$\Delta LM2(-1)$</td>
<td>0.433213</td>
<td>0.561846</td>
<td>0.771 055</td>
</tr>
<tr>
<td>$\Delta MPR(-1)$</td>
<td>0.014462</td>
<td>0.883111</td>
<td>0.016 376</td>
</tr>
<tr>
<td>$\Delta MPR(-2)$</td>
<td>-0.010760</td>
<td>-0.608782</td>
<td>0.017 674</td>
</tr>
<tr>
<td>$\Delta MPR(-3)$</td>
<td>0.026255</td>
<td>1.500649</td>
<td>0.017 495</td>
</tr>
<tr>
<td>$\Delta MPR(-4)$</td>
<td>-0.046804***</td>
<td>-2.844617</td>
<td>0.016 454</td>
</tr>
</tbody>
</table>
\[
\begin{align*}
ECT_{t-1} & = -1.010163^{***} & -5.413762 & 0.186 \\
C & = -0.006452 & -0.195073 & 0.033
\end{align*}
\]

\[
R^2 = 0.466859
\]

Diagnostics

\[
\begin{align*}
DW & = 1.98366 \\
Ramsey & = 0.1822 \\
LM Serial correlation & = 0.4948 \\
Heteroskedasticity & = 0.0565 \\
Normality & = 4.5239
\end{align*}
\]

Note: ***, **, * indicates the level of significance at 1%, 5%, and 10%, respectively. \(ECT_{t-1}\) represents the estimated error correction series in the model, and \(DW\) is the Durbin Watson statistic.

5.5 Joint Probability Test for the ARDL

Due to the various lags in the model, it will be wrong to select one coefficient of the lagged terms and interpret it for the short run. To tackle this issue, the Wald test is run to find the joint significance of the lagged terms.

**Table 5: Wald Test**

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-statistics</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFCR</td>
<td>3.035807</td>
<td>0.0028***</td>
</tr>
<tr>
<td>MPR</td>
<td>1.736004</td>
<td>0.0889*</td>
</tr>
</tbody>
</table>

Note: “the following null hypotheses were tested: for LFCR H0: C(3)=C(4)=0, and for MPR H0: C(6)=C(7)=C(8)=C(9)=0, while ***, **, * indicates the level of significance at 1%, 5%, and 10%, respectively”.

5.6 Long Run Estimation Results

**Table 6: The FMOLS, Long-Run coefficients**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Coefficients</th>
<th>t-Statistics</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFCR</td>
<td>0.275389***</td>
<td>12.05038</td>
<td>0.022853</td>
</tr>
<tr>
<td>LM2</td>
<td>0.162275***</td>
<td>6.713952</td>
<td>0.024170</td>
</tr>
<tr>
<td>MPR</td>
<td>0.000940</td>
<td>1.357000</td>
<td>0.000693</td>
</tr>
<tr>
<td>C</td>
<td>0.257325</td>
<td>3.825941</td>
<td>0.067258</td>
</tr>
</tbody>
</table>

\[
R^2 = 0.992185 \\
Adj. R^2 = 0.992051 \\
S. E = 0.021125 \\
Long run variance = 0.001357
\]

Note: “LFCR= foreign currency reserves, LM2=money supply, and MPR= monetary policy rate. The ***, **, * represent 1%, 5%, and 10% significance levels, respectively”.

33
5.7 Robustness Check

Table 7: The DOLS, Long-Run coefficients.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Coefficients</th>
<th>t-Statistics</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFCR</td>
<td>0.274801***</td>
<td>11.07656</td>
<td>0.024809</td>
</tr>
<tr>
<td>LM2</td>
<td>0.162955***</td>
<td>6.159740</td>
<td>0.026455</td>
</tr>
<tr>
<td>MPR</td>
<td>0.001032</td>
<td>1.297902</td>
<td>0.000795</td>
</tr>
<tr>
<td>C</td>
<td>0.255407</td>
<td>3.509336</td>
<td>0.072779</td>
</tr>
</tbody>
</table>

$R^2$          | 0.994555     |

Adj. $R^2$     | 0.994157     |

S. E          | 0.017915     |

Long run variance | 0.001322     |

Note: “LFCR= foreign currency reserves, LM2=money supply, and MPR= monetary policy rate. The ***, **, * represent 1%, 5%, and 10% significance levels, respectively”.

5.7 Diagnostic Tests

Figure 5-Cusum

Figure 6-Cusum Square
From Table 4, the diagnostic assessments suggest the non-occurrence of serial correlation and heteroskedasticity and that the model is normally distributed. Moreover, Figures 5 & 6 of the “CUSUM and CUSUMsq”, respectively developed by Brown et al. (1975) disclosed the stability in the model; thus, in both figures the blue lines are within the boundaries of the redlines depicting the 5% significant level, thereby, demonstrating that the model is stable. In Table 6 the Standard Error of the regression and long run variance in the FMOLS and DOLS showed that the models do not suffer from autocorrelation and heteroskedasticity problems and are properly specify. Moreover, the R-square which determines goodness-of-fit for linear model is 0.99%, this suggest that the 99% of the variation in inflation is described by independent variables.

5.8 Discussion

5.8.1 Findings

The ARDL in Table 4 showed that foreign currency reserves have a significant negative influence on inflation at lag two, but insignificant at lag one. This implies that an increase in foreign currency reserves leads to a decrease inflation rate. This outcome can be attributed to the effect of open market operations employed by CBG. The result also showed that Central Bank of The Gambia was able to neutralize the impact of inflow of foreign reserves in the short run. Similarly, the monetary policy rate has an inverse association with inflation. However, M2 has an insignificant correlation with inflation in the short run. This also means that M2 does not cause inflationary pressure in the short run. “Moreover, the lagged ECM (error correction term) in the short-run estimation has a coefficient of −1.01, this infers that instead of monotonically converging to the equilibrium path directly, the error correction process fluctuates around the long-run value in a dampening manner. However, once this process is complete, convergence to the equilibrium path is rapid” (Narayan and Smyth, 2008).

Joint Probability Test for the ARDL: The outcome of the analysis revealed that foreign reserves have a positive significant relationship with inflation in the short run, meaning that an increase in foreign reserve will trigger a soaring inflation. Similarly, in the short run monetary policy rate was found to have a positive significant effect on inflation.

The long run estimation in Table 6 & 7: The outcomes from the FMOLS and DOLS confirmed that both foreign currency reserves and money supply positively affects inflation at 1% significance; suggesting that an increase in LFCR increases inflation in the long run. This outcome is in conformity with the result of Zhou (2014) who found a positive association between foreign reserves and inflation in China.

The above short and long run analysis indicated that foreign currency reserves have a positive significant impact on inflation. These show that an increase in foreign reserves will trigger inflation both in the short and long run. These findings can be attributed to the following reasons: first, the domestic assets substituted with foreign assets caused by the frequent demand for foreign currency by the monetary authorities through intervention policies (purchasing foreign currency via the domestic market) that could be eventually pumped into the domestic market either in the form local investments or spending, thereby increasing the reserve money which triggers inflation due to unsterilized operations. Due to these activities, the Gambian dalasi had depreciated against all the major currencies leading to a high inflation and macroeconomic imbalance. Likewise, as postulated by Aizenmann and Marion (2004), the inflation in The Gambia arising from foreign currency reserves can be attributed to the moral hazard channel. This channel hypothesized that reserves buildup can be inflationary due to the incentive special effects, which might encourage The Gambia to pursue more expansionary fiscal policy channels as a result of the apparent safety provided by reserves accumulation.
However, the short run results highlighted that money supply has no significant impact on inflation in the short run, which can be attributed to the effective open market operation performed by CBG toward controlling the money in circulation (which can potentially raise inflation rates). In contrast, the long run positive impact of money supply on inflation confirms the traditional theoretical nexus among M2 and inflation, which states that LM2 should have a long run significant positive influence on the price level. The significance of LM2 consistently indicates the robust impact of monetary expansion on the level of liquidity in The Gambia. Furthermore, an upsurge in liquidity in The Gambia, increases “real money balances” of the general public, which stimulate cumulative demand and cause the lethargy of supply to react to the unanticipated rise in demand arising from low production capability and setbacks in the supply chain of commodities from the local and international supply channels, thereby causing pressure on prices and, consequently, stimulating inflation (Ozekhome, 2017). Furthermore, in the mid-2018 to date, the Central Bank of The Gambia has cut the monetary policy rate. This policy has made loans inexpensive for individuals to borrow and consequently, people hold more nominal Gambian Dalasi (GMD) than required and spend them faster, triggering inflation or a rise in prices.

### 6.0 CONCLUSION & POLICY RECOMMENDATIONS

Although The Gambia is considered to be among the countries with the lowest inflation rate within the West Africa Monetary Zone (WAMZ), however, due to recent the steady increasing inflation, The Gambia may be exposed to the risk of being unable to comply with the WAMZ single digit convergence criterion on inflation, Economic Community of West Africa States (ECOWAS) 5% inflation target, and the 5% inflation target set by Ministry of Finance and Economic Affairs of The Gambia. Due this fact, the author is motivated to investigate the dynamic impact of foreign reserves and money supply on inflation using a monthly data (2005M1-2019M12). The Autoregressive Distributed Lag model, and Fully Modified Ordinary Least Squares techniques are employed to evaluate the short run and long run relationships between foreign currency reserves, money supply and inflation in The Gambia. Due to the various lags in the ARDL model, the Wald Test is utilized to establish the joint significance of the lagged terms, since it will be wrong to select one coefficient of the lagged terms and interpret for the short run. The Wald test joint probability estimation suggests that foreign reserves have a positive significant relationship with inflation in the short run, meaning that an increase in foreign reserves will trigger inflation, while money supply has a neutral relationship with inflation. Furthermore, the results revealed that both FCR and M2 induce inflationary pressure in the long run; this outcome is in conformity with the quantity theory of money and the Monetarist postulation, which propounded that inflation is triggered or increased by an increase in money supply. However, monetary policy has a neutral impact on inflation both in the short- and long run.

In the light of the above, I suggest the following recommendations: first, the CBG should endeavor to monitor the expansionary influence of net foreign assets (NFA) on inflation. Second, the monetary authority should closely tie the expansion of money supply to the goal of stimulating growth. This will help in suppressing the inflationary propensities from money growth in The Gambia. Consequently, “monetary policy management” ought to be anchored on stabilizing prices. Third, the Central Bank’s liquidity management mechanisms should strictly comply with the money supply growth targets. Finally, the CBG should use liquidity management techniques to monitor the money in circulation and use its monetary policy instruments (CBG bills) to curb excess liquidity in the economy when appropriate.
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**APPENDIX**

VAR Lag Order Selection Criteria  
Endogenous variables: LOGCPI LOGFCR MPR LOGM2  
Exogenous variables: C  
Date: 12/27/20   Time: 11:02  
Sample: 2005M01 2019M12  
Included observations: 176

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Exogenous variables: C  
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Sample: 2005M01 2019M12  
Included observations: 176

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Exogenous variables: C
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Sample: 2005M01 2019M12
Included observations: 176

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VAR Lag Order Selection Criteria
Endogenous variables: MPR LOGFCR LOGCPI LOGM2
Exogenous variables: C
Date: 12/27/20   Time: 11:03
Sample: 2005M01 2019M12
Included observations: 176

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