Money supply and economic growth of Nepal: ARDL approach[1]

Keshar Bahadur Kunwar

Abstract

There are a number of theories illustrating the relationship between money supply and gross domestic product. Money supply can be defined as the total stock of money circulating in the economy. The circulating money involves the currency, printed notes, money in the deposit accounts, and in the form of other liquid assets. Valuation of money supply helps analysts and policy makers to frame the policy or to alter the existing policy of increasing or reducing the supply of money. The valuation is important as it ultimately affects the business cycle and thereby affecting the economy. This study sought to provide answers to the question, what are the effects of money supply on the gross domestic product in Nepal? The study undertook a causal research design using time series data from the period 1974/75 to 2017/18 to critically investigate the relationship between money supply and economic growth by establishing an empirical relationship that exists between them. The study employed the Augmented Diky fuller test and ARDL- VECM model. The results indicate the existence of a significant long-run relationship between money supply and economic growth as measured by GDP. LNBM is significant to LNGDP and LNGDP is also significant to LNBM so there is bi-directional causality. There is unidirectional relationship existing between LNINF to LNGDP and LNINF to LNBM. ECT coefficient vale are negative and the p-value of above three approaches are also less than 5 percent which is desirable for the ARDL model.

Key words: ARDL; Augmented Dicky fuller; Broad money; Inflation; VECM

Keshar Bahadur Kunwar, Associate Professor, Tikapur Multiple Campus, Farwestern University, Nepal.
Email: keshar497@gmail.com

Introduction

There is rising attention in money supply and its relationship to GDP. Over the past few years, modeling the relationship between money supply and income levels have been one of the main controversial issues of interest for economists, researchers and policy makers. Swamy (1994) noted that the public sector in the 1980s was becoming over-extended and increasingly suffered from economic mismanagement. Over the years, theories on the nexus between monetary policy and economic growth have flourished resulting in different strands of opinions among different schools of thought. This was predicated on the fact that high economic growth rate capable of translating into economic development required a proper mixed monetary policy variables, hence this has generated a lot of attention among various schools of thought ranging from Classical to neo-Classical, Keynesian to neo-Keynesian etc. In the present study, theoretical framework would be reviewed in two phases: impact of money supply on economic growth on the one hand and impact of inflation on economic growth on the other.

Theoretical propositions on the impact of money supply on economic growth are traceable to the Classical and Keynesian monetary theory, which is also known as Quantity theory of money. The Classical monetary theory is hinged on Irving Fisher equation of exchange or what he called value theory. Irving Fisher in his statement as cited by Jhingan (2005) postulated, "Other things remaining unchanged, as the quantity of money in circulation increases, the price level also increases in direct proportion and the value of money decreases and vice versa". This implies that the quantity of money is the main determinant of the price level or the value of money. Any change in the quantity of money produces an exactly proportionate change in the price level.

The Fisher equation of exchange states that the quantum of money multiplied by the velocity of money is equal to the price level multiplied by the amount of goods sold. It is often replicated as MV= PQ, M is defined as the quantity of money, V is the velocity of money (the number of times in a year that a currency goes around to generate a currency worth of income), P represents the price level and Q is the quantity of real goods sold (real output). On the contrary, the attack of Keynes on the classical quantity theorists brought about a reformulated quantity theory of money, which brought about a transition from monetary theory of prices to monetary theory

of output. Keynes integrated monetary theory with value theory and link theory of interest into monetary theory. In the Keynes statement as cited by Jhingan (2005), "it is through the theory of output that value theory and monetary theories are brought into just a position with each other".

Keynes disagrees with the older quantity theorists on their conclusion that there is a direct and proportional relationship between quantity of money and prices. He made it clear that, the effect of change in the quantity of money on prices is indirect and non-proportional and changes in the money supply affect only the absolute price level but exercise no impact on the relative price level. Keynes believes that so long as there is unemployment, output will change in the same proportion as the quantity of money and there will be no change in prices; and when there is full employment, prices will change in the same proportion as the quantity of money. Looking at the theories relating to Inflation Growth relationship, a number of theories and postulations were put forward by Classical, Keynesian, neo Keynesian, Monetarist, and Endogenous growth theorists, each with their respective contribution to the inflation-growth relationship.

Keynesian and Neo-Keynesian theory provided a more comprehensive model for linking Inflation to Growth under the aggregate supply-aggregate demand (AS-AD) framework. The aggregate (AS-AD) framework postulated a positive relationship between inflation and growth where, as growth increased, so inflation does. According to this model, in the short-run, the (AS) curve is upward sloping rather than vertical, which is its critical feature. If the AS curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in AD affect both price and output, (Dornbusch, et al., 1996). This holds that many factors drive the inflation rate and the level of output in the short-run. These include changes in: expectations, labour force, prices of other factors of production, fiscal and/or monetary policy.

Literature review

Aliason (2001) discloses three theoretical reasons often advanced for government money supply namely: first, if the government is unable to meet its expenditure commitments from domestically raised revenue, such as taxes, duties and externally sourced grants and borrowings, then it may resort to deficit financing where it borrows internally.

Christensen (2004) employed a cross country survey of the role of money supply market in sub-Saharan African based on a new data set of 27 sub-Saharan African countries during the 20 years period (1980-2000), the study findings reveals that money supply markets in these countries are generally small, highly short term and often have a narrow investor base. Also in these countries "interest rate payment presents a significant burden to the budget, despite much smaller money supply than foreign indebtedness. Further still, it was revealed that the use of money supply is also found to have significant crowding out effect on private investment.

Oshadami (2006) carried out a study and found out that the growth of money supply has affected the growth of the economy negatively. This situation is premise on the fact that majority of the market participant are unwilling to hold longer maturity and as a result the government has been able to issue more short term debt instruments. This has affected the proper conduct of monetary policy and affected other macro-economic variables like inflation, which makes proper prediction in the economy difficult.

Abbas and Christensen (2007) in their recent study analyzed optimal money supply levels in the low income countries (including 40 sub-Saharan African Countries Kenya included) and emerging market between 1975 and 2004. They found out that moderate levels of marketable money supply as a percentage of GDP have significant positive effects on the gross domestic product. The study also provided evidence that the debt levels exceeding 35 percent of total bank deposits have negative impact on the gross domestic product. However, the relevance of this conclusion to Kenya doubtful since a lot of development has overtime been witnessed in the management of money supply. The country has witnessed an accelerated economic growth between 2005 and 2007 which was not captured in the study.

Looking at the impact of injection and withdrawal of money stock on economic growth in Nigeria, Taiwo, (2012) adopted Ordinary Least Square (OLS) of as estimation technique over a period of (1970-2008). The results revealed that monetary aggregate injection has positive effect on economic growth while withdrawal of money stock showed a negative impact on the GDP of Nigeria. Chinuba, Akhor, and Akwaden (2015) estimating a time series data covering a period

of 1981-2008 with simple OLS on the Nigeria economy, the result supply that money supply exerts a considerable positive impact on economic growth.

Specific objective

The specific objectives are as follow:

- To assess the impact of money supply on GDP.
- To examine the relationship and causality among Gross Domestic Product (GDP), Broad Money (BM) and Inflation (INF).

Research hypotheses

1 H_0: Money supply has no significant contribution to GDP.

2 H_1: Money supply has significant contribution to GDP.

3 H_0: There is no relationship among the variables.

4 H_1: There is relationship among the variables.

5 H_0: There is no causality among the variables.

6 H_1: There is causality among the variables.

Significance of the study

This study focused on what policies can be formulated, what regulatory acts are needed and necessity of amendments regarding the rules and regulation to develop it and make the market perfect functioning. The standard is one of the elements to money market development. Financial statement should maintain accordingly which fulfill the requirement of related parties needed information. The study will provide relevant information for government organs. The researcher insights the study would be useful to formulate appropriate policy to all stakeholders. Furthermore, the study will be used as a reference for other researchers for further study in the topic.

Limitation of the study

There are some limitations of the study. Lack of time, limited budget, and updated information are the major limitations of the study. Apart from this some more limitation are presented below:

) The study centers on achieving the broad objective which is to evaluate the impact of money supply for the development of Nepalese economy. This study only covers the time period of forty-four years from 1974/75 to 2017/18 the rational for choosing this period is mainly for simplicity of analysis. Some selected variables do not have data of covering period.

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⟩ This study will only use secondary data from the different sources so that validity and reliability may depend on the goodness of these data.

⟩ This study will be examined the impact of money supply on GDP. It also includes broad money (BM) and Inflation (INF) explanatory variables at current price.

⟩ It is not a complete study of money market of Nepal.

Research methodology

The research design

This study combines form of both analytical and descriptive research. It has used both the qualitative and quantitative techniques depending on the nature and source of data and information. This study applied some tools such as econometric models, graphs, tables and statistical tools.

Nature and sources of data

The basic objectives of the study analyze the impact of money supply on economic growth of Nepalese economy. In order to seek the information regarding this study the relevant materials review and gather the necessary information from the various secondary sources. Time series data covering period of forty-four years from 1974/75 to 2017/18 has been used to assess the impact of money supply on GDP. The secondary data has been taken from Ministry of Finance (MOF), Nepal Rastra Bank (NRB) and various web pages including google.com, libraries as per need.

Data collection tools and procedures

The study has employed specific techniques of data collection and analysis methods in a way that seems pertinent to the study. As a result, it has used specific tool; review the existing data that enable to capture information pertinent to the study objectives. The study has employed a document reviewing method.

Techniques of Data Analysis

The information has been collected from the secondary sources processed to analyze regression. To address the objectives of the research and to analyze the data, descriptive statistics, simple and multiple regressions has been employed. The time series information (annual data has been used for statistical computations of the contribution and hence, used for testing the hypotheses. Statistical computation has been employed to explore the inherent relationships among the variables. This study

tests some reliable models like Augmented- Dickey Fuller unit root test and ARDL model which give reliability and validity of the model.

Autoregressive distributed lag (ARDL)

Economic analysis suggests that there is a long run relationship between variables under consideration as stipulated by theory. This means that the long run relationship properties are intact. In other words, the means and variances are constant and not depending on time. However, most empirical researches have shown that the constancy of the means and variances are not satisfied in analyzing time series variables. In the event of resolving this problem most co-integration techniques are wrongly applied, estimated, and interpreted. One of these techniques is the Autoregressive Distributed Lag (ARDL) co-integration technique or bound co-integration technique. Hence, this study reviews the issues surrounding the way co-integration techniques are applied, estimated and interpreted within the context of ARDL co-integration framework. The study shows that the adoption of the ARDL co-integration technique does not require pretests for unit roots unlike other techniques. Consequently, ARDL co-integration technique is preferable when dealing with variables that are integrated of different order, I(0), I(1) or combination of both and, robust when there is a single long run relationship between the underlying variables in a small sample size.

The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F statistic exceeds the critical value band. The major advantage of this approach lies in its identification of the co-integrating vectors where there are multiple co-integrating vectors. However, this technique will crash in the presence of integrated stochastic trend of I(2). To forestall effort in futility, it may be advisable to test for unit roots, though not as a necessary condition. Based on forecast and policy stance, there is need to explore the necessary conditions that give rise to ARDL co-integration technique in order to avoid its wrongful application, estimation, and interpretation. If the conditions are not followed, it may lead to model misspecification and inconsistent and unrealistic estimates with its implication on forecast and policy.

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The model specification and data measurement

ARDL- VECM and casual inference model

$\Delta L \quad = \beta 0 + \sum_{i-1}^{p-1} \beta 1 i \Delta L \quad -1 + \sum_{i-0}^{q-1} \beta 2 i \Delta L \quad -1 + \sum_{i-0}^{q-1} \beta 3 i \Delta L \quad -1 + \emptyset E \quad -1 + et \ldots\ldots\ldots\ldots(1)$

$\Delta L \quad = \beta 0 + \sum_{i-1}^{p-1} \beta 1 i \Delta L \quad -1 + \sum_{i-0}^{q-1} \beta 2 i \Delta L \quad -1 + \sum_{i-0}^{q-1} \beta 3 i \Delta L \quad -1 + \emptyset E \quad -1 + et \ldots\ldots\ldots\ldots.(2)$

$\Delta L \quad = \beta 0 + \sum_{i-1}^{p-1} \beta 1 i \Delta L \quad -1 + \sum_{i=0}^{q-1} \beta 2 i \Delta L \quad -1 + \sum_{i=0}^{q-1} \beta 3 i \Delta L \quad -1 + \emptyset E \quad -1 + et \ldots\ldots\ldots\ldots..(3)$

Where,

GDP = GDP at current prices.

BM= Broad money is defined as   the   sum of savings and time deposits with commercial banks.

INF = General increase in pricesof goods and services over a period of time measured on consumer price index in Nepal.

ECT = Error Correction Term

$_0$, $_1$, $_2$ and $_3$are model parameters and et is the stochastic error term. The 'priori' expectation is that the model parameter is expected to be positively signed. The implication is the real context as growth has been expected even when BM and INF have been collected.

Natural logarithm has been used to make the data under study to be normal and linear. This is because natural log is one of the transformations methods that make the data normal if they are not normal with their actual numbers. It also gives elasticity.

Data analysis and result

Empirical results

Augmented Dickey Fuller (ADF) test has revealed that LNGDP and LNBM are non-stationary in level but when the variables are converted into first difference becomes stationary and the LNINF is stationary in level so this is mixed type in this case we can run ARDL model.

Table no 1.1: Augmented Dickey Fuller test

Variables	Level constant	Level constant and trend	First difference constant	First difference constant and trend
LNGDP	0.017543 (09550)	-1.860205 (0.6575)	-6.572602 (0.0000)	-6.487835 (0.0000)
LNBM	-0.619807 (0.8552)	-2.187356 (0.4840)	-4.563283 (0.0007)	-4.543484 (0.0040)
LNINF	-4.465338	-4.828814	-10.13064	-10.00741

	(0.0009)	(0.0019)	(0.0000)	(0.0000)

Source: Based on author's calculation

In above three models after running the ARDL the value of F statistics and T statistics are above the I(1) so the null hypothesis of no co-integration is rejected meaning there is co-integration and desirable to run long run error correction form. After running the long run error correction form following result appeared:

Table no 1.2: ARDL summarization

Dependent variables	Repressor's t statistics	ECT t-statistics	Pairwise Grager Test
LNGDP	LNBM-Significant	Significant	LNINF ⟶ LNBM LNINF ⟶ LNGDP
LNBM	LNGDP-Significant	Significant	LNBM ⟷ LNGDP
LNINF	Insignificant	Significant	

Source: Based on author's calculation

LNBM is significant to LNGDP and LNGDP is also significant to LNBM so there is bi-directional causality. There is unidirectional relationship existing between LNINF to LNGDP and LNINF to LNBM. ECT coefficient vale are negative and the p-value of above three approaches are also less than 5 percent which is desirable for the ARDL model. (See in Appendix)

Table 1.3: Summary results of serial correlation, hetero-skedasticity, ARCH and normal distribution

Particulars	Obs* R-squared	P- Value
Breusch-Godfrey Serial Correlation LM Test:	0.832499	0.6595
Heteroskedasticity Test: Arch	0.108772	0.7541
Histogram Normality test	--	0.202612

Source: Based on author's calculation

Here we choose Obs*R-squared and the corresponding P-value which is greater than 5 percent in above three cases so here we cannot reject null hypothesis. The null hypothesis is not serially correlated, residuals are homoscedasticity, residuals are normally distributed which is desirable for the ARDL Model. So in conclusion this ARDL model is accepted. (See in Appendix)

CUSUM test

The green line is in between the two red lines so this model is desirable
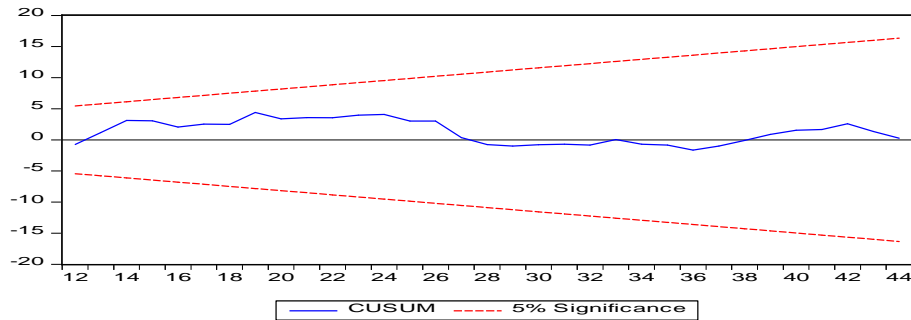
Conclusion

In conclusion, there is bi-direction causality existing between the broad money and gross domestic production. Inflation also causes to broad money and gross domestic production.

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Appendix: ARDL Result

ARDL Error Correction Regression
Dependent Variable: D(LNGDP)
Selected Model: ARDL(1, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:26
Sample: 1 44
Included observations: 42

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.077685	0.212342	5.075231	0.0000
CointEq(-1)*	-0.342568	0.076220	-4.494484	0.0001
R-squared	0.335552	Mean dependent var		0.123950
Adjusted R-squared	0.318941	S.D. dependent var		0.060715
S.E. of regression	0.050106	Akaike info criterion		-3.102916
Sum squared resid	0.100423	Schwarz criterion		-3.020170
Log likelihood	67.16124	Hannan-Quinn criter.		-3.072587
F-statistic	20.20039	Durbin-Watson stat		1.968519
Prob(F-statistic)	0.000058			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.396790	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-4.494484	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNGDP)
Selected Model: ARDL(1, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:20
Sample: 1 44
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.077685	0.299853	3.594046	0.0009
LNGDP(-1)*	-0.342568	0.097109	-3.527645	0.0011
LNBM**	0.260373	0.073774	3.529360	0.0011
LNINF**	0.031998	0.015842	2.019768	0.0505

 * p-value incompatible with t-Bounds distribution.
** Variable interpreted as $Z = Z(-1) + D(Z)$.

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNBM	0.760064	0.011743	64.72246	0.0000
LNINF	0.093406	0.056566	1.651285	0.1069

$EC = LNGDP - (0.7601*LNBM + 0.0934*LNINF)$

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.396790	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36
Actual Sample Size	42		Finite Sample: n=45	
		10%	3.33	4.347
		5%	4.083	5.207
		1%	5.92	7.197
			Finite Sample: n=40	
		10%	3.373	4.377
		5%	4.133	5.26
		1%	5.893	7.337

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-3.527645	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNBM)
Selected Model: ARDL(1, 0, 1)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:32
Sample: 1 44
Included observations: 41

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.252025	0.251463	-1.002238	0.3229
LNBM(-1)*	-0.064565	0.060560	-1.066138	0.2935
LNGDP**	0.087170	0.079559	1.095654	0.2805
LNINF(-1)	0.060176	0.015261	3.943147	0.0004
D(LNINF)	0.036154	0.013873	2.606062	0.0132

 * p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	1.350100	0.072867	18.52838	0.0000
LNINF	0.932022	0.976623	0.954331	0.3463

EC = LNBM - (1.3501*LNGDP + 0.9320*LNINF)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	7.409564	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36
Actual Sample Size	41		Finite Sample: n=45	
		10%	3.33	4.347
		5%	4.083	5.207
		1%	5.92	7.197
			Finite Sample: n=40	
		10%	3.373	4.377
		5%	4.133	5.26
		1%	5.893	7.337

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-1.066138	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

ARDL Error Correction Regression
Dependent Variable: D(LNBM)
Selected Model: ARDL(1, 0, 1)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:37
Sample: 1 44
Included observations: 41

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.252025	0.087003	-2.896753	0.0064
D(LNINF)	0.036154	0.012007	3.011025	0.0047
CointEq(-1)*	-0.064565	0.013329	-4.843926	0.0000

R-squared	0.383907	Mean dependent var		0.168555
Adjusted R-squared	0.351481	S.D. dependent var		0.045095
S.E. of regression	0.036315	Akaike info criterion		-3.722799
Sum squared resid	0.050114	Schwarz criterion		-3.597416
Log likelihood	79.31739	Hannan-Quinn criter.		-3.677142
F-statistic	11.83951	Durbin-Watson stat		2.051750
Prob(F-statistic)	0.000101			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.409564	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-4.843926	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNINF)
Selected Model: ARDL(1, 1, 2)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:44
Sample: 1 44
Included observations: 40

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.185460	3.028849	-0.061231	0.9515
LNINF(-1)*	-1.024383	0.150666	-6.799027	0.0000
LNGDP(-1)	0.412120	0.967054	0.426160	0.6728
LNBM(-1)	-0.363346	0.738448	-0.492040	0.6259
D(LNGDP)	1.979436	1.177240	1.681421	0.1021
D(LNBM)	3.553957	1.615801	2.199502	0.0350
D(LNBM(-1))	3.706215	1.647539	2.249547	0.0313

 * p-value incompatible with t-Bounds distribution.

Levels Equation Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	0.402310	0.944017	0.426168	0.6728
LNBM	-0.354698	0.720946	-0.491989	0.6260

EC = LNINF - (0.4023*LNGDP -0.3547*LNBM)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	15.78248	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36
Actual Sample Size	40		Finite Sample: n=40	
		10%	3.373	4.377
		5%	4.133	5.26
		1%	5.893	7.337

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-6.799027	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

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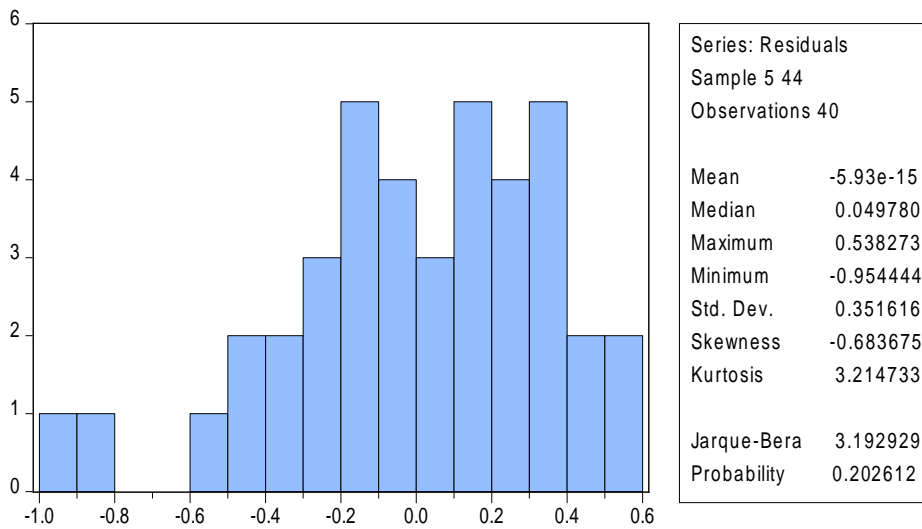
ARDL Error Correction Regression
Dependent Variable: D(LNINF)
Selected Model: ARDL(1, 1, 2)
Case 3: Unrestricted Constant and No Trend
Date: 04/01/19   Time: 15:45
Sample: 1 44
Included observations: 40

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.185460	0.277266	-0.668890	0.5082
D(LNGDP)	1.979436	1.055486	1.875379	0.0696
D(LNBM)	3.553957	1.525702	2.329391	0.0261
D(LNBM(-1))	3.706215	1.586442	2.336180	0.0257
CointEq(-1)*	-1.024383	0.144556	-7.086394	0.0000

R-squared	0.626849	Mean dependent var		0.011608
Adjusted R-squared	0.584203	S.D. dependent var		0.575607
S.E. of regression	0.371165	Akaike info criterion		0.972128
Sum squared resid	4.821717	Schwarz criterion		1.183238
Log likelihood	-14.44255	Hannan-Quinn criter.		1.048458
F-statistic	14.69892	Durbin-Watson stat		1.961604
Prob(F-statistic)	0.000000			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	15.78248	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-7.086394	10%	-2.57	-3.21
		5%	-2.86	-3.53
		2.5%	-3.13	-3.8
		1%	-3.43	-4.1

Series: Residuals	
Sample 5 44	
Observations 40	
Mean	-5.93e-15
Median	0.049780
Maximum	0.538273
Minimum	-0.954444
Std. Dev.	0.351616
Skewness	-0.683675
Kurtosis	3.214733
Jarque-Bera	3.192929
Probability	0.202612

Heteroskedasticity Test: ARCH

F-statistic	0.103483	Prob. F(1,37)	0.7495
Obs*R-squared	0.108772	Prob. Chi-Square(1)	0.7415

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/01/19　Time: 15:58
Sample (adjusted): 6 44
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.116952	0.035584	3.286614	0.0022
RESID^2(-1)	0.052585	0.163465	0.321688	0.7495

R-squared	0.002789	Mean dependent var	0.123261
Adjusted R-squared	-0.024163	S.D. dependent var	0.183226
S.E. of regression	0.185427	Akaike info criterion	-0.482393
Sum squared resid	1.272175	Schwarz criterion	-0.397082
Log likelihood	11.40666	Hannan-Quinn criter.	-0.451784
F-statistic	0.103483	Durbin-Watson stat	1.942926
Prob(F-statistic)	0.749500		

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Pairwise Granger Causality Tests
Date: 04/01/19   Time: 15:39
Sample: 1 44
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNGDP does not Granger Cause LNBM	42	0.80554	0.4545
LNBM does not Granger Cause LNGDP		5.00078	0.0120
LNINF does not Granger Cause LNBM	39	2.78447	0.0759
LNBM does not Granger Cause LNINF		3.08654	0.0586
LNINF does not Granger Cause LNGDP	39	3.58063	0.0388
LNGDP does not Granger Cause LNINF		0.87288	0.4269