Effect of Money Supply on Economic Growth in Rwanda

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Abstract: **The effect of money supply in enhancing economic growth in Rwanda is investigated in this study. This study aims at assessing the Effect of money supply on economic growth in Rwanda through economic growth (GDP) per capita in Rwanda. The study uses Rwanda National Bank and World Bank data from 2008 to 2018. This study used the autoregressive distributed lag (ARDL)-bounds testing to co-integration and Ordinary Least Squares regression technique for analysis of the data to assess the impact of money supply on GDP per capita in Rwanda. The study model is composed of five macroeconomics variables which are Gross Domestic Product per capita, Money supply, Lending Interest Rate, Gross Capital Formation and deposit rate. The study findings Shows a statistical significant positive association between money supply and economic growth in Rwanda both in short run and long run. This study suggests that money supply should be increase at a steady rate by keeping pace with the growth of Rwandan economy.**

Keywords: **money supply, Rwanda, economic growth, Lending Interest Rate, Ordinary Least Squares regression**

I. INTRODUCTION

Money supply is a principal macroeconomic element that impacts the economic growth by ensuring that all economic activities are running effectively in private and public sectors(1). Money supply impact on economic growth in Rwanda has received little coverage. Yet, it is significant and crucial to establish the impact that money supply has on economic growth in Rwanda so that for policy makers can effectively base on to grow the economy.

Most countries has a monetary policy that focuses basically on holding low inflation which is often associated with money supply increase. From management of the central banks and international financial organizations representatives point of view, financial markets are controlled and significant fluctuation is avoided however, money is a commodity as it's lack leads to the price increase as well as other goods that have money as an equivalent. Also economic growth impact positively health sectors in fighting diseases(2, 3) and development in general, therefore money supply compression may lead to demand inflation and deterioration of quality of life(4).

The connection between money supply and output has recently attracted a lot of attention for it's role in economic growth in both industrialized and emerging economies(5).

The private sectors are able to obtain credits through money supply that can help incarrying on businesses at interest rate, thus money supply is a an essential monetary policy tool which is highly essential to boost a national economic growth.

The Rwandan economy has undergone a significant transformation over time by recording an average rate of economic growth of 1.2 % per annum in real terms. From 1994 to 2017, Rwanda experienced a remarkable improvement on the 5.4% average on annual growth(6)

Given the significant impact that money supply has on economic growth, this study aims to investigate the impact of money supply on Rwandan economic growth with Autoregressive Distribution Lag (ARDL) approach during 2008 to 2018. The model is specified with four macroeconomics variables, namelyGross Domestic Product, Lending interest rate, Deposit rate bills rate and Gross Capital Formation

II. METHODOLOGY

2.1. Variables

The dependent variable is GDP at constant 2008 is used as an indicator for economic growth. Predictor's variables are Lending Interest Rate, Gross Capital Formation, and Deposit rate.

2.2. Data Source

The study used time- series data from 2008 to 2018 to investigate the causal relationship between money supply and economic growth in Rwanda. The data was obtained from National Bank of Rwanda (BNR)(7) and World Bank(8). Data analysis was performed using Eviews 7.2(9)

2.3. Study hypothesis

Theoretically, the macroeconomics references predict that there is short run effect of market rate on aggregate demand of the economy

2.4. Model presentation

The function of our model is specified as follows: $GDP_t = \beta_0 + \beta_1 LIR_t + \beta_2 GCF_t + \beta_3 DRt + U_t$

Whereby:

GDP_t: Gross Domestic Product on the period t

LIR_t: Lending Interest Rate on the period t

Unit root at 1st difference

GCF_t: Gross Capital Formation at period t

DRt: Deposit rate at period t

β_0: Intercepts

β_1, β_2, β_3: Are the coefficients of explanatory variables

III. RESULTS

3.1. Unit root test

In order to check whether variables have unit root or not, unit root tests were performed. Augmented Dickey Fuller, Phillips and Perron and Dickey Fuller Generalized Least Squares unit root tests were used.

Series	EQUATION		Augmented Dickey Fuller (ADF)		Philips Perron (PP)			Conclusion
		LAG	T-test	Prob*	Bandwidth	T-stat	Prob*	
D(GDP)	INTERCEPT	0	-4.4387	0.0056	1	-3.2737	0.00158	There is stationarity at 1st difference
	TREND & INTERCEPT	0	-6.3207	0.0108	1	-5.07675	0.0000	
D(LR)	INTERCEPT	1	-6.4239	0.0001	3	-5.20325	0.0000	There is stationarity at 1st Difference
	TREND&INTERCEPT	1	-5.7467	0.0000	4	-6.3594	0.0000***	
D(GCF)	INTERCEPT	0	-7.438469	0.0001	8	-7.4393	0.0001***	There is stationarity at 1st Difference
	TREND&INTERCEPT	0	-4.383471	0.0009	1	-4.3755	0.0009***	
D(DR)	INTERCEP	0	-7.622	0.0000	0	-8.697	0.0000***	There is stationarity at 1st Difference
	TREND& INTERCEPT	0	-7.699	0.0002	0	-8.888	0.0000	

***: Stationary at 1% level of significance
**: Stationary at 5% level of significance
*: Stationary at 10% level of significance

The unit root analysis results depict that the null hypothesis of non-stationary ((I(1)) should not be rejected at levels for all the variables. Therefore, the null hypothesis that depicts that there is no stationary should be rejected. Overall, the variables have shown to be stationary in first difference. This result confirms the aptness of granger-causality analysis and the ARDL-bounds test for co-integration

3.2 ARDL-Bound Test Approach to Co-integration

The following step is to assess the long run relationship between economic growth, Lending interest rate, money supply, deposit rate and Gross Capital Formation after confirming that variables are stationary.

Selection order criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-76.6482	NA	0.001621	4.927016	4.105477	4.877133
1	100.1635	307.1705	5.42E-07	-5.20037	-4.311470*	-5.00314
2	131.2834	32.41367	4.16E-08	-5.56015	-4.03411	-5.12633
3	155.0967	29.16824*	3.02e-07*	-6.13214*	-3.4532	-5.12619

There is a co-integration because the F-statistics results of the effect of the impact of money supply Rwanda's on economic growth   as F-statistics of 21.18 falls above the upper bound of critical value of -4.20at 1 percent level of significance). We can conclude that there is a long run relationship between money supply and economic growth in Rwanda.

Bound F-test for Co-integration

After determining that the variables are stationary, examining the long run relationship between economic growth, Lending Rate, money supply and Gross capital formation and deposit rate, determining the optimal lag is necessary.

Predictor variable	Function	F-Statistic	Co-integration Results
GDP	F(GDP|LR,GCF,DR)	21.18***	Co-integrated
Lending Rate	F(LR|GDP,GCF,DR)	4.68**	Co-integrated
Gross capital formation	F(GCF|GDP,LR,DR)	6.22***	Co-integrated
Deposit rate	F(DR|GDP,LR,GCF)	5.43***	Co-integrated

Exogenous: Constant			
Lag Length: 3 (Automatic - based on SIC, maxlag=3)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.736060	0.0289
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	
*MacKinnon (1996) one-sided p-values.			

3.3. Long run analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	15.12711	2.275794	-0.056966	0.0000
Lending Rate	0.427613	0.316606	0.371445	0.0074
Gross capital formation	0.376728	0.120623	2.211253	0.0001
Deposit rate	0.3.56831	0.113481	2.132474	0.0021
R-squared	0.742304	Mean dependent var		16.123186
Adjusted R-squared	0.622723	S.D. dependent var		0.862106
S.E. of regression	0.957547	Akaike info criterion		2.938526
Sum squared resid	6.908586	Schwarz criterion		2.075466
Log likelihood	13.56968	Hannan-Quinn criter.		2.925849
F-statistic	17.86253	Durbin-Watson stat		2.939330
Prob(F-statistic)	0.199802			

Source: Eviews7, September 2019

The long run analysis shows that pass through in Rwanda is still limited, mainly due to low level of financial rate pass through. Recall that, high interest rate pass through would suggest a developed competitive and efficient financial system while low interest rate pass through suggest the opposite.

The above estimated coefficients depict that money supply has a significant statistical positive effect on economic growth in Rwanda, which is in accordance with argument that money supply can boost economic growth. More specifically, the long run elasticity of money supply is 0.42, which implies that a 1% increase in money supply leads to about 0.42% increase in economic growth. These results are in accordance with previously published studies' findings with the findings (5, 10-12)

3.4. Short run analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-0.040518	0.224266	-0.180671	0.8602
Lending Rate	0.563515	0.829043	0.679717	0.5121
Gross capital formation	0.241149	0.098496	2.448313	0.0344
Deposit rate	-0.757202	0.293277	-2.581863	0.0273
R-squared	0.605367	Mean dependent var		-0.123186
Adjusted R-squared	0.486977	S.D. dependent var		1.086106
S.E. of regression	0.777930	Akaike info criterion		2.570596
Sum squared resid	6.051752	Schwarz criterion		2.753184
Log likelihood	-13.99417	Hannan-Quinn criter.		2.553694
F-statistic	5.113330	Durbin-Watson stat		2.215898
Prob(F-statistic)	0.021209			

It was validated that the error terms of the short run models are free of heteroscedasticity, have no serial correlation and are normally distributed. It was also discovered that the Durbin Watson statistics is greater than the R2, which implies that the short run models are not spurious.

The stability of the long run parameters were tested using the cumulative sum of recursive residuals (CUSUM) and CUSUM of recursive squares (CUSUMQ). The results are presented in Figures 4. The results fail to reject the null hypothesis at 5 percent level of significance because the plots of the tests fall within the critical limits. Therefore, it can be realised that our selected ARDL model is stable.

Short-run diagnostics

| Test	F-statistics	P-value
Normality	1.1278	0.4459
Heteroskedasticity	0.7976	0.4398
Serial correlation	0.2341	0.7933

The short run models' error terms are free of heteroscedasticity as depicted by the table above. There is no serial correlation detected and errors are normally distributed. In addition, the short run models are not spurious as the Durbin Watson statistics is greater than the R^2

Using CUSUM (the cumulative sum of recursive residuals)and CUSUMQ (CUSUM of recursive squares, the stability of the study's long run parameters were tested. The graph above shows that our model is stable because the navigating blue line of graph does not cross red line or cross the borders (the straight lines represent critical bounds at 5% significance level); this indicates that the market rate has effect on aggregate demand have short run effect aggregate demand in Rwanda from 2000-2018

3.5. CUSUM Test
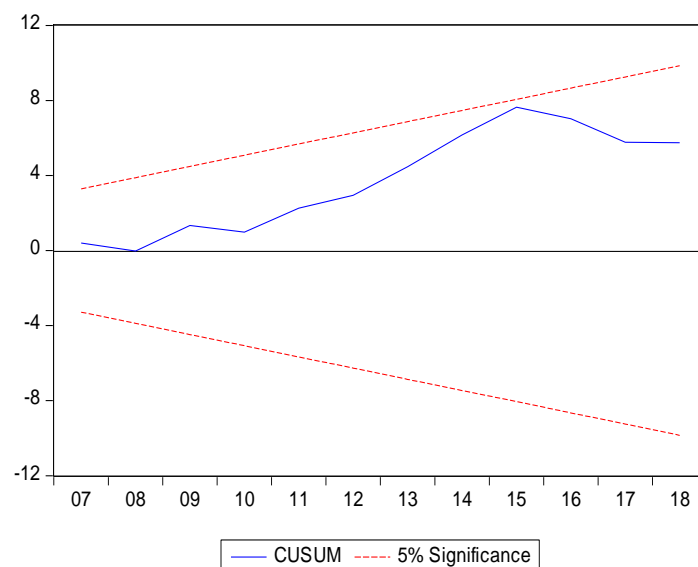
CUSUMQ Test
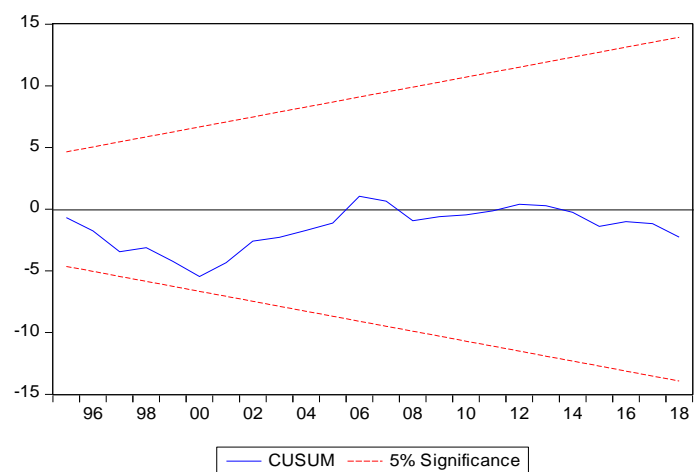
IV. DISCUSSION

This study assessed the impact of money supply on economic growth in Rwanda using time-series data from2008 to 2018. The research has used the Autoregressive Distributed Lag (ARDL) modeling approach in order to estimate short and long run elasticities of the selected macroeconomics variables .This study findings shows a significant positive association between money supply and economic growth both in short run and long run. This study results are in accordance with various previously published researches.

The study results are of great importance in policy formulation and implication in Rwanda. Therefore, authors recommend allowing money supply to steadily increase by keeping pace with the economic growth. In addition to that, friendly and open agreement should be promoted in order to attract short term and long term investment that can be quickly converted into cash. Through that, the poverty and unemployment would be alleviated in Rwanda as these study findings presents very clear the benefits of money supply on Rwandan economy.

The limitation of this study relies on using data from National Bank of Rwanda. Thus, the validity of the Findings may be limited. Therefore, we would recommend a follow-up study by gathering data from different and reliable institutions. Notwithstanding these study limitations; this research provides a significant contribution to the monetary policy makers in Rwanda

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