
Dynamics of Inflation and Remittances on Economic Growth in Liberia: A Granger Causality Approach

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Abstract: Inflation and economic growth relationship remain an extensive theoretical and empirical debate in developing countries with regards to monetary policy. The study examines the nexus among economic growth, remittance and inflation in Liberia. The study employed the Granger Causality test to identify if changes in variable of interest temporally precede changes in another, was considered. The VECM specification and result shows a cointegrating equation which indicate a statistically significant long run relationship. The second lag of GDP is positively affecting economic growth significantly. Lag one of inflation showed a significant and positive relation with GDP, hence inflation positively affect economic growth. The result of the VEC Granger Causality/Block exogeneity Wald tests below show Inflation Granger causes GDP in Liberia which is consistent with our ECM result. The result also showed remittance Granger cause GDP in Liberia while inflation Granger causes remittance in the Liberian economy. In conclusion, the study shows that inflation and remit granger caused GDP at a significant level and inflation granger cause remit, hence there is unidirectional causality from inflation to GDP, and from inflation to remit in Liberia.

Keywords: Granger Causality, Inflation, Remittances

1. Introduction

The correlation between inflation and economic growth continued to be the focus of immense theoretical and empirical discussion in the parlance of monetary policy formulation [10]. Depending on the macroeconomic context, the relationship between these two variables can be neutral, positive and at times negative. Stable and developing economies like Liberia appreciates high economic growth and a low manageable inflation rate which has been the target for policy makers. However, a number of factors can be recognized as the major culprit of rising inflation in countries like Liberia. Trade disparity, low volume of export and high imports put pressure on struggling economies which eventually bid up inflationary pressure. The Liberian economy has been at the mercy of the global economies, in terms of trade, especially China, USA and Europe. In 2020 alone, China export to Liberia was around 3.4 billion dollars [13]. This amount is more than Liberia's annual gross domestic product of 3.2 billion

dollars [14]. The country has been able to manage its inflation level over the last three years pushing inflation down from 26.97% in 2019 to around 6.7% in 2021 [14]. This remarkable strive by the government of Liberia through the Central Bank of Liberia (CBL) in collaboration with the Ministry of Finance and Development Planning (MOFDP) has stabilized the economy from fragile to the path of growth. According to the World Bank, remittance inflows to GDP for Liberia was 26.7% [14], more than a quarter of the country's GDP for the year. This means that Liberia is a highly vulnerable but stable country.

In the work of inflation and economic growth [3], found a bi-directional Granger Causality between inflation and economic growth in the Liberia economy. He also found a stable inflation rate of 19% to support economic growth. The implication of a deviation from 19% in the Liberian economic need to establish further. This calls for further investigation to establish the dynamic channels inflation

transmit to economic growth.

2. Literature Evaluation

In the literature, inflation results from a persistent elevation in the overall price level in a country. It can be categorized by various kinds depending on the cause and effect of the situation, as Anochiwa and Maduka described that when there is an increased in aggregate demand without a corresponding increase in supply give rise to demand pull and when there is a reduction in supply caused by increased in the cost or price of the commodities produced [2] or as Umaru and Zubairu observed that it can be structural or built-in when there are changes in monetary policy [12]. These various characterization of the phenomenon described above is one of the vicious events that spiral economies downward. Whatever the source, inflation has been very detrimental to economies, both robust and fragile and it has been the target of policy makers. Economists may not all agreed on the remedies, but they do all agree on the impact, however, positive or negative it has on the lives of real people. Studies on inflation and economic growth remain perennial and has given rise to different schools of thought [1].

Developing countries, like Liberia relies heavily on various inflows to help sustain the economy from both internal and external macroeconomic shocks caused by anomalies like inflation and unemployment. Vulnerable forms of employment occurs to approximately 42 percent of workers (or 1.4 billion) worldwide, while this share is expected to remain particularly high in developing and emerging countries, at above 76 per cent and 46 per cent, respectively in 2017; while more than 192.7million people were unemployed in the world, a figure that is 31 million more individuals that were unemployed before the financial crisis in 2007 [7]. High level of unemployment can be said to be failure of the economy to utilize its available human capacity and according to Irge, factors explaining unemployment such as low level of general economic activity, recession, inflation, rapid changes in technology, disability, willingness to work and discrimination are visible [8]. This is why remittances inflow to Liberia is significant in terms of its annual gross

domestic product. Remittances are used by the country to address macroeconomic shocks caused primarily by imbalances from trade. Remittances is also important in our economy to address income inequality amongst the population.

Looking into the Liberian economy, Bellepea examined the nexus between inflation and economic growth in the Liberian economy; considering unit root test, cointegration and Granger causal technique with data from 1960 to 2007, the study used an optimization model to analyze the threshold level of inflation for Liberia. And the findings revealed that Granger-Causality test identifies a feedback or bilateral causality between inflation and economic growth and the results from the optimization model recommend a 19% optimal level of inflation, which is conducive for economic growth [3]. The implication is that any inflation rate above this optimal level would affect economic growth negatively in the Liberian economy. The long-run and short-run results indicate that growth rate of gross domestic product is positively affected by foreign direct investment, inflation rate, exports, exchange rate and investment rate.

3. Research Methodology

The paper adopts the Granger Causality test to establish a causal relationship between the variables identified: GDP, Remittance and Inflation. While Granger causality test can identify if changes in variable of interest temporally precede changes in another, it is a common misconception that this test alone is enough to rule out endogeneity [5].

Granger Causality Test

The Granger causality test assumes that the information relevant to the prediction of the respective variables is contained solely in the time series data on these variables [16]. Granger's contention was based on the identifiability of a unique linear model [11]. Designating the vector of variables at time t by $X_t = (X_{1t}, X_{2t}, \dots, X_{pt})^T$, Granger considered the linear model: $A^0 X_t = \sum_{k=0}^n A^k X_{t-k} + e_t$. Our model involves estimating the following types of regression [6]:

$$\begin{aligned} \text{GDP}_t &= \sum_{i=1}^n \alpha_i \text{inflation}_{t-i} + \sum_{j=1}^n \beta_j \text{remit}_{t-j} + \sum_{m=1}^n \gamma_m \text{GDP}_{t-m} + \mu_{1t} \\ \text{inflation}_t &= \sum_{i=1}^n \sigma_i \text{remit}_{t-i} + \sum_{j=1}^n \rho_j \text{GDP}_{t-j} + \sum_{m=1}^n \lambda_m \text{inflation}_{t-m} + \mu_{2t} \\ \text{remit}_t &= \sum_{i=1}^n \varphi_i \text{inflation}_{t-i} + \sum_{j=1}^n \theta_j \text{GDP}_{t-j} + \sum_{m=1}^n \tau_m \text{remit}_{t-m} + \mu_{3t} \end{aligned}$$

4. Presentation of Result: Lag Length Criteria

Selecting appropriate Lag length is important in a time series that will be used as a predictor in a VAR model because typically, a large number of lags will be used to generate a model and then a restriction applied to select a

more parsimonious model [4]. Lütkepoh indicated that using too few lags can result in auto correlated errors whereas using too many lags results in over-fitting, causing an increase in mean-square-forecast errors of the VAR model [9]. Table 1 below shows the results from the lag length criteria and that the maximum lag for this model is 3. We can now run the vecm for the model using lag minus 1 which means the vector error correction model will have 2 lags.

Table 1. Lag length criteria Results.

VAR Lag Order Selection Criteria						
Endogenous variables: LNGDP LNINFLATION LNREMIT						
Exogenous variables: C						
Date: 10/20/21 Time: 17:13						
sample: 2001 2021						
Included observations: 16						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-31.683	NA	0.015333	4.335373	4.480233	4.342791
1	13.1295	67.21872*	0.00018	-0.14119	0.438254	-0.111515
2	19.24289	6.877564	0.000302	0.219639	1.233661	0.271565
3	41.3667	16.59285	9.28e-05*	-1.420837*	0.027767*	-1.346657*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: author computation in eviews, 2022.

Table 2. Shows the error correction model having 2 lags.

Vector Error Correction Estimates			
Date: 10/20/21 Time: 17:40			
Sample (adjusted): 2005 2020			
Included observations: 16 after adjustments			
Standard errors in () & t-statistics in []			
Cointegrating Eq:	CointEq1		
LNGDP(-1)	1		
LNINFLATION(-1)	-0.20711		
	-0.24906		
	[-0.83156]		
LNREMIT(-1)	-0.15527		
	-0.08774		
	[-1.76974]		
C	-20.5578		
Error Correction:	D(LNGDP)	D(LNINFLATION)	D(LNREMIT)
CointEq1	-0.1659	0.209746	0.684806
	-0.02138	-0.27954	-0.40797
	[-7.76032]	[0.75033]	[1.67855]
D(LNGDP(-1))	0.055194	-1.47197	3.285079
	-0.08294	-1.0845	-1.58279
	[0.66547]	[-1.35728]	[2.07550]
D(LNGDP(-2))	0.577852	0.730144	-3.030915
	-0.11054	-1.44537	-2.10947
	[5.22762]	[0.50516]	[-1.43681]
D(LNINFLATION(-1))	0.071316	-0.1865	-1.350672
	-0.02607	-0.34095	-0.4976
	[2.73509]	[-0.54700]	[-2.71439]
D(LNINFLATION(-2))	-0.03107	-0.52013	-0.481954
	-0.02575	-0.33672	-0.49143
	[-1.20652]	[-1.54469]	[-0.98072]
D(LNREMIT(-1))	-0.0188	-0.1495	-0.02166
	-0.01546	-0.20221	-0.29512
	[-1.21574]	[-0.73929]	[-0.07339]
D(LNREMIT(-2))	0.048254	0.002777	-0.284734
	-0.012	-0.15689	-0.22897
	[4.02174]	[0.01770]	[-1.24353]
C	0.035466	0.135697	0.128679
	-0.01266	-0.16554	-0.2416
	[2.80139]	[0.81971]	[0.53260]
R-squared	0.921446	0.385568	0.626049
Adj. R-squared	0.852712	-0.15206	0.298842
Sum sq. resids	0.008323	1.423114	3.031277
S.E. equation	0.032256	0.421769	0.615556
F-statistic	13.40588	0.717166	1.91331

Vector Error Correction Estimates			
Date: 10/20/21 Time: 17:40			
Sample (adjusted): 2005 2020			
Included observations: 16 after adjustments			
Standard errors in () & t-statistics in []			
Cointegrating Eq:	CointEq1		
Log likelihood	37.78709	-3.34509	-9.394178
Akaike AIC	-3.72339	1.418136	2.174272
Schwarz SC	-3.33709	1.80443	2.560567
Mean dependent	0.091233	0.048276	0.03442
S.D. dependent	0.084047	0.39295	0.735123
Determinant resid covariance (dof adj.)		2.85E-05	
Determinant resid covariance		3.57E-06	
Log likelihood		32.242	
Akaike information criterion		-0.65525	
Schwarz criterion		0.648494	

Source: author computation in eviews, 2022.

The VECM result shows a cointegrating equation which indicate a long run relationship with adjusting mechanism of the correct sign of negative and significant. The second lag of GDP is positively affecting economic growth significantly. Lag one of inflation showed a significant and positive relation with GDP, hence inflation positively affect growth.

Table 3 showed the result of the VEC Granger Causality/Block exogeneity Wald test below. The results shows that Inflation Granger causes GDP in Liberia which is consistent with our ECM result. The result also shows remittance Granger causes GDP in Liberia while inflation Granger causes remittance in the Liberian economy.

Table 3. Granger causality/block exogeneity test.

VEC Granger Causality/Block Exogeneity Wald Tests			
Date: 10/20/21 Time: 17:46			
Sample: 2001 2021			
Included observations: 16			
Dependent variable: D(LNGDP)			
Excluded	Chi-sq	df	Prob.
D(LNINFLATION)	9.515491	2	0.0086
D(LNREMIT)	18.11803	2	0.0001
All	25.21857	4	0
Dependent variable: D(LNINFLATION)			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	1.845176	2	0.3975
D(LNREMIT)	0.549084	2	0.7599
All	1.937301	4	0.7473
Dependent variable: D(LNREMIT)			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	4.929122	2	0.085
D(LNINFLATION)	7.959615	2	0.0187
All	10.61438	4	0.0313

Source: author computation on eviews, 2022.

5. Summary Analysis

The study sought to examine the dynamic link among GDP, REMITTANCE and INFLATION in Liberia. Since Granger Causality test can identify if changes in variable of interest temporally precede changes in another, it is amenable for this study.

The VECM result shows a cointegrating equation which indicate a long run relationship with adjusting mechanism of the correct sign of negative and significant. The second lag of GDP is positively affecting economic growth significantly.

Lag one of inflation showed a significant and positive relation with GDP, hence inflation positively affect growth.

The result of the VEC Granger Causality/Block exogeneity Wald test below showed that Inflation Granger causes GDP in Liberia which is consistent with our ECM result. The result also showed remittance Granger cause GDP in Liberia while inflation Granger causes remittance in the Liberian economy.

In conclusion, the study shows that inflation and remit granger caused GDP at a significant level and inflation Granger causes remittance. Hence, there is unidirectional causality from inflation to GDP, and from inflation to remit in Liberia.

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