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The Effect of Investment, Exports, and Interest Rates on the Gross Domestic Product of the Republic Of Yemen: An Econometric Analysis

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Abstract

Purpose: *The study aims to examine the effect of investment, exports, and interest rates on the gross domestic product of the Republic of Yemen.*

Approach/Methodology/Design: *This study is based on secondary data. Data on the gross domestic product, interest rate, gross capital formation were obtained and analyzed using the autoregressive distributed lag (ARDL) technique, Wald test, Serial Correlation LM Test. The data were presented the*

Findings: *The results through the use of the (E-VIEWS) program showed that there is a direct statistically significant relationship at a level of 5% between investment and gross domestic product. This means that if investment increases by 1%, it will lead to an increase in GDP by 28.63%. The result also showed that the dummy variable relationship to the GDP is direct and statistically significant. The level of significance is 5%, that is, by increasing the dummy variable by 1%, it leads to an increase in GDP by 25.13%. As long as the interest rate was on an inverse relationship and statistically significant at a significant level (10%), this means that an increase in interest rates by 1% would lead to a decrease in GDP rates by 19.54%. In addition, there is a positive relationship between exports and GDP and a statistical significance at level 5%. This means that an increase in exports by 1% leads to an increase in GDP by 69.76%.*

Practical Implications: *The investment could be double more than what the results showed in the case of political and economic stability. Improving legislation is also a significant aspect. There is an urgent need to focus on investment in infrastructure. In addition, increasing exports improve the gross domestic product. Based on the results, it is recommended to real invest instead of placing capital in banks as increasing interest rates lead to lower gross domestic output.*

Originality/value: *The analysis indicates that there is a direct statistical and significant relationship between total investment and gross domestic product at a significant level of 5%, as whenever the investment increased by 1%, this led to an increase in the gross domestic product by about 28.63%.*

1. Introduction

Investing in many ways is of great importance to the economy in any country. Real investment, financial investment, and investment in the manner of build-operate-transfer (BOT) in developing the infrastructure of the state and society are the main pillars of economy. The urbanization of countries and the extent of their progress are measured by their interest in investment in all sectors and infrastructure development. It is considered the backbone and the main factor on which major investments and projects depend, contributing to the development of society and providing a healthy and safe environment for the individual and society. Investment in the national capital in the manner of building, operating, and transferring (BOT) is also one of the most important investments that play a major role in the economic development,

especially when focusing on developing the infrastructure, as many economists emphasize its importance. In addition, investment in infrastructure is a major factor in attracting capital for investments in other sectors.

Economists have measured the return from infrastructure development and it is found out that it contributes in one way or another to economic growth. Infrastructure is vital to economic development, as it is key to achieving higher and stable economic growth. (Ismail & Mahyideen, 2015). Infrastructure, for example, plays a key role in facilitating trade. Studies have confirmed that infrastructure development helps the growth of other sectors and, therefore, the interest in investing in infrastructure is considered as a leading sector in facilitating investments. Infrastructure is a key element of poverty alleviation. It often acts as a catalyst to development and enhances the impact of interventions to improve the poor's access to other assets (Gaal & Afrah 2017). In other sectors, there is a direct contribution to increasing the national income, by raising the efficiency of services, whether direct or indirect.

From this point of view, this study aims to identify the impact of investment on the gross domestic product given the turbulent situation in the country. Investment in Yemen currently faces many challenges and obstacles, whether political, economic, or social. Therefore, it is necessary to focus on policies and procedures that improve the current situation and attract capital. Capital is a coward; looking for safety to achieve the maximum possible earnings. Hence, efforts must be doubled to ensure the safety of national capital and provide the necessary facilities for all investors.

Given the importance of investment in creating developments in all fields under normal circumstances, and due to the war in the country, it is necessary to study the impact of investment on the gross domestic product. Yemen is a country with a wide spectrum of economic potential for several industries and shows a bright and promising future for its agriculture and fishery sectors (Badeeb & Lean, 2017). However, there are many obstacles to investment, whether political, economic, structural, or legislative. For instance, Yahya et al. (2017) indicated that political instability in Yemen has a positive and significant influence on bank's profitability. It is well-established that capital is cowardly and always looking for a safe zone to invest in and achieve maximum profit. Accordingly, the study is significant and will have practical implications for concerned authorities. Given the unstable conditions in Yemen, the study provides a venue for investment operations during a turbulent period in Yemen. Four hypotheses are formulated as follows:

1. There is no direct statistically significant relationship between total investment and gross domestic product.
2. There is no direct statistically significant relationship between export and gross domestic product.
3. There is no direct statistically significant relationship between interest rates and gross domestic product.
4. There is no direct relationship between the dummy variable (expressing events) and GDP.

2. Methodology and Procedures

The study employs the descriptive methodology and the standard analytical methodology. This study is based on secondary data. Data on the gross domestic product, interest rate, gross capital formation were obtained and analyzed using the autoregressive distributed lag (ARDL) technique, Wald test, Serial Correlation LM Test. GDP in terms of a record was presented by using the E-VIEWS program.

3. Results and Discussion

The impact of investment and some variables on the gross domestic product:

Defining the model variables and studying their stability:

Many variables affect the Gross Domestic Product (GDP), and accordingly, this study will place some variables that affect the GDP, the most important of which are total investment (I), interest rates (R) and exports (X), and the dummy variable will be added. (Phantom), which expresses the occurrence of important events during the study and is symbolized by the symbol (D)

The model for multiple linear regression would be as follows:

Defining the variables:

GDPt = F (I, X, R, Dummy) (1)

whereas:

I: It represents the total investment. GDP: Gross domestic product at current prices.

R: Represents the rate of interest rates. X: Exports. α0: constant amount.

α1, α2, α3: Coefficients of independent variables.

Annual time series data for the variables included in the model, in addition to the rest of the indicators that may affect the gross domestic product for the period (2000-2015), were collected from the annual statistical reports issued by the Central Bureau of Statistics and the Central Bank of Yemen and Appendix No. (1) clarifies these raw data. The data were divided into quarterly data using custom formulas, and this was based on previous studies, such as Al-Rafik's study (2009) and Al-Bazai's study (1999). The quarterly data are shown in Appendix No. (2).

Studying the stability of variables:

To study the stability of the variables that are used in the model, the variables are tested because the time series of many macroeconomic indicators are unstable. Therefore, it is preferable to test the variables first for the unit root, and the model includes the regression estimation of an unstable series. The time series is stable if both the mean and the variance are constant across time. At the same time, the subjective difference coefficient depends on the gap between those two periods, and not on the actual time in which the differential coefficient is prominent. On the other hand, the time series needs the difference for stability.

Usually, Phillips-Person or the Dickey-Fuller test are employed. This test includes an estimate of the equation formulated as follows (Stock, 2003; Fuller, 1996; Said & Dickey. 1984; Said, 1991):

$$\Delta GDP_t = a + b_1 GDP_{t-1} + u_t \qquad (2)$$

The Extended Dickey-Fuller (ADF) test takes the following form:

$$\Delta GDP_t = a + b_1 GDP_{t-1} + \sum b_i GDP_{t-i} + u_t \qquad (3)$$

Where: Δ denotes the first differences, a: denotes the second.

It appears from Table No. (1) after conducting a study of the stability of the variables included in the model through the outputs of the E-VIWES program, using Phillips-Person, that the variables are stable at the first difference, whether in the case of the constant or in the case of the temporal trend or the absence of the constant and temporal direction.

Table No.1: Time Series Variables (Phillips-Person) Test Results

in the level	**UNIT ROOT TEST TABLE (PP)**					
Variables	**DUMMY**	**R**	**X**	**I**	**GDP**	
With difficulty	-0.6088	-1.9693	-1.6534	-1.4390	-1.3082	t-Statistic
	0.8599	0.2992	0.4490	0.5566	0.6196	P- Value
With constant and temporal direction	-1.9338	-2.2314	0.2494	-1.2315	-0.2279	t-Statistic
	0.6234	0.4632	0.9979	0.8938	0.9908	P- Value
Without static and without temporal direction	0.0000	-0.2091	0.1796	0.7005	1.9615	t-Statistic
	0.6784	0.6064	0.7345	0.8638	0.9872	P- Value
When the first difference						
With difficulty	-7.3485	-4.4279	-2.9938	-4.6308	-3.4346	t-Statistic
	0.0000	0.0008	0.0418	0.0004	0.0139	P- Value
With constant and temporal direction	-7.3556	-4.3918	-3.2842	-4.6943	-3.8186	t-Statistic
	0.0000	0.0049	0.0798	0.0020	0.0230	P- Value
Without static and without temporal direction	-7.2801	-4.4629	-3.0484	-4.5120	-2.8978	t-Statistic
	0.0000	0.0000	0.0029	0.0000	0.0045	P- Value

Source: Prepared by the researcher based on the data in Appendix No. (2) of the E-Views program outputs

Building the Auto Regressive Distributed Lags (ARDL):

This method is considered one of the advanced methods of processing models based on studying and analyzing time-series data. Through the ARDL model, we can determine the complementary relationship between the dependent variable and the independent variables, in addition to determining the size of the effect of all independent variables on the dependent variable in the short and long terms.

The advantage of the ARDL model is that it can combine variables with more than one level of stability, such as I (0) and I (1), and it is not required that all of them be stable at the same level, as it depends on the SBC standard (Schwarz Bayesian Criteria) that is used to determine the number of slowdowns Optimum and gives an error correction result that measures the ability of the model to balance after an emergency malfunction or disturbance.

$$\Delta(GDP_t) = c + \lambda(GDP_{t-1}) + \alpha_1(I_{t-1}) + \alpha_2(X_{t-1}) + \alpha_3(R_{t-1}) + \alpha_4(Dummy_{t-1}) + \sum_{i=1}^{m} \beta_{1,i} * \Delta(GDP_{t-i}) + \sum_{i=1}^{k} \beta_{2,i} * \Delta(I_{t-1}) + \sum_{i=1}^{k} \beta_{3,i} * \Delta(X_{t-1}) + \sum_{i=1}^{k} \beta_{4,i} * \Delta(R_{t-1}) + \sum_{i=1}^{k} \beta_{5,i} * \Delta(Dummy_{t-1}) + u_t \qquad (4)$$

whereas :

GDP: domestic product. I: Total investment. R: Interest rates. X: Exports. .

Dummy: The dummy. Ut: random error

The equation (4) consists of three parts, which are as follows:

Part One: $c + \lambda(GDP_{t-1}) + \alpha_1(I_{t-1}) + \alpha_2(X_{t-1}) + \alpha_3(R_{t-1}) + \alpha_4(Dummy_{t-1})$ **(5)**

From it, we obtain the long-term information or the long-term relationship and the series of the five variables at the level represent slower for one year. Through the information we obtain from this part, we get the joint integration equation (equation of the long-term relationship between GDP and the independent variables) and according to the ARDL method,

The parameters of the independent variables (1α, 2α, 3α, 4α) do not have an economic meaning, but a statistical meaning, and can be used to obtain the marginal tendency or elasticity (if using the logarithm of time series) for the independent variables (I, R, X, Dummy) In the long-term relationship model if we have the following regression equation:

$GDP_t = ß + b_1(I) + b_2(X) + b_3(R) + b_4(Dummy) + U_t$ (6)

$$\beta = \frac{-c}{\lambda}, b_1 = \frac{-\alpha_1}{\lambda}, b_2 = \frac{-\alpha_2}{\lambda}, b_3 = \frac{-\alpha_3}{\lambda}, b_4 = \frac{-\alpha_4}{\lambda} \quad (7)$$

The parameter is required to be negative to have a long-term relationship and the possibility of returning to equilibrium. It represents the percentage of the short-term error that can be corrected per unit of time and which represents a fraction of the year in this model.

Part Two: is represented by the slowdowns of the dependent variable.

$$\sum_{i=1}^{m} \beta_{1,i} * \Delta(GDP_{t-i}) \quad (8)$$

- The third part: is represented by the slowdowns of the independent variables.

$$\sum_{i=1}^{k} \beta_{2,i} * \Delta(I_{t-1}) + \sum_{i=1}^{k} \beta_{3,i} * \Delta(X_{t-1}) + \sum_{i=1}^{k} \beta_{4,i} * \Delta(R_{t-1}) + \sum_{i=1}^{k} \beta_{5,i} * \Delta(Dummy_{t-1}) \quad (9)$$

As the second and third parts of the equation represent short-term information.

Estimated Model Tests and Results Analysis:

The model is estimated using the (OLS) method within the programming of the (ARDL) model, and after this step of estimating using the E-VIEWS program, we obtain the results shown in Appendix No. (4) and are organized in the following table:

Table No. 2: Choosing the best results of slowdowns out of the total

Statement	GDP	I	X	R	Dummy
Number of models evaluated slowdowns	**2500**				
Best number of slowdowns selected	**1**	**4**	**4**	**2**	**4**
Views	52				

Source: Prepared by the researcher depending on the data in Appendix No. (2) using the ARDL form

Table No. (3) shows that the number of evaluated slowdown models that were completed through the E-VIEWS program amounted to 2,500 models and that the ARDL model is distinguished by choosing the best slowdown periods for each variable according to Appendix No. (4), where it worked on choosing one slowest period for the output variable. The selection of 4 slower periods for the total investment variable, 2 slower periods for the interest rate variable, 4 slower periods for the export variable, and 4 slower periods for the dummy variable, where the selection was made based on the results of Akike Info Criterion (AIC) selection, and we note from the appendix the number of views was 52 views for each variable.

Test for long-term error correction potential and conditions for the error correction parameter signal and significance ג:

Table No. 3: Significant test results and signal correction factor

Parameter correction The error	Parameter value	Standard error	T-test	P-Value
ג	-0.268782	0.019565	-13.738011	0.0000
Independent variables	Parameter value	Standard error	T-test	P-Value
Total investment (I Ln)	0.286312	0.079287	3.611062	0.0010
Exports (X Ln)	0.697582	0.131185	5.317528	0.0000
Interest rate (R Ln)	-0.195372	0.111341	-1.754722	0.0889
Dummy variable	0.251320	0.047359	5.306693	0.0000
Static Limit (C)	-2.873099	1.582788	-1.815215	0.0789
$Ln(GDP_t) = ß + b_1(Ln\ I) + b_2(LnX) + b_3(Ln\ R) + b_4(Dummy) + U_t$ $Ln(GDP_t) = -2.873099 + 0.286312\ (Ln\ I) + 0.697582(LnX) - 0.195372\ (LnR) + 0.251320\ (Dummy)$ (10)				

Source: Prepared by the researcher depending on the data in Appendix No. (2) using the ARDL form

It appears from the results in Table (3) that the analysis will take two directions:

- The first analysis is represented by a negative value (-0.268782), which is significant, as the value of t-test = -13.738011 and the value of P- Value= 0.000, which is less than 1%, and this means fulfilling the conditions of the error correction parameter that was mentioned previously. Thus, there is the possibility of correcting the short-term error in the long term and returning to the equilibrium position, that is; 13.74 percent of the short-term error is addressed in the long term.
- The second analysis: It is represented by the value of the t-test for each of the total investments, exports, and the dummy variable, which was about (3.61, 5.32, and 5.31), respectively, and it is statistically significant because the P-value was less than 5%. The total investment, exports, and the dummy variable are by 1%. This will lead to an increase in the GDP by (28.63%, 69.76%, and 25.13%) respectively. Although the dummy variable expresses the occurrence of events in the period (2011-2015) and is

assumed to be the sign of the coefficient of the dummy variable, it is negative. Its effect on the gross domestic product is negative, but it appears that the effect of the dummy variable was positive. This is due to several reasons, including the existence of instability, money laundering, investments increased in many projects. such as exchange companies, and oil stations. There may be some capital owners who could not get their money out. They, therefore, invested it in real estate, private hospitals, private schools, and private universities. Therefore, all the transactions of the independent variables express the elasticities of output with respect to total investment, exports, and other variables. The effect of each variable is positive, while the variable related to interest rates was at the value of t-test = -0.195372, which is statistically significant at 10% and P-value = 0.0889. Therefore, an increase in the interest rate of 1% will lead to a decrease in the gross domestic product by 19.54%, which expresses the flexibility of the product with the interest rate. All the independent variables are consistent with the economic theory.

WALD TEST to examine the existence of a long-term relationship:

After establishing an equation for the impact of investment and some variables on the gross domestic product during the long term, the signal correction factor test was accepted. Another important test is done to decide whether or not the model is accepted. It involves testing the existence of a long-term relationship, starting from the independent variables included in the model (I, X, R, Dummy) to the dependent variable (GDP). Therefore, the BONDS TEST within the E-VIEWS program is used, depending on the F distribution and is based on the following optional rule:

The test hypotheses are:

There is no long-term relationship that goes from the independent variables to the dependent variable: H0

There is a long-term relationship that goes from the independent variables to the dependent variable: H1

The comparison for this test is done through the tabular values developed by Pesaran, as there is an upper limit I1 and a minimum I0 dependent on the number of independent variables K. If the value of F is greater than I1, we reject H0 and accept H1, meaning that there is a long-term relationship that moves from the independent variables to the dependent variable. If the value of F is smaller than I0, we accept H0 and reject H1, meaning that there is no long-term relationship that moves from the independent variables to the dependent variable. But if F is between I1 and I0, then in this case the decision is not specified (that is, we cannot make the decision).

After applying the test through the E-VIEWS program, we obtain the results shown in Appendix No. (7) and arranged in Table No. (5), in which a long-term relationship appears, moving from the independent variables to the dependent variable, as well as judging the explanatory ability of the estimated model in the short term and hence the judgment of the quality of the estimated model as a whole.

Table No. 5: Results of WALD TEST examining the existence of a long-term relationship

BONDS TEST			
Tabular value at 5% level		F-Statistic	Number of independent variables K
H_1	H_0	27.20475	4
3.49	2.56		
F-Statistic and R^2 and Adjusted R-squared			
Adjusted R-squared	R^2	P-value	F-Statistic
0.906900	0.941585	0.000000	27.14737

Source: Prepared by the researcher using the data in Appendix No. (2) using the ARDL form

It appears from the above table that the value of F = 27.20, which is greater than the highest tabular value, i.e. higher than 3.49. This means the existence of a long-term relationship leads the independent variables to the dependent variable. Therefore, we reject hypothesis H0 and accept hypothesis H1, meaning that there is a long-term relationship that leads from the independent variables (I, X, R, and Dummy) to the dependent variable (GDP).

R2, which shows the explanatory ability of the estimated model over the long term, which we arrived at through equation (10), confirms to us that 94% of the change in GDP comes from independent variables, which is a high percentage that reflects the good choice of the model representing the relationship under study. Therefore, the value of the Adjusted R-squared coefficient, which takes into account the number of observations and the number of estimators, was supportive of the estimated model and the explanatory capacity, as it reached 91%.

Given the value of F = 27.15 and the P-value = 0.000, we reject the null hypothesis and accept the alternative hypothesis which states that the estimated parameters differ from zero, meaning that the estimated regression equation for the impact of investment and some variables on GDP are statistically significant. This explains the investment effect on GDP, and the value of F, R2 and Adjusted R-squared reflects the overall significance of the model in the short term, which appears in Appendix No. (7).

Serial Correlation LM Test:

According to ARDL methodology, the discovery of the auto clinking problem is done through the Breusch-Godfrey test which is based on the idea of the Lagrange multiplier LM Test for series correlation. It cautions many economists against using the Durban-Watson (DW) test in this model. This test is based on the F-test statistic and Chi-Square statistic and is structured

The test is as follows:

- No self-correlation for H0 errors:
- There is a self-correlation for H1 errors:

Then the calculated values for each Chi-Square or F-statistic are compared or based on their probabilities that appear in the test, where the comparison is made as follows:

When P_value <0.05 we accept null hypothesis H0: (no serial self-correlation errors)

When P_value> 0.05 we accept null hypothesis H1: (Presence of serial autocorrelation errors)

After applying the test through the E-VIEWS program, we obtain the results shown in Appendix No. (6), which were summarized in the following table:

From the previous Table (6), we note that the probability of the F and Chi statistics is significant. Its probabilities were greater than the level of 5% and thus we accept the null hypothesis, which states that there is no self-sequential correlation of errors in the investment impact model and some variables on the estimated GDP, meaning that the variance of errors is homogeneous.

Table (6): Serial Correlation LM Test results

P-Value	Test value	Statement
0.7411	0.302197	F-statistic
0.6432	0.882712	Chi-Square

Source: Prepared by the researcher depending on the data in Appendix No. (2) using the ARDL form

4. Conclusion and Suggestion

After studying the effect of investment, exports, and interest rates on the gross domestic product of the Republic of Yemen, the data revealed that Yemen is in dire need of investments in all sectors, especially in infrastructure. There are some obstacles to investment, the most important of which are economic, political, structural, and legislative. Based on the results of the study, the investment requirements lie in real investment and investment in infrastructure. The analysis indicates that there is a direct statistical and significant relationship between total investment and gross domestic product at a significant level of 5%, as whenever the investment increased by 1%, this leads to an increase in the gross domestic product by about 28.63%. The results of the impact of exports on the GDP indicated that it has a positive relationship with the GDP at the level of significance of 5%, meaning that whenever exports increase by 1%, this leads to an increase in GDP by 69.76%. The independent variable represented in interest rates had a negative effect on the GDP, which is statistically significant at the level of 10%, that is; by increasing interest rates by 1%, this leads to a decrease in the GDP by about 19.54%. More importantly, the analysis showed that the dummy variable (which expresses the situation in Yemen) had a direct relationship and statistical significance at the level of 5%.

Based on the results of the study, there is a need to pay attention to investments and to provide facilities for all investors, whether local or international. It is also imperative to assess the economic, political, structural, and legal obstacles and urgently work on overcoming them. Collaboration of efforts among all institutions and ministries is recommended to eliminate investment obstacles facing national and foreign capital. It is also important for authorities and concerned bodies to invest in all sectors, especially infrastructure. Encouraging real investments and reducing investments in financial derivatives may improve the gross domestic product.

Conflict of Interests

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Appendices

Appendix No. (1)

Total investment, GDP, interest rate and exports in the Republic of Yemen for the period (2000 -2015)

YEARS	DUMMY VAR	Export By thousand	Interest Rate %	GDP In million riyals	Total of Investment In million riyals
2000	0	613,937,112	13	1560926	266481
2001	0	521,629,032	13	1684554	286940
2002	0	540,732,149	13	1878007	297,754
2003	0	659,476,436	13	2160608	411,755
2004	0	731,781,051	13	2563490	493,537
2005	0	1,040,657,905	13	3208501	806,119
2006	0	1,270,866,272	13	4,265,586	1,121,344
2007	0	1,214,516,246	13	4,845,838	1,378,156
2008	0	1,438,333,210	13	5,711,289	1,534,091
2009	0	1,225,847,862	10	5,772,915	1,239,261
2010	0	1,361,809,897	20	6,786,814	1,299,867
2011	1	1,482,141,374	20	6,644,660	1,168,212
2012	1	1,471,754,070	18	6,875,253	1,326,845
2013	1	1,539,178,595	15	7,468,564	1,145,868
2014	1	1,334,893,400	15	7,139,534	1,506,048
2015	1	168,227,913	15	5,729,031	600,636

Source: 1) Ministry of Planning and International Cooperation, Statistical Yearbook, various issues.
2) The Central Bank of Yemen, the annual report prepared differently.

Appendix No. (2)

Total investment, GDP, interest rate and exports in the Republic of Yemen for the period Divided into a quarter

the years Divided Quarter	**DUMMY VAR**	**Interest rates R**	**EXPORT X**	**Total Investment I**	**GDP**
2001:1	0	3.25	134881556.73	70288.39	407376.91
2001:2	0	3.25	130680407.04	71321.74	415638.43
2001:3	0	3.26	128879410.88	72566.99	427237.41
2001:4	0	3.25	127846453.86	73125.55	436547.35
2002:1	0	3.25	129678577.54	69492.46	448503.15
2002:2	0	3.25	132250475.82	71681.86	461366.71
2002:3	0	3.26	137151735.99	75952.91	478187.95
2002:4	0	3.25	142423330.06	81095.61	492513.47
2003:1	0	3.25	155768392.91	93645.51	509672.98
2003:2	0	3.25	162246895.94	100131.43	528501.33
2003:3	0	3.26	168875777.08	106693.83	552229.82
2003:4	0	3.25	173461600.24	111864.29	573224.01

2004:1	0	3.25	167167681.19	106865.01	594490.71
2004:2	0	3.25	175140490.25	115418.61	622606.93
2004:3	0	3.26	187989003.27	128467.99	658241.24
2004:4	0	3.25	202661956.16	143673.76	691884.72
2005:1	0	3.25	234623479.40	172387.97	726618.66
2005:2	0	3.25	252356063.90	191699.61	772309.64
2005:3	0	3.26	270346256.70	212327.79	829339.17
2005:4	0	3.25	284819301.76	230978.86	885131.36
2006:1	0	3.25	307746890.29	253435.31	987327.52
2006:2	0	3.25	317239485.26	271854.42	1044539.56
2006:3	0	3.26	323765623.04	290970.92	1100067.59
2006:4	0	3.25	323626723.89	306693.74	1139420.22
2007:1	0	3.25	298369344.17	324857.92	1147520.13
2007:2	0	3.25	298822885.57	338878.18	1186641.56
2007:3	0	3.26	305350727.27	353157.21	1236959.94
2007:4	0	3.25	313668579.25	363098.16	1281455.66
2008:1	0	3.37	356117080.39	387016.97	1379968.35
2008:2	0	3.32	362815948.57	389215.71	1419618.56
2008:3	0	3.24	364273324.64	385990.58	1453785.34
2008:4	0	3.09	356704769.43	373489.32	1464997.09
2009:1	0	2.28	313176641.89	323981.19	1402160.59
2009:2	0	2.29	304934525.97	310697.27	1418981.66
2009:3	0	2.53	303768801.34	304547.65	1458699.95
2009:4	0	2.93	305598051.50	301613.73	1501086.00
2010:1	0	4.46	328765960.33	327223.61	1649045.55
2010:2	0	4.92	336570040.94	327579.41	1692117.04
2010:3	0	5.25	345913140.42	326410.52	1725339.26
2010:4	0	5.39	352344079.81	320133.81	1728531.99
2011:1	1	5.08	364849249.77	293442.52	1662125.18
2011:2	1	5.05	369839033.07	289362.87	1656870.12

2011:3	1	5.00	374599367.14	291400.09	1665821.57
2011:4	1	4.89	374667409.34	295586.19	1668223.60
2012:1	1	4.73	366358676.05	330542.43	1685296.22
2012:2	1	4.59	366439211.48	334714.43	1703105.11
2012:3	1	4.44	369606885.37	335047.46	1735573.82
2012:4	1	4.26	371220236.68	328009.82	1760268.39
2013:1	1	3.92	389594510.13	282674.14	1850009.36
2013:2	1	3.77	389056508.18	279437.81	1870219.70
2013:3	1	3.69	385981016.30	286393.35	1884904.07
2013:4	1	3.63	376255893.38	299096.28	1872321.08
2014:1	1	3.75	390906176.06	392676.14	1860328.44
2014:2	1	3.75	362665456.39	394921.85	1820515.41
2014:3	1	3.76	319974652.70	378423.92	1771311.14
2014:4	1	3.75	261939034.80	341063.65	1694891.18

Source: The process of dividing the data into quarter was done based on the data in Appendix No. (1)

1- AL-Rafik, Muhammad Yahia, The Impact of Investment on Economic Growth in the Republic of Yemen, An Analytical Standard Study, Journal of Ashoun Al-Udar.

2- Hammed s. AL- BAZAI, "The Role of Money in Saudi Arabia," j.kau: Econ. & Adm. (1999) VOL.13.No. 1, pp37.

1st quarter = 0.05469X t-1 + 0.2347X t - 0.03906X t + 1

2nd quarter = 0.00781X t - 1 + 0.26563X t - 0.02344X t + 1

3rd quarter = - 0.02344X t- 1+ 0.26563X t + 0.00871X t + 1

4th quarter = - 0.03906X t-1 + 0.23437X t + 0.05469X t + 1

Appendix No. (3)

Dependent Variable: LNGDP
Method: ARDL
Date: 08/20/20 Time: 21:38
Sample (adjusted): 2002Q1 2014Q4
Included observations: 52 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LNI LNX LNR DUMMY
Fixed regressors: C
Number of models evalulated: 2500
Selected Model: ARDL(1, 4, 2, 4, 4)

Prob.*	t-Statistic	Std. Error	Coefficient	Variable

0.0000	15.90009	0.045988	0.731218	LNGDP(-1)
0.0042	-3.081999	0.031189	-0.096124	LNI
0.1545	1.458342	0.046307	0.067531	LNI(-1)
0.4788	0.716553	0.044499	0.031886	LNI(-2)
0.7031	0.384519	0.042936	0.016510	LNI(-3)
0.1592	1.441283	0.039654	0.057153	LNI(-4)
0.0000	9.080056	0.044125	0.400658	LNX
0.0010	-3.616531	0.075818	-0.274199	LNX(-1)
0.2655	1.133380	0.053856	0.061039	LNX(-2)
0.0000	5.758264	0.028094	0.161773	LNR
0.0028	-3.240024	0.041008	-0.132866	LNR(-1)
0.9878	-0.015424	0.039970	-0.000616	LNR(-2)
0.9823	-0.022342	0.039530	-0.000883	LNR(-3)
0.0928	-1.732516	0.046130	-0.079920	LNR(-4)
0.4958	-0.689030	0.019634	-0.013528	DUMMY
0.0199	2.451025	0.014784	0.036236	DUMMY(-1)
0.1980	1.314522	0.014752	0.019392	DUMMY(-2)
0.8624	0.174745	0.014502	0.002534	DUMMY(-3)
0.0693	1.879752	0.012191	0.022916	DUMMY(-4)
0.0480	-2.055913	0.375618	-0.772238	C

13.94904	Mean dependent var	0.999723	R-squared
0.472765	S.D. dependent var	0.999559	Adjusted R-squared
-6.102120	Akaike info criterion	0.009933	S.E. of regression
-5.351642	Schwarz criterion	0.003157	Sum squared resid
-5.814405	Hannan-Quinn criter.	178.6551	Log likelihood
1.916359	Durbin-Watson stat	6078.523	F-statistic
		0.000000	Prob(F-statistic)

*Note: p-values and any subsequent tests do not account for model selection

Appendix No. (4)

ARDL Cointegrating And Long Run Form
Original dep. variable: LNGDP
Selected Model: ARDL(1, 4, 2, 4, 4)
Date: 08/23/20 Time: 15:08
Sample: 2001Q1 2014Q4
Included observations: 52

Cointegrating Form

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0006	-3.802434	0.025280	-0.096124	D(LNI)
0.0007	-3.756924	0.028094	-0.105548	D(LNI(-1))
0.0113	-2.687526	0.027409	-0.073663	D(LNI(-2))

0.0509	-2.028644	0.028173	-0.057153	D(LNI(-3))
0.0000	11.442884	0.035014	0.400658	D(LNX)
0.1539	-1.460603	0.041790	-0.061039	D(LNX(-1))
0.0000	7.772428	0.020814	0.161773	D(LNR)
0.0020	3.357527	0.024250	0.081420	D(LNR(-1))
0.0013	3.526693	0.022912	0.080803	D(LNR(-2))
0.0017	3.428962	0.023307	0.079920	D(LNR(-3))
0.1815	-1.365845	0.009905	-0.013528	D(DUMMY)
0.0001	-4.378135	0.010242	-0.044842	D(DUMMY(-1))
0.0159	-2.545311	0.009999	-0.025450	D(DUMMY(-2))
0.0266	-2.323847	0.009861	-0.022916	D(DUMMY(-3))
0.0000	-13.738011	0.019565	-0.268782	CointEq(-1)

CointEq = LNGDP - (0.2863*LNI + 0.6976*LNX -0.1954*LNR + 0.2513 *DUMMY -2.8731)

Long Run Coefficients

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0010	3.611062	0.079287	0.286312	LNI
0.0000	5.317528	0.131185	0.697582	LNX
0.0889	-1.754722	0.111341	-0.195372	LNR
0.0000	5.306693	0.047359	0.251320	DUMMY
0.0789	-1.815215	1.582788	-2.873099	C

Appendix No. (5)

skedasticity Test: Breusch-Pagan-Godfrey

0.9562	(19,32)	66	tic
0.9105	Chi-Square(19)	64	-squared
0.9318	Chi-Square(19)	16	explained SS

quation:
dent Variable: RESID^2
d: Least Squares
8/18/20 Time: 20:18
e: 2002Q1 2014Q4
ed observations: 52

Prob.	t-Statistic	Std. Error	Coefficien	Variable
0.6775	60	80	26	
0.0477	90	08	58	P(-1)
0.4471	00	80	69	

0.5768	68	13	02	)
0.7043	387	85	262	)
0.8658	366	61	113	)
0.2266	48	10	52	)
0.5795	59	79	80	
0.9498	26	67	05	1)
0.5580	27	29	91	2)
0.8515	787	32	-05	
0.6864	15	31	57	1)
0.9533	050	15	-05	2)
0.6892	48	08	45	3)
0.1875	588	10	956	4)
0.2864	24	02	28	ΔY
0.8928	50	28	05	ΔY(-1)
0.9299	15	27	05	ΔY(-2)
0.8391	64	23	05	ΔY(-3)
0.6644	85	88	05	ΔY(-4)

6.07E-05	lependent var	82	red
0.000137	pendent var	067	ed R-squared
-14.45036	info criterion	53	regression
-13.69988	z criterion	07	uared resid
-14.16264	n-Quinn criter.	93	elihood
2.162286	-Watson stat	66	tic
		09	-statistic)

Appendix No. (6)

Breusch-Godfrey Serial Correlation LM Test:

0.9721	Prob. F(2,30)	0.028354	F-statistic
0.9521	Prob. Chi-Square(2)	0.098110	Obs*R-squared

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 08/23/20 Time: 15:07
Sample: 2002Q1 2014Q4
Included observations: 52
Presample missing value lagged residuals set to zero.

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.9582	0.052903	0.049837	0.002637	LNGDP(-1)
0.9837	-0.020629	0.032461	-0.000670	LNI

0.9889	0.013986	0.047864	0.000669	LNI(-1)
0.9991	0.001181	0.045987	5.43E-05	LNI(-2)
0.9925	0.009469	0.044462	0.000421	LNI(-3)
0.9618	-0.048320	0.043403	-0.002097	LNI(-4)
0.9817	0.023133	0.047404	0.001097	LNX
0.9779	-0.027972	0.080071	-0.002240	LNX(-1)
0.9885	0.014476	0.055840	0.000808	LNX(-2)
0.9659	0.043089	0.029983	0.001292	LNR
0.9671	-0.041575	0.042979	-0.001787	LNR(-1)
0.9998	0.000254	0.042242	1.08E-05	LNR(-2)
0.9921	-0.009938	0.040824	-0.000406	LNR(-3)
0.9659	0.043090	0.049601	0.002137	LNR(-4)
0.9710	-0.036677	0.020783	-0.000762	DUMMY
0.9918	-0.010326	0.015271	-0.000158	DUMMY(-1)
0.9940	-0.007621	0.015286	-0.000116	DUMMY(-2)
0.9966	-0.004357	0.014967	-6.52E-05	DUMMY(-3)
0.9953	-0.005989	0.012583	-7.54E-05	DUMMY(-4)
0.9773	-0.028745	0.402199	-0.011561	C
0.8182	-0.231931	0.201326	-0.046694	RESID(-1)
0.9997	-0.000327	0.219811	-7.20E-05	RESID(-2)

-5.86E-15	Mean dependent var	0.001887	R-squared
0.007868	S.D. dependent var	-0.696793	Adjusted R-squared
-6.027086	Akaike info criterion	0.010249	S.E. of regression
-5.201560	Schwarz criterion	0.003152	Sum squared resid
-5.710599	Hannan-Quinn criter.	178.7042	Log likelihood
1.843421	Durbin-Watson stat	0.002700	F-statistic
		1.000000	Prob(F-statistic)

Appendix No. (7)

ARDL Bounds Test
Date: 08/22/20 Time: 17:06
Sample: 2002Q1 2014Q4
Included observations: 52

Null Hypothesis: No long-run relationships exist

k	Value	Test Statistic
4	27.20475	F-statistic

Critical Value Bounds

I1 Bound	I0 Bound	Significance

3.09	2.2	10%
3.49	2.56	5%
3.87	2.88	2.5%
4.37	3.29	1%

Test Equation:
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 08/22/20 Time: 17:06
Sample: 2002Q1 2014Q4
Included observations: 52

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0042	-3.081999	0.031189	-0.096124	D(LNI)
0.0093	-2.766927	0.038146	-0.105548	D(LNI(-1))
0.0538	-2.001969	0.036795	-0.073663	D(LNI(-2))
0.1592	-1.441283	0.039654	-0.057153	D(LNI(-3))
0.0000	9.080056	0.044125	0.400658	D(LNX)
0.2655	-1.133380	0.053856	-0.061039	D(LNX(-1))
0.0000	5.758264	0.028094	0.161773	D(LNR)
0.0349	2.203464	0.036951	0.081420	D(LNR(-1))
0.0397	2.144709	0.037676	0.080803	D(LNR(-2))
0.0928	1.732516	0.046130	0.079920	D(LNR(-3))
0.4958	-0.689030	0.019634	-0.013528	D(DUMMY)
0.0014	-3.495282	0.012829	-0.044842	D(DUMMY(-1))
0.0475	-2.061500	0.012345	-0.025450	D(DUMMY(-2))
0.0693	-1.879752	0.012191	-0.022916	D(DUMMY(-3))
0.0480	-2.055913	0.375618	-0.772238	C
0.0150	2.571303	0.029929	0.076956	LNI(-1)
0.0000	5.531147	0.033898	0.187498	LNX(-1)
0.1212	-1.592035	0.032984	-0.052512	LNR(-1)
0.0033	3.174412	0.021280	0.067550	DUMMY(-1)
0.0000	-5.844577	0.045988	-0.268782	LNGDP(-1)

0.025962	Mean dependent var	0.941585	R-squared
0.032555	S.D. dependent var	0.906900	Adjusted R-squared
-6.102120	Akaike info criterion	0.009933	S.E. of regression
-5.351642	Schwarz criterion	0.003157	Sum squared resid
-5.814405	Hannan-Quinn criter.	178.6551	Log likelihood
1.916359	Durbin-Watson stat	27.14737	F-statistic
		0.000000	Prob(F-statistic)