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## The Relationship between Inflation, Exchange Rate, Money Supply and Economic Growth in The Gambia

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**Abstract.** Instability in the movement of prices is a major concern in all countries. The rise in foreign exchange and prices of goods and services are among the key factors that causes fluctuation in the economic growth of a country. Thus, this paper adopted the ARDL model to examine whether real effective exchange rate, economic growth and money supply causes Inflation in the Gambia for the period 1985 to 2021. The finding reveals that all our variables causes inflation positively and negatively in the long run and short run respectively at a significant level of 1% except real effective exchange rate and money supply which is significant at 5% level in the long run. The recursive cumulative sum shows that the relationship was stable and the square recursive cumulative sum reveals instability in the relationship of our dependent and independent variables which could be as a result of exogenous shock in output and increase amount of public debts. The study recommends the Gambian government to be caution in taking increase amount of public debts and also the central bank of the Gambia to move from monetary targeting to inflation targeting so as to maintain economic growth and price stability. However, the central bank of the Gambia should assess the entire economy before implementing the policy.

**Keywords.** Inflation; real effective exchange rate; money supply; economic growth

### Introduction

A sustainable economy growth is the core aim of every country. Inflation and exchange rates are two key factors for measuring a country's macroeconomic performance. Instability in the movement of prices is a major concern in all countries. The rise in foreign exchange and prices of goods and services are among the key factors that cause fluctuations in the economic progression of a country. The significance of the exchange rate on inflation is ascertained by the countries exchange rate administration.

Inflation is a key variable in underlying economic situations and it has been argued to having a positive or negative effect on the economy (Barguelli et al., 2018). The continuous fluctuation in inflation makes it tedious to calculate, track and analyze monetary policies on time. Any doubt in the calculation of the inflation rate shows a high level of uncertainty in policy decisions. On the other hand a consistent inflation forecasts are vital for drafting monetary policies. To evaluate and track the effect of inflation, several factors should be

considered for example exchange rate, wage rate, interest rate, money supply, potential output and trade openness and expectations (Musarat, Alaloul & Liew 2021). Inflation remains fairly stable in many emerging economies, despite the negative economic impact. This is partly due to major changes in the monetary policy framework, particularly the flexible exchange rates regimes which target inflation (Madhou et al, 2021).

Exchange rate volatility is a persistent fluctuation in the exchange rate. It is one of the main issues in recent times because of the effects on economic activities (Olamide, Ogujiuba, & Maredza, 2022). Exchange rate volatility is caused by inflation, interest rates, and the balance of payments. There is no doubt that exchange rate fluctuation significantly impact the economy of developing country (Madesha, Chidoko, & Zivanomoyo, 2013). However, the direction in which exchange rate volatility affects economic growth is still debatable, this might be due to methodology used to analyse the data, the period of study and country-specific features. Ozcelebi (2018) argued that exchange rate instability drives economic growth in an economy, while Barguelli et al. (2018) argued that it hampers the growth process. The high volatility and uncertainty of exchange rate has motivated policymakers and academics to examine the type and magnitude of the effect of such volatility on trade volumes and economic at large (Ozturk, 2006). To achieve economic growth, countries need to apply appropriate exchange rate policies and limit the adverse impact of exchange rate (Karakostas, 2021).

Volkan, Saatçioğlu and Korap (2007) translate the outcome of exchange rate variations on national inflation, this has been a subject of concentration in modern-day economics literature. From the perspective of developing countries, exchange rate stabilization policies affect the effective implementation of other economy policies. In 2000, the Anti-Inflation control program, headed by the Quasi-Monetary Commission, was instituted to combat national inflation. The Board established fixed exchange rates for domestic and foreign currencies to shape the exchange rate parity expectations of economic participants. This method was effective in decreasing inflation by half in the first ten months of performance, but in two of the subsequent months economic distress led to a sharp decline in real incomes and the program was terminated.

Regardless of the mixed effect of covid-19 pandemic, the economy of The Gambia was estimated to grow at 4.3% in 2021 while in 2022 the economic was projected to grow at 5.6%. However, due to the effect of the war in Ukraine, inflation has been intensifying in The Gambia affecting different sectors and supply changes. At end of April 2022 inflation rate in The Gambia reached 11.7%, forcing the central bank to take measures such as progressing reforms on various fronts, including transparency of COVID-19 expenditure, the institutional framework of public institution, revenue control, and public financial management to contain inflationary pressures (IMF, 2022). Thus, there is a need to examine how exchange rate, money supply and economic growth causes inflation in the Gambia for the period 1985 to 2001.

The study aims to answer the following research questions:

- (1) Does exchange rate cause inflation in the Gambia?
- (2) Does money supply causes inflation in The Gambia?
- (3) Does economic growth causes inflation in The Gambia?

The rest of the paper is arranged in this way: Literature Review, Research Methodology, Empirical Results, Conclusion and Recommendation

### **Literature review**

Keynesians, monetarists, and neoclassical economists agree that the steady inflation rate is closely related to the growth of the money supply, and that monetary policy cannot influence the equilibrium rate of unemployment. The new classical economics further state that predictable monetary policies affects price level because the Quantity Theory equation has no systematic impact on the degree of production or speed (Stein, 2015) .

The monetarists put emphasis on the function of money and contemporary quantity theory states that inflation is always a monetary event that is cause from a rapid increase in the magnitude of money supply than in total production (Totonchi, 2011). According to Totonchi (2011) structural inflation theory holds that in the economic, increase supply is cause by the forces of demand push, even if unemployment production factors are impossible or slow. Therefore, this is some of the reason why less developed countries are not able to successfully achieve self-economic growth.

The level of concern regarding the impact of exchange rate pass-through on consumer prices have increased in several developing countries because of the magnitude of consequences it has on price, exchange rate stability and the macroeconomic policy environment. One of the key challenges in managing economic policy around the world, especially in emerging and developing economies, is the impact of exchange rate changes have on inflation and economic activities (Bada, 2016).

Ceesay and Njie (2021) used the vector error correction model(VECM) to examine the causal relationship between money supply and inflation. Their findings, reveals that there is no long run causality between between inflation and the independent variables. In short run, they reveal that money supply positively affect inflation at a 5% significant level.

Akinbobola (2012) in his study examine the dynamic of money supply, exchange rate and Inflation using nigeria as a case. He adopted the vector error correction model to determine how money supply and exchange rate affect inflation. The study reveals in the long run exchange rate and money supply have significant negative on inflationary pressure. His justification for the negative relationship is that inflation may not be due to aggregate demand but rather setbacks of the supply chain of goods both local and internationally.

Hoang, Thi and Minh (2020) used the Vector Autoregressive model to evaluate the impact of exchange rate on economic growth and inflation in Vietnam for the period 2005-2018. They used six edegenous variables in their model namely: consumer price index, exchange rate, gross domestic product, money supply, import and exports and two exogeneous variables international price and US federal reserve interest rate. Their findings reveals that an increase in exchange rate have positive effect on inflation in the first and second quarter and negative effect in the third quarter while it has negative effect on gross dometic product in the first and thrid quarter and postive effect in the second quarter.

Abonazel and Elnabawy (2020) used the ARDL bound test of cointegration approach to study inflation in Egypt. They concluded that from the error correction model money suuply and exchange rate have significant positive effect on inflation while GDP negative effect on inflation but it is not significant.

### **Research methodology**

#### **Data source**

This study uses annual time series data from 1985 to 2021 for Inflation, Real effective exchange rate, Broad money supply and Gross Domestic Product. The data was retrieved from world development indicators data bank (WDI). In our model the level of inflation and broad

money (M2) were used because they are already in percentage form and using the log will not be logical. Gross Domestic Product and Real effective exchange rate were transformed to log.

#### **Definition of Variables**

The variables used in this study are outline below. The definitions of the variables are adapted from World Development Indicators (WDI).

**Inflation, consumer prices (annual %):** It is calculated using the consumer price index, it reveals the annual percentage difference in the cost to the mean consumer of obtaining a basket of goods and services that could be static or change at a stated intervals such as annually.

**Real effective exchange rate index (2010 = 100):** This is a measure of the value of a country's currency alongside a weighted mean of different external currencies) divided by the index of costs.

**Broad money (% of GDP):** Is the summation of demand deposits, currency outside banks, with the exemption of the central government; the time, savings, and foreign currency credits of local sectors with the exemption of the central government; traveler's and bank checks ; Certificates of deposit and commercial paper.

**GDP (current US\$):** Gross domestic product at purchaser's values is the summation of gross value plus all producers residing in the economy and any produce taxes subtract subsidies excluded in the cost of the produce. Thus, this is computed with no deductions for depreciation of invented assets or for depletion and degradation of natural resources. U.S.dollars is used as a measure for the data. These figures are converted from local currency using 2015 official exchange rate.

#### **Model Specification**

To answer our research questions, the following econometrics model is specified:

$$\text{Inflation}_t = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln GDP_t + \beta_3 M2_t + \mu_t \text{ equation (1)}$$

Where Inflation is Inflation, consumer prices (annual %), lnREER is the log of real effective exchange rate index (2010=100), lnGDP is the log of GDP (current US\$), M2 is the Broad money (% of GDP).

#### **Estimation of empirical results**

##### **Unit root test**

This is necessary when dealing with time series data to check if the variables of interest follow a unit root process. To ascertain this, Augmented Dickey Fuller was used since from literature is the most commonly used test for stationarity. Thus, the results of the unit root as seen table 1 below reveals that, Inflation is stationary at level using 5% significant level while all the other variables are non-stationary at that level but after taking the first difference they become stationary. Therefore, Inflation is the only I (0) series and all other variables such as lnREER, lnGDP and M2 are I (1) series. This indicates that, we are having both I (0) and I (1) series in our model. This qualifies us to use the Autoregressive Distributed Lag Model (ARDL). The ARDL model will help us to determined efficiency and the optimal lags to include in the bound test of co-integration. The results, shows that one lag should be included in each of the variables as seen in table 2

**TABLE 1:** Unit Root Test

Variables	Augmented Dickey Fuller Test		Integrated Order
	Level	First Difference	
Inflation	0.0000		I(0)
lnREER	0.6776	0.0448	I(1)
lnGDP	0.1920	0.0007	I(1)
M2	0.9937	0.0030	I(1)

Source: Authors Computation from STATA 17

**TABLE 2:** Lag Selection using Akaika Information Criterion (AIC)

Variables	Lags(r)
Inflation	1
lnREER	1
lnGDP	1
M2	1

Source: Authors Computation from STATA 17

**Gregory and Hansen (1996) Co-integration test**

The Gregory and Hansen (1996) test for cointegration is applied if our variables are I (0) or I (1) and there is presence of structural break in our model.

Gregory and Hansen specification is specified using equation 1:

$$Inflation_t = \alpha_1 + \alpha_2 Z_t + \beta_1 lnREER_t + \beta_2 lnGDP_t + \beta_3 M2_t + \mu_t \quad \text{equation (2)}$$

$$Inflation_t = \alpha_1 + \alpha_2 Z_t + \delta t + \beta_1 lnREER_t + \beta_2 lnGDP_t + \beta_3 M2_t + \mu_t \quad \text{equation (3)}$$

$$Inflation_t = \alpha_1 + \alpha_2 Z_t + \beta_1 lnREER_t + \beta_{11} Z_t lnREER_t + \beta_2 lnGDP_t + \beta_{22} Z_t lnGDP_t + \beta_3 M2_t + \beta_{33} Z_t M2_t + \mu_t \quad \text{equation (4)}$$

The results in table 3 reveals that long run relationship exist between the variables inflation, real effective exchange rate, gross domestic product and broad money at 5% significant level. Therefore, cointegration is established in the intercept shift and intercept shift with trend in date 2003 using the  $Z_t$ . So we generate a dummy call it ' $Z_t$ ' where it is equal to one(1) if time=2003 through 2021 and all the time period before the break is equal to Zero(0). We also generate an interaction term between the dummy and the independent variables.

Null Hypothesis: no Cointegration

Alternate Hypothesis: There is Cointegration

**TABLE 3:** Gregory Hansen Cointegration test

Gregory Hansen Models	Augmented Dickey Fuller		Zt		Za	
	Statistics	Break Point	Statistics	Break Point	Statistics	Break Point
Intercept shift (2)	-7.79**	1995	-5.99**	2003	-36.85	2003
Intercept shift with trend (3)	-7.76**	1995	-6.13**	2003	-37.59	2003
Intercept shift with slope(4)	-7.30**	1991	-6.03**	1990	-37.21	1990

Note: \*\* denotes significant at 5% level. The 5% critical values for Augmented Dickey Fuller (ADF) and Zt are -5.28, -5.57 and -6.00 for model 2, 3 and 4 respectively while Za for the same models are -53.58, -59.76 and -68.94 respectively. Akaika Criterion Information (aic) was used in the lag selection of the Gregory Hansen test for cointegration.

Source: Authors Computation using Stata 17

*Error Correction (EC) Representation of the ARDL Model and Post Estimation Diagnostics*

The EC is used to determine the long run relationship that exists between variables and it is only used if the variables are cointegrated. The EC can also be applied in ARDL models if the Gregory Hansen test shows that there is cointegration between variables. As seen in table 3 the variables exhibit a long run relationship. Thus, our ARDL model in EC representation is specified as follows:

$$\Delta \ln \text{inflation} = \alpha_0 + \sum_{i=1}^p \alpha_{1i} i \Delta \ln \text{inflation}_{t-1} + \sum_{i=1}^q \alpha_{2i} \Delta \ln \text{REER}_{t-1} + \sum_{i=1}^q \alpha_{3i} \Delta \ln \text{GDP}_{t-1} + \sum_{i=1}^q \alpha_{4i} \Delta \text{M2}_{t-1} + \gamma \text{ECT}t - 1_{t-1} + \varepsilon_t$$

Where

$\gamma$  = is the speed of adjustment parameter with a negative sign

ECT = error correction term and  $\alpha_{1i}$ ,  $\alpha_{2i}$ ,  $\alpha_{3i}$ ,  $\alpha_{4i}$  are the short run dynamic coefficients of the model's adjustment long run equilibrium

**TABLE 4:** ARDL Model in EC Representation

VARIABLES	(1) ADJ	(2) LR	(3) SR
lnREER		-53.14** (19.66)	
lnGDP		-26.16*** (5.376)	
M2		-1.336** (0.550)	
z		-753.5***	

		(205.8)	
lnREER_z		83.50***	
		(23.65)	
lnGDP_z		14.93*	
		(7.520)	
M2_z		2.016***	
		(0.549)	
L.Inflation	-0.875***		
	(0.127)		
D.lnREER			-3.378
			(13.10)
D.lnGDP			-21.94***
			(6.903)
D.M2			-1.529***
			(0.389)
Constant			734.7***
			(220.5)
Observations	36	36	36
R-squared	0.878	0.878	0.878

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors computation using Stata 17

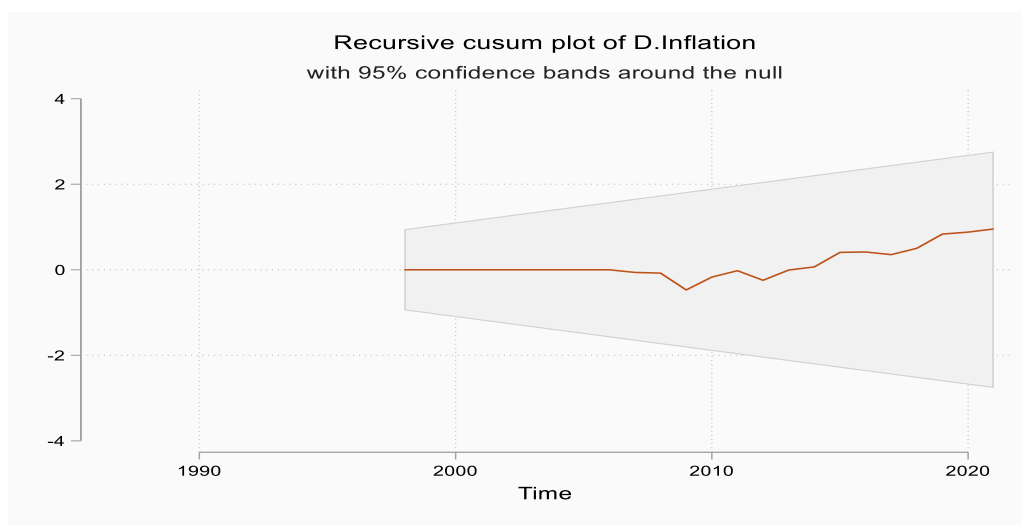
In estimating the EC model the dummy variables and the interaction terms were added to capture the structural break that occurs at year 2003. Thus, table 4 reveals that there is a long run relationship between the independent variables (lnREER, lnGDP, M2) and Inflation at significant level of 1%. Also, to interpret the long run coefficients of each variable we need to reverse the sign. Thus, the results reveals that all the variables in the model causes inflation positively in the long run at a significant level of 5% except lnGDP which is significant at 1% level. On the other hand, the dummy variable causes inflation positively and all other interactions terms causes inflation negatively in the long run at significant level of 1% except lnGDP\_z which is significant at 10% level. In the Short run, lnREER, lnGDP and M2 causes inflation negatively at a significant level of 1%.

The diagnostic test presented in table 5 shows that, there is no serial correlation, Variance is constant meaning homoscedasticity and residuals are normality distributed. The model is also stable using the recursive cusum plot as seen in figure 1 is between the 95% confidence bands around the null but interestingly the square recursive cusum as seen in figure 2 reveals that the relationship between the variables is not stable this may be due to exogenous shock in output, high amount in public debt especially external debt, inadequate data quality since GDP of the is collected annually in the Gambia which may not give reliable estimates.

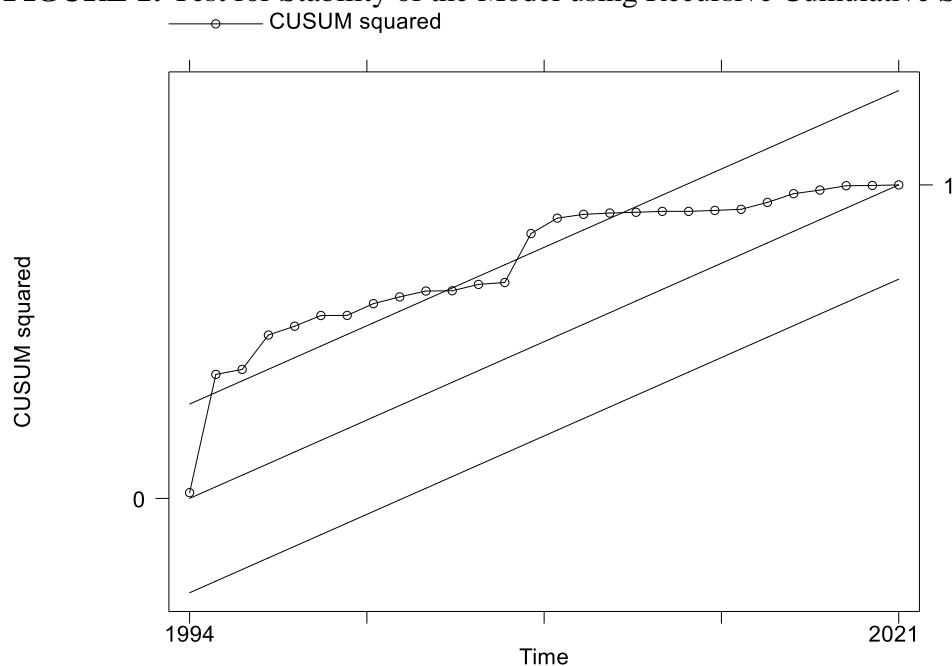
**TABLE 5:** Post estimation Diagnostic test

Statistics	P-values	Null Hypothesis
Breusch–Godfrey LM test for autocorrelation	0.1077	No Serial Correlation
White's test	0.4215	Homoskedasticity
Jarque-Bera normality test	.7932	Normality

Source: Authors computation using Stata 17



**FIGURE 1:** Test for Stability of the Model using Recursive Cumulative Sum



**FIGURE 2:** Test for Stability of the Model using Square Recursive Cumulative Sum

### Conclusion

The aim of this study was to examine whether real effective exchange rate, economic growth and money supply causes Inflation in the Gambia for the period 1985 to 2021 in a Multivariate autoregressive framework. The unit root test shows that only Inflation is stationary at level and all other variables are stationary at first difference indicating a mixture of I (0) and I (1) series. The ARDL model using the Akaike information criterion (AIC) indicates that all variables have one (1) lag. Gregory and Hansen (1996) test of cointegration was used because of the presence of structural break in the model and the test of cointegration reveals a long run equilibrium relationship between the variables in the model. The result of the ARDL model in EC representation reveals a long run relationship between the independent variables and Inflation at 1% significant level. The individual coefficient reveals that all the variables causes inflation positively in the long run at a significant level of 5% except gross domestic product which is significant at 1% level. In the short run, all the variables in our model causes inflation negatively at 1% significant level. The post estimation test reveals no serial correlation, normality and homoskedasticity. The model is stable using the recursive cusum plot but the square recursive cusum plot reveals that the relationship between the variables is not stable. This may be due to exogenous shock in output; high amount in public debt especially external debt. Thus, the study recommends the government of the Gambia to be caution in taking increase amount of Public debt and the central bank of the Gambia should move from monetary targeting to inflation targeting framework together with exchange rate targeting this will help to maintain economic growth and price stability. However, the central bank of the Gambia should assess the entire economy before implementing the policy.

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