استعمال اختبار دكي _ فولر الموسع لاختبار استقرارية متغيرات دالة الاستثمار في العراق

Using dickey _ fuller expanded test for testing variables of investment function in Iraq

M. M. Aqeel Hamid Farhan

University of Diyala. **College of Administration and Economics**

aqeel_hameed@ymail.com

07712339856

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Abstract

To ascertain the stability or instability of time series, three versions of the model proposed by Dickie-Voller were used in this paper. The aim of this study is to explain the extent of the impact of some economic variables such as the supply of money, gross domestic product, national income, after reaching the stability of these variables. The results show that the variable money supply, the GDP variable, and the exchange rate variable were all stable at the level of the first difference in the time series. This means that the series is an integrated first-class series. Hence, the gross fixed capital formation variable, the variable national income, and the variable interest rate are stable at the time series level. Which means that the series is a complete zero-grade. In this study, it is found that most of these variables are unstable in time series but stable in the first difference. It is also concluded that the contribution of the independent variable (money supply) in the investment becomes negative.

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1. Introduction

Some believe that investment means "sacrificing an existing benefit that can be achieved by satisfying current consumption in order to obtain a future benefit that can be obtained from greater future consumption." And others are aware of the investment that "the abandonment of the use of existing funds and for a certain period of time in order to obtain more cash flows in the future will compensate for the lost opportunity of the invested funds, as well as compensation for the expected decline in the purchasing power of funds invested due to inflation with the possibility of obtaining a return reasonable in return of taking a risk element. On this basis, an investment can be said to be different from saving, which means "to refrain from part of current consumption in order to obtain more consumption in the future." Savings differ from investment in that saving does not tolerate any degree of risk [5]

There is a direct correlation between the volume of investment and the national income, that is, the increase in investment leads to an increase in the national product. The increase in the national product leads to an increase in investment. Based on the Keynesian theory, Induced Investment is an increasing function of income levels and is generated by the Acceleration Principle. As incomes increase, consumer demand increases, which is a catalyst for increased investment. As the net investment determined by the accelerator will be positive when increasing the income and equal to zero steadily income and will decline at the low.

1.1 the Study Problem of the research

The study problem is to test the extent of the stability of the time series and its impact on the estimation of the investment function in Iraq.

1.2 The aim of the research

The aim of the research is to use expanded dickey _ fuller to test the stability of the variables of the investment function in Iraq and its impact on predicting.

1.3 The Study Methodology of the research

To achieve the objectives of this study, we will use quantitative analytical methodology based on modern standard methods according to the following steps:

1. Using the Dickey-Fuller test to test each variable used in the estimate
2. Using the variance method to address the non-stability of the time series of the variables used in the estimation.

1.4 Study Outline of research

The time series for indicators of some of the economic variables related to the investment function in Iraq for the period (1980-2000) were used.

1.5 The Study Hypotheses of research

The research will be testing the following null hypothesis:

H0: There is no unit root in the time series for the variables used in the search.

1.6 The Study Variables of research

The variables of the investment function were used and included the following:-
Approved variable including:
y: Investment
Investment is defined as sacrificing an existing benefit that can be achieved by satisfying current consumption in order to obtain a greater future benefit that can be achieved by satisfying future consumption [6].
X1: Money supply
The concept of money supply refers to the net currency in circulation plus the demand deposits, which banks are obliged to pay to a person on demand [5]
X2: GDP Gross domestic product
The concept of GDP relates to the productive economic activities that take place within the political boundaries of a given society over a given period of time, and the output is the sum of the added values achieved locally. [1,8]
X3: National Income
Is the value of the production of that State of goods and services during a given period that is the basis for measuring this income. Economic custom is based on the estimate of national income for a period of one year. [5]
It is worth mentioning that all variables were obtained from the Ministry of Planning - Central Statistical Organization - Directorate of National Accounts in addition to the Central Bank of Iraq Directorate-General for Research and Statistics from 1980 to 2000 [2, 3]

2. Theoretical background

Before beginning to study the volatility of any economic phenomenon, it is necessary to first ascertain the existence of a trend in the time series. Depending on the nature of the chain growth, we can distinguish between stable time series and unstable time series. A stable time series can be defined as a series whose levels change over time without changing the average within a relatively long period of time, i.e., the chain has no direction of either increase or decrease. As for the unstable time series, the level of the average is constantly changing, whether to increase or decrease.[4]

There is an implicit but fundamental assumption behind the regression theory that uses the time series in the estimate that these time series have the Stationary property or the Angel Granger jargon are integrals of the zero rank, which is referred to as the symbol I (0). For example, it is known that t-statistic tables are designed primarily to deal with regression results that use static strings. The previous hypothesis was treated as axiomatic until the mid-1970s when the researchers carried out the applied studies without taking into account the characteristics of the time series used before the assessment. The results of these tests were accepted and the significance of the estimations was accepted on the basis of the application of the statistical inference theory to these estimations. But Granger and Newbold 1974 produced random, non-stationary string sequences using the simulation method. These strings do not express any known

variable and are therefore considered independent. They then made a large number of regression estimates using these strings on each other. [7]
After estimating, the statistical values t were calculated with the assumption that the real parameter was zero (i.e., the estimated parameter of the regression should be insignificant for the independence and randomness of the variables used in the estimate), but although the time series were random and independent, The zero hypothesis is that the true parameter of zero is rejected by a repetition or greater probability than the theory expected. The significance of the relationship was statistically accepted.

Thus, the researchers concluded that the statistical capabilities and tests resulting from gradients using non-static time series are incorrect or spurious regression, and the results of statistical inferences cannot be ascertained. This research formed the starting point for new research in the string static test, casting doubts on the results of all previous standard tests that used time series and did not take the time series characteristics into account before the estimate.[4,7]

3. Stability of Time Series

A common assumption in many methods of time series analysis is that the data is stable, and the stability process means that mean, variance and self-correlation structures do not change over time. In the absence of stability for time series, the regression we obtain between time series variables is often spurious. An initial indication that the estimated slope of unstable time series data is false is the large coefficient of selection and the statistically significant increase of the highly estimated parameters with a self-serial correlation shown in the value of the Durbin-Watson coefficient. This is due to the fact that data often have a trend factor that reflects certain conditions that affect all variables, making them change in the same direction, although there is no real relationship between them. This often occurs in waves of boom and recession or recession that engulfs societies.

3.1 Extended dickey_ Fuller test in the ADF time series stability test

To address the weakness of the AD test, Deke-Fuller (1981) proposed the use of a slow variable within the interpreted variables. This adjustment is called the Dickey-Fuller Extended ADF test, which is more efficient than the simple AD test. This test depends on three elements to ascertain the stability or instability of the time series: model formula used, sample size, and moral level. There are three versions of the model that can be used in the case of ADF:
Formula I

$$\Delta Y_t = \lambda Y_{t-1} + \sum_{j-1}^{K} P\,\Delta Y_{t-1} + e_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Noting that this formula does not contain the fixed limit and time trend. The assumptions, in this case are[1, 6]

$H_0 : P = 1$ $\qquad$ $H_1 : P < 1$

In order to disappear the problem of self-correlation expressed by a statistic, a number of time-gap differences should be included in equation (1).

It is noted here that if this problem disappears after the inclusion of three boundaries of differences, for example, these differences are:

$$\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$$
$$\Delta Y_{t-2} = Y_{t-2} - Y_{t-3}$$
$$\Delta Y_{t-3} = Y_{t-3} - Y_{t-4}$$

The sumptuous tau-Dickey-Fuller formula is then estimated according to the following formula.[1, 6]

$$\tau * \lambda = \frac{\hat{\lambda}}{S_\lambda} \dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

The critical values of $ADE_{\lambda(I,n,e)}$ **in the model, sample size, and moral level are then obtained. This formula is different from the previous as having a fixed limit as follows: -**

$$\Delta Y_t = a + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

The value of the extended Dickey-Fuller must be calculated using Formula (2-3) and Tao for the vector parameter τ^*_a **using the following formula:**

$$\tau * a = \frac{\hat{a}}{S_a} \dots\dots\dots\dots\dots\dots \quad \dots\dots\dots (4)$$

The critical values of (a, y), as follows:

The critical value of is: ADF_λ **(II, n, e) OR The critical value of is:** ADF_a **(II, n, e)**

Then we compare the calculated value with the tabular values.

The third formula [2, 3]

This formula includes a fixed limit and a time trend that can be written as follows [1, 6]

$$\Delta Y_t = a + B_t + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \dots\dots\dots\dots\dots\dots (5)$$

The calculated values for the different parameters are calculated as follows:

$$\tau * \lambda = \frac{\hat{\lambda}}{S_\lambda} \dots (6) \qquad \tau * a = \frac{\hat{a}}{S_a} \dots (7) \qquad \tau * B = \frac{\hat{B}}{S_B} \dots (8)$$

The calculated value is then compared with the tabular values.

The steps of the extended Dickey-Fuller test are as follows:

- The first step

1- Evaluate the third formula and then test the following hypothesis:

H0: $\lambda = 0 \; or \; \rho = 1$

If $\mathrm{ADF}_{\lambda(III,n,e)} < \tau_{\lambda}$ **This leads to rejecting the null hypothesis that the root of the unit exists and accepting the alternative hypothesis that the time series data is stable or static. Then we stop taking any other tests. In case** $\mathrm{ADF}_{\lambda(III,n,e)} > \tau_{\lambda}$

This leads to acceptance of the null hypothesis that there is a root unit in the string and then continue to the next point.

2. Test the hypothesis $\beta = 0$**, which is the time trend parameter. If** $\mathrm{ADF}_{\beta(III,n,e)} > \tau_{\beta}$ **we accept the null hypothesis. This confirms the existence of the root of the unit and continues to the second step in the test directly.**

3- If $\mathrm{ADF}_{\beta(III,n,e)} < \tau_{\beta}$ **we reject the null hypothesis of the temporal trend and accept the alternative hypothesis, then we test the following hypothesis:**

H0: $\lambda = 0 \; or \; \rho = 1$

Using t-test under a normal distribution and the decision is as follows:

A - If $t_{\lambda,n,e} < t^{*}_{\lambda}$ **we reject the null hypothesis and accept the alternative hypothesis that there is no root unit in the time series, this means that the string is stable and stops at this limit.**

B - If $t_{\lambda,n,e} > t^{*}_{\lambda}$ **we accept the null hypothesis and then there is a root unit of the series and continue to the next step.**

The second step :

1 - Estimation of the second formula and then test the following hypothesis: -

H0: $\lambda = 0 \; or \; \rho = 1$

If $\mathrm{ADF}_{\lambda(II,n,e)} < \tau_{\lambda}$ **this leads to rejection of the null hypothesis that there is a root of unity and accepts the alternative hypothesis that the time series data is stable or static. Then we stop taking any other tests.**

In the case $\mathrm{ADF}_{\lambda(II,n,e)} > \tau_{\lambda}$ **, this leads to acceptance of the null hypothesis that there is a root of unity in the chain and then continue to the next point.**

2- testing the following null hypothesis

H0:α=0

If the tabular value was more than the calculated value which is $ADF_{\alpha(II,n,e)} > \tau^{*}_{\alpha}$

Then we accept the null hypothesis and continue to the third step

dropping all the other points of the second step.

3- If $\mathrm{ADF}_{\alpha(II,n,e)} < \tau_{\alpha}$ **We reject the null hypothesis and accept the alternative hypothesis, and then re-test the following hypothesis:**

H0: $\lambda = 0 \; or \; \rho = 1$

Using t-test under a normal distribution and the decision is as follows:

- If $t_{\lambda,n,e} < t^{*}_{\lambda}$ **we reject the null hypothesis and accept the alternative hypothesis that there is no root unit in the time series, this means that the string is stable and stops at this limit.**

- If $t_{\lambda,n,e} > t^{*}_{\lambda}$ **we accept the null hypothesis and then there is a root unit of the series and continue to the next step.**

The third step :

We estimate the first formula of the model and then test the hypothesis of the following null:

H0: $\lambda = 0 \; or \; \rho = 1$

If $\mathrm{ADF}_{\lambda(I,n,e)} > \tau_{\lambda}$ **we accept the null hypothesis i.e., the chain is unstable**

4. Practical Framework

Using EVIEWS7.2 for the purpose of applying the Expanded Dickey-Fuller methodology to the time series stability test for the search variables as follows:

4.1 Dickey-Fuller test for the variable cash supply

For the purpose of applying the expanded Dickey-Fuller test for the cash supply chain, the following stages were passed:

4.1.1 Estimation of the third model, including a fixed limit and a time trend:

$$\Delta Y_t = a + B_t + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

So that :

α: Fixed limit parameter

β: The time trend parameter

ΔY_t **: First difference of money supply variable**

Y_{t-1} **: Money supply slows down for a single time period**

The results were as follows:

Table 1 Dickey-Fuller Extended Test of the Third Cash supply Model

Null hypothesis including a fixed limit and a time trend				
Exogenous: Constant, Linear Trend				
			Test value	Prob.*
Dickey-Fuller test stats			0.008378	0.9932
Test critical values	1% level		-4.498307	
	5% level		-3.658446	
	10% level		-3.268973	
Variable	Coefficient value	Marginal error	T test	Estimated test value
Stable limit	-97474.42	88482.43	-1.101625	0.2860

It is noted from Table (1) that

1. the calculated value of the Dickey-Fuller test (0.008378) is less than the critical values of the test below the level of significance (1%, 5%, 10%) in absolute values, which leads to acceptance of the null hypothesis that there is a root Only for the money supply chain, so the next step will be to move to the next step, which is to test the significance of the time trend as follows:
2. The calculated value of the t-test for the time trend parameter was -1.101625, which is less than the table values below the level of 1%, 5% and 10% in absolute values. This is an initial indication that the series is unstable.

4.1.2 - Estimation of the second model and includes a fixed limit:

This step includes the estimation of the second model, which is a categorical existence, which can be written as follows:

$$\Delta Y_t = a + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (10)$$

Where the results were where the results are shown as in the following table

Table 2 Dickey-Fuller Extended Test of the second Cash supply Model

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, max lag=4)				
			Test values	Prob.*
Dickey-Fuller test stats			2.478374	0.9999
Variable	1% level		-3.808546	
Test critical values	5% level		-3.020686	
	10% level		-2.650413	
Variable	Coefficient value	Marginal error	T test	Estimated test value
Money supply slows down for a single time period	47716.29	44450.13	1.073479	0.2972

Table (2) shows the following:

1. The calculated value of the Dickey-Fuller extended test (2.478374) is less than the critical values of the test below a significant level (1%, 5%, 10%) in absolute values, which leads to acceptance of the null hypothesis that there is a root alone for the money supply series, To the next step, which is a test of the fixed limit, as follows:

2. The calculated value of the t-test for the constant-limit parameter was 1.073479, which is lower than the table values below 1%, 5% and 10% in absolute values. This is a preliminary indication that the series is unstable.

4-1-3 Estimation of the first model, including the absence of a fixed limit and a time trend:

This step includes the estimation of the third model, which is the absence of a limit and a general trend, which can be written as follows:

$$\Delta Y_t = \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (11)$$

The results were as follows:

Table 3 Dickey-Fuller Extended Test of the first Cash supply Model

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			قيمة الاختبار	Prob.*
Dickey-Fuller test stats			3.639783	0.9996
Test critical values	1% level		-2.685718	
	5% level		-1.959071	
	10% level		-1.607456	

It is noted from Table (3) that the probabilistic value of the Extended Dickey-Fuller test for the one-time delayed cash supply parameter is 0.9996, which is greater than the significant level (1%, 5%, 10%). This is indicative of the non-stability of the time series. Therefore, the first differences of the money supply variable will be taken as follows:

Table 4 Dickey-Fuller Extended Test of the third Cash supply Model regarding the first difference

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.480421	0.0104
Test critical values:	1% level		-4.498307	
	5% level		-3.658446	
	10% level		-3.268973	
Variable	Coefficient value	Marginal error	T test	Estimated test value
First difference Money supply slows down for a single time period	-1.104667	0.246554	-4.480421	0.0003

Table (4) shows the following: The calculated value of the Dickey-Fuller extended test (-4.480421) is greater than the critical values of the test below a significant level (1%, 5%, 10%) in absolute values, leading to rejection of the null hypothesis That there is a root alone for the money supply chain, that is, the series is stable by the first difference.

4.2 Extensive Dickey-Fuller test for the gross fixed capital formation variable

For the purpose of applying the expanded Dickey-Fuller test for the cash supply chain, the following stages were passed:

4.2.1 - Estimation of the third model, including a fixed limit and a time trend:

$$\Delta Y_t = a + B_t + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (12)$$

Providing that

ΔY_t **: The first difference of the variable of gross fixed capital formation**

Y_{t-1} **: Total fixed capital formation slowing down one time period**

The results were as follows:

Table 5 Dickey-Fuller Extended Test of the Third Model Series of Gross Fixed Capital Formation at Constant Prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)			**Test value**	**Prob.***
				0.8269
Dickey-Fuller extended test statistic	**-1.406146**		**-4.498307**	
Test critical values:	**1% level**		**-3.658446**	
	5% level		**-3.268973**	
	10% level	**Marginal error**	**T test**	**Estimated test value**
Total fixed capital formation (investment) slows for one time period	**0.259212**	**1694.411**	**0.619768**	**0.5436**

Table (5) shows the following:

1. The calculated value of the Dickey-Fuller extended test of(- 1.406146) is less than the critical values of the test below the significant level (1%, 5% and 10%) in absolute values, which leads to acceptance of the null hypothesis that there is a root alone for the total fixed capital formation series , So we will move on to the next step of the chronological trend test as follows.

2. The calculated value of the t-test for the time trend parameter was (- 0.54536), which is less than the table values below the level of 1%, 5% and 10% in absolute values. This is an initial indication that the series is unstable.

4.2.2 - Estimation of the second model and includes a fixed limit:

This step includes the estimation of the second model, which is a categorical existence which can be written as follows

$$\Delta Y_t = a + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (13)$$

Where the results were where the results are shown as in the following table:

Table 6 DICKY - FULLER EXPERIMENT OF THE SECOND MODEL Gross capital formation at constant prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			Test values	**Prob.***
Dickey-Fuller extended test statistic			**-2.063234**	**0.2600**
Test critical values:	**1% level**		**-3.808546**	
	5% level		**-3.020686**	
	10% level		**-2.650413**	
Variable	**Coefficient value**	**Marginal error**	**T test**	**Estimated test value**
Stable limit	**151.1945**	**384.4025**	**0.393323**	**0.6987**

Table (6) shows the following:

1. The calculated value of the Dickey-Fuller extended test (-2.063234) is less than the critical test values below 1%, 5% and 10% in absolute values, thus accepting the null hypothesis that there is a root alone for the investment series to the next step, which is a test of the fixed limit, as follows:

2. The calculated value of the t-test for the constant-limit parameter was 0.393323, which is lower than the table values below 1%, 5% and 10% in absolute values. This is a preliminary indication that the series is unstable.

4.2.3 - Estimation of the first model and included the absence of a fixed limit and time trend:

This stage is the estimation of the third model, which is the absence of a common denominator and direction, which can be written as follows:

$$\Delta Y_t = \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (14)$$

The results were as follows:

Table 7 The Dickey-Fuller test of the first model is not aesthetic fixed capital

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			Test values	**Prob.***
Dickey-Fuller extended test statistic			**-2.595577**	**0.0123**
Test critical values	**1% level**		**-2.685718**	
	5% level		**-1.959071**	
	10% level		**-1.607456**	
Variable	**Coefficient value**	**Marginal error**	**T test**	**Estimated test value**
S3(-1)	**-0.146690**	**0.056515**	**-2.595577**	**0.0178**

It is noted from Table (7) that the calculated value of the Extended Depreciation test for the delayed cash supply parameter for a period of one time (-2.595577) is greater than the nominal value below the level of 1%, 5%, 10%. Therefore, we reject the null hypothesis that there is a root of unity and this indicates the stability of the time series.

4.3 Expanded Dickey-Fuller test for the national income variable

For the purpose of applying the Expanded Dickey-Fuller test for the national income series, the following stages were passed:

4.3.1 - Estimation of the third model, including a fixed limit and a time trend:

$$\Delta Y_t = a + B_t + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Providing that

The first difference of the variable of gross national income

ΔY_t : National income slows down one time period

Y_{t-1} : The results were as follows:

The results were as follows:

Table 8 Dickey-Fuller Extended Test of the Third National Income Series Model

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			Test values	Prob.*
Dickey-Fuller extended test statistic			-5.101373	0.0030
Test critical values	1% level		-4.498307	
	5% level		-3.658446	
	10% level		-3.268973	

It is noted from Table (8) that the calculated value of the extended Dicky-Fuller test (5.101373) is greater than the critical values of the test below a significant level (1%, 5%, 10%) in absolute values, which negates the null hypothesis that there is root alone. Indicates that the string is stable

4.4 Expanded Dicky-Fuller test for GDP variable at constant prices

For the purpose of applying the Expanded dickey _foller test for the GDP series at constant prices, the following stages were passed:

4.4.1 - Estimation of the third model, including a fixed limit and a time trend:

$$\Delta Y_t = a + B_t + \lambda Y_{t-1} + \sum_{j-1}^{K} P_j \Delta Y_{t-j} + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Providing that:

ΔY_t : First difference of GDP variable

Y_{t-1} : GDP slows down one time period

The result was as follows

Table 9 Expanded Dickey-Fuller test for the third model of the GDP series at constant prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			Test value	Prob.*
Dickey-Fuller extended test statistic			-0.957180	0.9279
Test critical values:	1% level		-4.498307	
	5% level		-3.658446	
	10% level		-3.268973	

It is noted from Table (9) that the calculated value of the Dickey-Fuller extended test (-0.957180) is less than the critical values of the test below the level of significance (1%, 5%, 10%) in absolute values which leads to acceptance of the null hypothesis that there is a root alone This is an initial indication that the series is unstable and will move on to the next step

4.4.2 - Estimation of the second model and includes a fixed limit:

This step represents the estimation of the second model, which is a categorical existence. The results were as follows:

Table 10 Expanded Dicky-Fuller test for the first model of the GDP series at constant prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			Test value	Prob.*
Dickey-Fuller extended test statistic			-0.979764	0.7397
Test critical values:	1% level		-3.808546	
	5% level		-3.020686	
	10% level		-2.650413	
Variable	Coefficient value	Marginal error	T test	Estimated test value
GDP at constant prices slows for one period	-0.168020	0.171490	-0.979764	0.3402
C stable limit	3115.252	2925.149	1.064989	0.3010

It is noted from Table (10) that the calculated value of the extended Dicky-Fuller test (-0.979764) is less than the critical values of the test below a significant level (1%, 5%, 10%) in absolute values, which leads to acceptance of the null hypothesis that there is a root alone This is an initial indication that the series is unstable and will move on to the next step

4.4.3 - Estimation of the first model and included the absence of a fixed limit and time trend:

Which included the estimation of the third model, which is the absence of a categorical and general trend, where the results were as follows:

Table 11 Expanded Dickey-Fuller test for the first model of the GDP series at constant prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 0 (Automatic – based on SIC, maxlag=4)				
			t-Statistic	Prob.*
Dickey-Fuller extended test statistic			0.229835	0.7426
Test critical values:	1% level		-2.685718	
	5% level		-1.959071	
	10% level		-1.607456	
Variable	Coefficient value	Marginal error	T test	Estimated test value
GDP at constant prices slows for one period	0.009392	0.040863	0.229835	0.8207

It is noted from Table (11) that the calculated value of the Dickey-Fuller extended test of 0.229835 is less than the critical values of the test below the level of 1%, 5% and 10% in absolute values, which leads to acceptance of the null hypothesis that there is a root alone A preliminary indication is that the series is unstable and will move on to the next step, which includes the estimation of the third model, namely, the existence of a general trend and a trend of the first difference of the GDP series, where the results were as follows:

Table 12 Dickey - Fuller's Extended Test of the Third Model of the First Divisions of the Gross Domestic Product Series at Constant Prices

Null hypothesis: time series contains one root (unstable series)				
Lag Length: 1 (Automatic - based on SIC, maxlag=4)				
Dickey-Fuller extended test statistic			-3.890392	0.0350
Test probable values:	1% level		-4.571559	
	5% level		-3.690814	
	10% level		-3.286909	

It is noted from Table (12) that the calculated value of the extended Dicky-Fuller test (-3.890392) is greater than the critical value of the test below the level of significance (5%) in absolute values, which leads to rejecting the null hypothesis that there is root alone.

4.5 Standard analysis of variables and their effect on investment.

To demonstrate the effect of each independent variable on the investment, the method of the smallest squares was used, taking into consideration the stability of each of these variables as follows:

4.5.1 The effect of national income on total capital formation at constant prices

Table 13 The effect of gross fixed capital formation (investment) on national income at constant prices

Variable	Coefficient value	Marginal error	T-test	Probable t-test value
Constant margin	1194.710	1078.033	1.108232	0.2816
National income	0.169824	0.071523	2.374382	0.0283
Limitation coefficient	0.228824	Mean dependent var		3235.195
Modified correlation coefficient	0.188236	S.D. dependent var		3310.457
Standard error	2982.654	Akaike info criterion		18.92941
Total squares	1.69E+08	Schwarz criterion		19.02889
Log-likelihood	-196.7588	Hannan-Quinn criteria.		18.95100
F test	5.637692	Durbin-Watson stat		0.619429
Probable f test value	0.028269			

Table (13) shows the following:

1. **The national income is 0.169824, which is a significant value. The probability value of the test is 0.0283, which is less than the level of significance of 5%. This means that increasing the national income by 100% leads to an increase in investment by 16.9824%.**
2. **The value of the coefficient of determination was (0.228824). This means that the independent variables, including the national income, account for 22.8824% of the changes in total fixed capital formation, while the remaining 87.2% are due to unexplained elements.**
3. **The calculated value of F was (5.637692) which is significant because the test value of (0.028269) is less than 5%. This means that the regression model is significant.**

4.5.2 Effect of the first difference in the presentation of cash on the total capital formation at constant prices.

Table 14 Effect of gross fixed capital formation at constant prices on cash supply

Variable	Coefficient value	Marginal error	T-test	Probable t-test value
Constant margin	3701.417	721.1677	5.132533	0.0001
Money supply (first difference)	-0.007332	0.003394	-2.160085	0.0445
Limitation coefficient	0.205858	Mean dependent var		2911.220
Modified correlation coefficient	0.161739	S.D. dependent var		3035.746
Standard error	2779.426	Akaike info criterion		18.79252
Total squares	1.39E+08	Schwarz criterion		18.89209

Log-likelihood	-185.9252	Hannan-Quinn criteria.		18.81195
F test	4.665968	Durbin-Watson stat		0.620968
Probable f test value	0.044500			

Table (14) shows the following:

1. **The value of the test is (-0.007332), which is significant value because the probability value of the test is (0.044500) less than the level of significance (5%). This means that a 100% increase in the money supply leads to a decrease in investment (-0.007332).**
2. **The value of the coefficient of determination was (0.205858). This means that independent variables, including national income, account for about 20.5858% of the changes in total fixed capital formation. The remaining 87.2% is due to unexplained elements and is included in the random error component.**
3. **The calculated value of F (4.665968) was significant because the probability value of the test (0.044500) is less than the level of significance (5%). This means that the regression model is significant.**

4.5.3 The effect of the first difference of GDP at constant prices on gross fixed capital formation

Table 15 The effect of fixed capital formation at constant prices on GDP

Variable	Coefficient value	Marginal error	T-test	Probable t-test value
Constant margin	2973.050	688.6991	4.316906	0.0004
GDP (first difference)	-0.186650	0.226363	-0.824560	0.4204
Limitation coefficient	0.036397	Mean dependent var		2911.220
Modified correlation coefficient	-0.017136	S.D. dependent var		3035.746
Standard error	3061.646	Akaike info criterion		18.98593
Total squares	1.69E+08	Schwarz criterion		19.08551
Log-likelihood	-187.8593	Hannan-Quinn criteria.		19.00537
F test	0.679899	Durbin-Watson stat		0.341381
Probable f test value	0.420414			

Table (15) shows the following:

1. **The gross domestic product (GDP) at constant prices was (-0.186650), which is a significant value because the test value of 0.420414 is less than the level of significance (5%). This means that increasing the national income by 100% leads to a decrease in investment (-0.186650).**
2. **The value of the coefficient of determination was (0.036397). This means that independent variables, including national income, account for about 3.6397% of the changes in total fixed capital formation. The remaining 87.2% is due to unexplained elements and is included in the random error component.**

3. The calculated value of F (0.679899) was significant since the test value of (0.420414) is less than the level of significance (5%). This means that the regression model is not significant.

5. Conclusions

From the results in the research board, the following points were reached:

1. The variable of cash supply is stable at the level of the first difference of the time series, meaning that the series is integrated into the first class.

2. The gross fixed capital formation variable is stable at the time series level, meaning that the series is zero-sum.

3. The national income variable is stable at the time series level, which means that the series is zero-sum.

4. The variable of GDP is stable at the level of the first difference of the time series, meaning that the series is integrated into the first class.

5. The variable of the exchange rate is stable at the level of the first difference of the time series, meaning that the series is integrated into the first class.

6. The variable of interest rate is stable at the level of the first difference of the time series, which means that the series is integrated from zero.

7. The contribution of the independent variable (money supply) to investment is negative. The negative sign of the parameter of the independent variable (cash supply) corresponds to the economic logic of modern quantum theory (Chicago School) Friedman and his supporters that the growth of money supply should be commensurate with GDP growth so as not to Disruptions in the balance of the economy and therefore its negative impact on investment. The growth in the money supply in Iraq was not commensurate with the GDP growth because the increase in the supply of money can affect some of the other economic factors and some of these factors have an impact on the economy, which leads to increase in interest rates and thus to reduce investment and these factors the impact of income and the impact of Price level and the impact of expected inflation.

8. The contribution of the independent variable (exchange rate) in the investment is negative. The reference parameter corresponds to the economic reality of Iraq in that the relationship is inverse between the exchange rate of the US dollar against the Iraqi dinar on the one hand and investment on the other

9. The contribution of the independent variable (interest rate) was negative for investment, and it is the result of the economic logic that increased interest rates lead to lower investment

10. The contribution of the independent variable (gross domestic product) to investment is negative

6. Recommendations

From the conclusions reached, the researchers recommend:

1. It is necessary to test the stability of the time series before any regression to avoid the problem of falling into the false regression

2. The use of other tests in the stability of time series including Phelps - Peron test.

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استعمال اختبار دكي_ فولر الموسع لاختبار استقرارية متغيرات دالة الاستثمار في العراق

م.م. عقيل حميد فرحان
جامعة ديالى/ كلية الإدارة والاقتصاد/
قسم الاحصاء
aqeel_hameed@ymail.com
07712339856

المستخلص :

للتأكد من مدى استقرارية السلاسل الزمنية او عدم استقرارها تم استخدام ثلاثة صيغ للانموذج التي اقترحها العالم ديكي– فوللر في هذا البحث. وهدفت هذه الدراسة الى بيان مدى تاثير بعض المتغيرات الاقتصادية والمتمثلة بـ عرض النقد، الناتج المحلي الاجمالي، الدخل القومي، وذلك بعد الوصول الى حالة الاستقرار لهذه المتغيرات. نتائج هذا البحث تثبت ان متغير عرض النقد ومتغير الناتج المحلي الاجمالي ومتغير سعر الصر جميعها مستقرة على مستوى الفرق الاول للسلسلة الزمنية. وهذا يعني ان السلسلة متكاملة من الدرجة الاولى. اما متغير اجمالي تكوين راس المال الثابت ومتغير الدخل القومي و متغير سعر الفائدة فهي مستقرة على مستوى السلسلة الزمنية. مما يعني ان السلسلة متكاملة من الدرجة صفر. في هذه الدراسة, تم التوصل الى ان اغلب هذه المتغيرات غير مستقرة بالسلسلة الزمنية ولكنها مستقرة بالفرق الاول. كما تم التوصل الى ان مساهمة المتغير المستقل (عرض النقد) في الاستثمار سالبة.