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THE EFFECT OF FOREIGN DIRECT REMITTANCES AND INFLATION ON ECONOMIC GROWTH IN LIBERIA: A VECTOR ERROR CORRECTION MODEL

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Abstract

The objective of this paper is to investigate the effect of foreign direct remittances and inflation on economic growth in Liberia from 2002 to 2020. This study analyzed the effect of foreign remittances and inflation on economic growth, captured as Gross Domestic Product (GDP). The data collected was annual time series data from the central bank of Liberia and the international monetary fund website. Augmented DF test as well as Unit roots to test for stationarity was used. The Johansen cointegration test to test for long run relationship in the economy. The presence of non-stationarity amongst the variables at levels and I(1) as well as cointegrating equations suggest and informed the used of vector error correction model. Heteroskedasticity as well as LM serial correlation tests for diagnostics were applied. The result from the model strongly link foreign direct remittances as well as inflation have contributed to the growth of the Liberian economy from 2002 to 2020.

Keywords: foreign direct remittances, inflation and economic growth

1.0 Introduction

The Liberian economy has experienced some shocks in recent times primarily due to several underlining structural problems. The country balance of trade is negative while most of its export have not attracted significant inflows of revenue due to lack of value addition. Domestic revenue mobilization is also a challenge as inflows from tax receipts continue to drop as a result of low disposal income on the one hand and a reduced investment into the country. Some of the challenges that fuelled the low volume of investment is the cost of doing business in the country. According to the World Bank report (2010), the low energy produce in the country has led to a diminished attraction of investment in the country. The country over the last decade has experienced double digit inflation which further exacerbate the problem according to the Central Bank of Liberia annual report (2017). However, Liberians living abroad continue to remain the lifeblood of their families members left home. According to the International Monetary Fund report (2016) in 2015, foreign direct remittances constitute around 20.5% of the GDP of the country. This significant inflow remains a cushion for foreign currency deficit in the country. This paper investigates the effect such foreign remittances and inflation have on the growth of the economy over the period 2002 to 2020.

2.0 review of existing literature

Foreign direct remittances remain one of the life stream of many developing economies. According to the World Bank (2014) report, global remittance constitute around $430 billion dollars in 2011 and 0.31% of global GDP in 2009. This mega inflow cushions many developing

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countries from balance of payment shocks which is most often times influences by low export volume and for the case of Liberia, the lack of value addition on its primary exports (iron ore, rubber and timber). Remittances also serve as an instrument to increase the balance sheets of receiving banks in terms of their capital position. Barajas, Chami, Fullenkamp, Gapen and Montiel (2009) argued that remittances increased the quantity of funds in the banking system. At the level of the household in Liberia, it has been observed that remittances have contributed significantly to food security, housing rental as well as taking care of domestic bills like school fees. Ratha (2003) cited in Meyer and Shera (2016) opine that remittances increase the consumption level of households which triggers into a multiplier effect in that remittances give rise to the purchase of locally produce goods. However, it has been observed in some instances that remittances act as a disincentive to work and prevent the collection of domestic revenue in the form of taxes. Amuedo-Dorantes and Pozo (2004) argued that remittances can appreciate real exchange rate in receiving countries and therefore can give rise to resource allocation from the tradable sector to the non-tradable sector. Remittances also creates some level of inequality amongst the citizenry of a country. This is especially observed in low income countries where disposal income for the working class is low. However, Stark, Taylor and Yitzhaki (1986) argued that the impact depends on the share of remittances in total income, the distribution of remittances, and where the recipients of remittances are located in the overall distribution of income. In another study, Ahlburg (2015) argued that remittances undermine productivity and growth in low-income countries because remittances are spent on consumption on foreign manufactured goods than on productive investments. Lipton (1980) observed similar pattern in the how remittances undermine productivity in especially underdeveloped countries. On the other hand, there are divergent of views based on empirical studies the effect of inflation on economic growth. Fischer (1993); Fabayo and Ajilore (2006); Khan and Senhadji (2001) have found evidence of nonlinearities in the inflation-growth nexus using various estimation techniques. The difference in estimation techniques used can explain the difference in the levels of inflation threshold (Ndoricimpa, 2017). In Liberia for example, inflation has spurred massive infrastructural intervention especially in the road construction industry. Despite the fear associated with inflation, there are empirical evidence of its relevance in the growth literature, depending on the threshold and size of the economy.

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Table 1: unit roots test

UNIT ROOT TEST RESULTS TABLE (ADF)				
Null Hypothesis: the variable has a unit root				
	At Level			
		LNGDP	LNINFLATION	LNREMITTANCES
With Constant	t-Statistic	-0.8159	-2.2041	-2.0759
	Prob.	0.7901	0.2122	0.2554
		n0	n0	n0
With Constant & Trend	t-Statistic	-0.8602	-1.8833	-2.5369
	Prob.	0.939	0.6163	0.3088
		n0	n0	n0
Without Constant & Trend	t-Statistic	1.7514	0.094	-0.455
	Prob.	0.9754	0.6984	0.5034
		n0	n0	n0
	At First Difference			
		d(LNGDP)	d(LNINFLATION)	d(LNREMITTANCES)
With Constant	t-Statistic	-3.1849	-3.9966	-4.6718
	Prob.	0.039	0.0093	0.0021
With Constant & Trend	t-Statistic	-4.3643	-4.3272	-4.5134
	Prob.	0.017	0.0195	0.0121
		**	**	**
Without Constant & Trend	t-Statistic	-2.4718	-4.12	-4.8208
	Prob.	0.0169	0.0005	0.0001
		**	***	***
Notes:				
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant				
b: Lag Length based on SIC				
c: Probability based on MacKinnon (1996) one-sided p-values.				
This Result is The Out-Put of Program Has Developed By:				
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College of Business and Economics				
Qassim University-KSA				

Source: author's computation in eviews 10, 2021

Table 1 shows that all the variables namely the log gross domestic product (GDP), the log of foreign remittances and the log of inflation exhibited unit roots at levels but upon I(1), the variables became stationary which remove spurious or useless results obtained from the regression. This indicates that the appropriate model suitable for this regression is Vector error correction model because all the variables are stationary at I(1). The next objective is to test for

both short and long run relationship by identifying whether the variables are cointegrated. Table 2 shows the result from the cointegration test using Johansson cointegration test.

Table 2: Johanssen cointegration test results

Date: 10/08/21 Time: 20:30				
Sample (adjusted): 2005 2020				
Included observations: 16 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LNGDP LNREMIT LNINFLATION				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.925707	59.84531	29.79707	0
At most 1 *	0.646383	18.2494	15.49471	0.0187
At most 2	0.09611	1.616766	3.841466	0.2035
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.925707	41.59591	21.13162	0
At most 1 *	0.646383	16.63263	14.2646	0.0207
At most 2	0.09611	1.616766	3.841466	0.2035
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
LNGDP	LNREMIT	LNINFLATION		
2.651096	-0.41164	-0.549064		
-2.71474	3.058876	0.385605		
-2.69505	3.492245	8.552911		
Unrestricted Adjustment Coefficients (alpha):				
D(LNGDP)	-0.06258	0.010597	0.001759	
D(LNREMIT)	0.258311	-0.342796	-0.014883	
D(LNINFLATION)	0.079117	0.061403	-0.089104	
1 Cointegrating Equation(s):		Log likelihood	32.242	
Normalized cointegrating coefficients (standard error in parentheses)				
LNGDP	LNREMIT	LNINFLATION		

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1	-0.15527	-0.207108		
	-0.08774	-0.24906		
Adjustment coefficients (standard error in parentheses)				
D(LNGDP)	-0.1659			
	-0.02138			
D(LNREMIT)	0.684806			
	-0.40797			
D(LNINFLATION)	0.209746			
	-0.27954			
2 Cointegrating Equation(s):		Log likelihood	40.55831	
Normalized cointegrating coefficients (standard error in parentheses)				
LNGDP	LNREMIT	LNINFLATION		
1.0000	0	-0.217508		
		-0.24639		
0	1	-0.066976		
		-0.56502		
Adjustment coefficients (standard error in parentheses)				
D(LNGDP)	-0.19467	0.058175		
	-0.0271	-0.02204		
D(LNREMIT)	1.615409	-1.154902		
	-0.35984	-0.2927		
D(LNINFLATION)	0.043053	0.155257		
	-0.39153	-0.31847		

Source: author computation in eviews 10, 2021

The result of the Johansson cointegration shows the presence of at least two cointegrating equation suggesting the presence of long run relationship amongst the variables in the model. This is seen in the regression table whereby we reject the null hypothesis of no cointegration since the decision criteria shows that the T stats for no cointegration is greater than the 5% critical value (59.84> 29.79). we accept at most 2 cointegrating equations from the model (1.61< 3.84). we can see the same from the Max eigenvalue statistics.

The interpretation of the johanson cointegration test shows that lngdp is positioned as the dependent variable and it also clearly shows that lninflation has a positive impact on the log of GDP on average, ceteris paribus. It can also be seen that foreign direct remittances also have a positive and not significant impact on lngdp in the economy on average, ceteris paribus.

3.0 Vector error correction model

If a time series model is nonstationary at levels but I(1) are cointegrated, the vector error correction model can be run to determine both short and long run dynamics of the series.

$$\Delta LNGDP_t = a_0 + \sum_{i=1}^{n-1} \alpha_i \Delta LNGDP_{t=1} + \sum_{i=1}^{n-1} \lambda_i \Delta LNINFLATION_{t-1} + \sum_{i=1}^{n-1} \varphi_i \Delta LNREMIT_{t-1} + \sigma Z_{t-1} + \varepsilon_t$$

$$\Delta LNINFLATION_t = a_0 + \sum_{i=1}^{n-1} \alpha_i \Delta LNINFLATION_{t=1} + \sum_{i=1}^{n-1} \lambda_i \Delta LNREMIT_{t-1} + \sum_{i=1}^{n-1} \varphi_i \Delta LNGDP_{t-1} + \sigma Z_{t-1} + \varepsilon_{2t}$$

$$\Delta LNREMIT_t = a_0 + \sum_{i=1}^{n-1} \alpha_i \Delta LNREMIT_{t=1} + \sum_{i=1}^{n-1} \lambda_i \Delta LNINFLATION_{t-1} + \sum_{i=1}^{n-1} \varphi_i \Delta LNGDP_{t-1} + \sigma Z_{t-1} + \varepsilon_{3t}$$

Where z is the error correction term which explains the previous period's deviation from long run equilibrium (which is the error) influences short run movement in the dependent variable (in this case lngdp), σ is the speed of adjustment and ε_t is the white noise.

Table 3: vector error correction model

Vector Error Correction Estimates			
Date: 10/09/21 Time: 18:17			
Sample (adjusted): 2005 2020			
Included observations: 16 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
Cointegrating Eq:	CointEq1		
LNGDP(-1)	1		
LNINFLATION(-1)	-0.207108		
	-0.24906		
	[-0.83156]		
LNREMIT(-1)	-0.155271		
	-0.08774		
	[-1.76974]		
C	-20.55777		
Error Correction:	D(LNGDP)	D(LNINFLATION)	D(LNREMIT)
CointEq1	-0.165902	0.209746	0.684806
	-0.02138	-0.27954	-0.40797
	[-7.76032]	[0.75033]	[1.67855]
D(LNGDP(-1))	0.055194	-1.471969	3.285079
	-0.08294	-1.0845	-1.58279
	[0.66547]	[-1.35728]	[2.07550]

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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	-0.186497	-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))	-0.018801	-0.149495	-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
Log likelihood	37.78709	-3.345085	-9.394178
Akaike AIC	-3.723386	1.418136	2.174272
Schwarz SC	-3.337092	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	
Number of coefficients		27	

Source: author computation in eviews 10, 2021

The system equation is needed to find the p-value in order to draw important decision concerning the long run and short run causality. The first variable which is the dependent variable lngdp is shown below

Table 4: system equation for the dependent variable ln GDP

Dependent Variable: D(LNGDP)				
Method: Least Squares (Gauss-Newton/Marquardt steps)				
Date: 10/09/21 Time: 19:49				
Sample (adjusted): 2005 2020				
Included observations: 16 after adjustments				
D(LNGDP) = C(1)*(LNGDP(-1) - 0.207108409857*LNINFLATION(-1) -				
0.155270875545*LNREMIT(-1) - 20.5577664969) + C(2)				
*D(LNGDP(-1)) + C(3)*D(LNGDP(-2)) + C(4)*D(LNINFLATION(-1))				
+ C(5)*D(LNINFLATION(-2)) + C(6)*D(LNREMIT(-1)) + C(7)				
*D(LNREMIT(-2)) + C(8)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.165902	0.021378	-7.760322	0.0001
C(2)	0.055194	0.08294	0.665466	0.5245
C(3)	0.577852	0.110538	5.227622	0.0008
C(4)	0.071316	0.026075	2.735086	0.0256
C(5)	-0.03107	0.025751	-1.206523	0.2621
C(6)	-0.018801	0.015465	-1.215739	0.2587
C(7)	0.048254	0.011998	4.021736	0.0038
C(8)	0.035466	0.01266	2.801394	0.0231
R-squared	0.921446	Mean dependent var		0.091233

Adjusted R-squared	0.852712	S.D. dependent var		0.084047
S.E. of regression	0.032256	Akaike info criterion		-3.72339
Sum squared resid	0.008323	Schwarz criterion		-3.33709
Log likelihood	37.78709	Hannan-Quinn criter.		-3.70361
F-statistic	13.40588	Durbin-Watson stat		2.619248
Prob(F-statistic)	0.00076			

Source: author computation in eviews 10, 2021

The system equation shows c(1) which is the speed of adjustment towards long run equilibrium is of interest satisfy the two important conditions for it to retain its economic interpretation. The coefficient is negative (-0.165902) and the p-value is statistically significant (0.0001). By being negative it tells us that if there is a departure from long run equilibrium, the correction will have to be pull back in the other direction. We want to determine whether inflation and foreign remittances jointly influence economic growth in the model. The Wald test shows such information. This is captured by c(4) and c(6).

Table 5: Wald test results

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	3.955476	(2, 8)	0.0639
Chi-square	7.910952	2	0.0191
Null Hypothesis: C(4)=C(6)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(4)		0.071316	0.026075
C(6)		-0.018801	0.015465
Restrictions are linear in coefficients.			

Source: author computation in eviews 10, 2021

The result from the Wald test shows that the p-value for the chi square is less than the 5% and therefore we conclude that we can reject the null hypothesis that remittances and inflation jointly have a strong and significant effect on economic growth (GDP).

We can now perform some diagnostics on the model to verify the results

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Table 6: LM autoserial correlation test

VEC Residual Serial Correlation LM Tests						
Date: 10/10/21 Time: 09:47						
Sample: 2001 2021						
Included observations: 16						
Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	9.183578	9	0.4205	1.087134	(9, 7.5)	0.4629
2	14.29309	9	0.1123	2.225622	(9, 7.5)	0.1448
Null hypothesis: No serial correlation at lags 1 to h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	9.183578	9	0.4205	1.087134	(9, 7.5)	0.4629
2	126.5774	18	0	81136.27	(18, 0.5)	0.0498
*Edgeworth expansion corrected likelihood ratio statistic.						

Source: author computation in eviews 10, 2021

The result shows that we cannot reject the null hypothesis of there is no serial correlation since the probability value of 14%> 5% decision criteria. This suggest that the model does not have any serial correlation.

Table 7: white heteroskedasticity test

VEC Residual Heteroskedasticity Tests (Levels and Squares)					
Date: 10/11/21 Time: 10:34					
Sample: 2001 2021					
Included observations: 16					
Joint test:					
Chi-sq	df	Prob.			
91.45572	84	0.2709			
Individual components:					
Dependent	R-squared	F(14,1)	Prob.	Chi-sq(14)	Prob.
res1*res1	0.960451	1.734638	0.5397	15.36721	0.3535
res2*res2	0.99996	1807.585	0.0184	15.99937	0.3134
res3*res3	0.999376	114.3342	0.0732	15.99001	0.314
res2*res1	0.875928	0.504276	0.8191	14.01485	0.4486
res3*res1	0.99945	129.7795	0.0687	15.9912	0.3139
res3*res2	0.843317	0.384452	0.8709	13.49308	0.4881

Source: author's computation in eviews 10, 2021

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The result shows there is no heteroskedasticity in the model as seen in white heteroskedasticity

Conclusion

Despite contrasting views on the impact of foreign remittances and inflation in the growth literature, it is certain that for the case of Liberia, the research has shown that remittances and inflation have both played a significant role in the growth of the Liberian economy, ranging from the stabilization of household income security to the expansion of the domestic economy. Diagnostics tests show that the model is good from the autoserial and heteroskedasticity tests done.

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