

Comparison of the Autoregressive Vector VAR with the Dynamic Error Correction Vector DVECM for Modeling COVID-19 Deaths

Ahmed Razzaq Abed ^{a,b*} and Ayad Habeeb Shamil ^{a,b}

^a Department of Statistics, University of Wasit, Wasit, Iraq.

^b Department of Statistics, University of Diyala, Diyala, Iraq.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Abstract

In this article, the Vector Auto-Regressive model and the Dynamic Error Correction Vector Model will be used in modeling data representing the number of deaths due to infection with the COVID-19 virus as a dependent variable and the variable platelet rate in the blood as an independent variable and finding the model equations that represent the relationship between the two variables using the two models and then estimating the equations that were obtained by estimating the two models using the least squares method, then choosing the best estimated equation from each model, and then, using the standard error of the regression and the coefficient of determination, selecting the best equations from the two models. The Dynamic Error Correction Vector Model is superior to the Vector Auto-Regressive model in assessing the link between corona virus mortality and the proportion of platelets in the blood, according to the analysis carried out using the E-Views application, and that there is a direct relationship through the equation for the Dynamic Error Correction Vector Model between the deaths of the corona virus and the proportion of platelets in the blood in the long term, which is logical as a result of the increase in the impact of the deaths of the Corona virus, the increase in the platelet rate, and thus the increase in the deaths of the corona virus.

*Corresponding author: Email: ahmedrazzaq@uowasit.edu.iq;

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1 Introduction

Analytical economic measurement is one of the latest branches of economics, which is of great importance in the modern era, as a basic tool that assesses the assumptions of economic theory by giving it numerical estimates that make it as close to reality as possible within the limits of logical and acceptance. Among the variables using economic theory, mathematics and statistical methods, with the aim of testing different economic theories on the one hand and helping businessmen and governments in making decisions and setting policies, on the other hand, analyzing real economic phenomena quantitatively, using appropriate statistical induction methods. That is, it is the science of using the methods of induction and statistical inference to discover objective economic laws and quantitatively determine their action. The quantitative analysis of economic phenomena is an attempt to verify economic relations and ensure their rationality in representing the complex reality that economic theory expresses in the form of hypotheses [1,2]. Thus, we can distinguish between the three main objectives of econometrics, which are testing different economic theories, decision making and forecasting. Therefore, standard models have an important role in testing and interpreting the relationships between the independent variables and the dependent variables, as the standard analysis has helped decision makers and economic policy makers and makers in making comparisons between the many values of the estimated parameters and then making the optimal decision for economic planning [3,4].

The conditions that the world community has been going through since the beginning of the emergence of the Corona virus “Covid 19” and its heavy spread, many economic repercussions appeared at the level of the world and at the level of the country itself, which led to the imposition of isolation and they took some necessary measures and distance between individuals and prevented travel and closure of government institutions schools, and all of this has negatively affected the economic situation of countries, which resulted in an impact on the economic and social system, which lasted for a long time [5,6]. Iraq, as it affected all countries of the world, as it is certain that any crisis experienced by the world as a society leaves its effects on everyone, despite the disparity of these effects between one country and another, according to its economic and political conditions, so it was necessary to model the causes and effects of infection with the Corona virus and to search for the best models that represent That relationship, so this came to research within the framework of modeling the mortality of patients infected with Corona virus as a dependent variable and the percentage of platelets in the blood as an independent variable using two important models of Time series models, namely the VAR model and the DVECM model, and the comparison between them to find the best of them.

2 Stationary

The stationary of the time series means that the mean, variance, and autocorrelation structures do not change with time. $s+h$), in other words, if we divide the time series data into sums of time periods, the different sections of these views appear similar, meaning that the series is in a special state of statistical equilibrium, that is, it has a constant arithmetic mean and variance with time, then it is said that the time series is stable in mean and contrast. A time series is stable if there is no upward or downward Trend line in the average over time (there is no general Trend line) or there is no difference about the mean over time. They change their levels over time without changing the average in them (ie, there is no growth or decay in the series). In fact, the state of stationary is very rare and is developed for the purpose of facilitating mathematical dealing with time series [7].

The time series is strictly stationary if its moments are not affected by the change in time. This means that the joint distribution of $(Y(t_1), Y(t_2), \dots, Y(t_T))$ is the same as the joint distribution $\{Y(t_1+k), Y(t_2+k), \dots, Y(t_T+k)\}$ for each real constant such as k and a positive integer constant such as T and the values of t_1, t_2, \dots, t_T , meaning that the following is achieved:

$$\begin{aligned}
 & FY(t_1), Y(t_2), \dots, Y(T)(Y_1, Y_2, \dots, Y_T) = \\
 & FY(t_1 + k), Y(t_2 + k), \dots, Y(t_T + \\
 & kY_1, Y_2, \dots, Y_T
 \end{aligned}
 \tag{2.0}$$

But in many practical applications, it is rare to obtain a completely stable process, in addition to that the assumptions of the method used to reach the desired goal of the practical application may not require complete stationary of the time series, but rather require stationary to one degree or another, and the time series is said to be stable of degree m. If the common moments up to m degree of $[Y(t_1), \dots, Y(t_T)]$ exist and the common moments up to m degree of $[Y(t_1+k), \dots, Y(t_T+k)]$ are equal to each real constant Like k and a positive integer constant like T and the values t_1, t_2, \dots, t_T ie:

$$E(Y_{t_1}^{m_1}, Y_{t_2}^{m_2}, \dots, Y_{t_m}^{m_k}) = E(Y_{t_1+k}^{m_1}, Y_{t_2+k}^{m_2}, \dots, Y_{t_m+k}^{m_k}) \tag{2.1}$$

Based on the foregoing, we can describe the process $Y(t)$ as stable of the first degree if its mean is constant and independent of time, and it is stable of the second degree or weakly stable (Weakly Stationary) if both its mean and variance are constant and independent of time, as well as the covariance function The autocovariance γ_k (Autocovariance function) is also independent of time. The covariance function of the two variables Y_t, Y_{t+k} can be written as in the following:

$$k = \text{Cov}(Y_t, Y_{t+k}) = E(Y_t - m)(Y_{t+k} - m) \tag{2.2}$$

The series variance is

$$\text{Var}(Y_t) = \text{Var}(Y_{t+k}) = \gamma_0 \tag{2.3}$$

To estimate the covariance function of the observations series Y_1, Y_2, \dots, Y_T , the formula is used:

$$\hat{\gamma}_k = \frac{1}{T} \sum_{t=1}^{T-k} (Y_t - \bar{Y})(Y_{t+k} - \bar{Y}) \tag{2.4}$$

$$\bar{Y} = \sum_{t=1}^T Y_t / T$$

It is possible by drawing the time series and using the autocorrelation function (ACF) and the partial autocorrelation function (PACF) to judge the stationary or stationary of the series. or by using the extended Dicke-Fuller unit root test.

The stationary of the time series is likely, either because of the stationary around the mean (Non stationary around the mean), which is the absence of fluctuation in the time series around a fixed mean, which means that the average is not static. with the time series. The process of taking the differences in the time series can be explained as follows:

If the observed time series Y_t shows a Trend line, whether specific or random, then the differences of the first series succeed in converting this series into a stable series, so if we symbolize the new series with the symbol K_t , then:

$$K_t = \Delta y_t = y_t - y_{t-1}, t=2,3, \dots, m \tag{2.5}$$

And n represents the number of observations available, or what is usually known as the length of the series, or metaphorically, the size of the sample.

If the observations of the original series are unstable are y_1, y_2, \dots, y_m , then taking the first differences for this series requires creating the following table.

Noting that the number of new views for the new series K_t is (n-1) only and not (n), meaning that we lose one view when taking the first difference of the series.

Table 1. Shows the first differences of the time series

Y_t	Y_{t-1}	$K_t=K_t - K_{t-1}$
Y_1	-	-
Y_2	Y_1	$K_2=Y_2 - Y_1$
\vdots	Y_2	$K_3=Y_3 - Y_2$
\vdots	\vdots	\vdots
Y_m	Y_{m-1}	$K_m=y_m - Y_{m-1}$

The series of the first differences, Z_t , may remain unstable as well. In this case, the second differences $2y_t$ or the first differences of the basket Z_t .

This type of transfer is useful in many cases. In such cases, it may be useful to make a table like this to find the second differences w_t .

Table 2. Shows the second differences of the time series

Y_t	Y_{t-1}	$K_t=K_t - K_{t-1}$	K_{t-1}	$L_t=K_t - K_{t-1}$
Y_1	-	-	-	-
Y_2	Y_1	$K_2=Y_2 - Y_1$	-	-
Y_3	Y_2	$K_3=Y_3 - Y_2$	K_2	$L_1=K_2 - K_1$
\vdots	Y_3	\vdots	K_3	$L_2=K_3 - K_2$
\vdots	\vdots	\vdots	\vdots	\vdots
Y_m	Y_{m-1}	$K_m=y_m - Y_{m-1}$	K_{m-1}	$L_m=K_m - K_{m-1}$

In addition, the number of views of the new series w_t is $(n-2)$, meaning that we lost only two views when taking the second differences of the original series y_t .

Or stationary in variance: (Non stationary in variance) In terms of stationary of variance, the issue of stationary of variance is one of the main problems in not obtaining an accurate model and taking transformations (logarithm or taking the square root.... etc) for time series data handles that.

There are four transformations available specifically for a positive series, and suppose that $Y_t > 0$ is the original string and X_t is the transformed string. Here are the transformations:

- 1-Logarithmic transformation $X_t=(Y_t)$
- 2-Logistic transformation $X_t=(cY_t/(1-cY_t))$

3 Unit Root Test

Time series data are mostly characterized by the presence of structural changes that affect the degree of inactivity of the time series in the model through the test, we find the stability of the time series and its stability rank. Each variable separately, if the series is basically stable, then it is said that the series is stable at its level, or stable of order zero $I(0)$, meaning that it is devoid of a unit root, but if the series is stable after taking the first difference, then it is said that the series is stable at the difference The first or the first order (Integrated order one) $I(1)$, but if the time series is stable after taking the second difference, then the first series is integrated from the second order, i.e. $I(2)$, and so on, more precisely, the time series $\{x_t\}$ It is integrated of degree (d) if it is stable at the level of differences (d) , that is, it contains a number (d) unit root [8].

In addition to the study carried out by (Stock & Watson, 1989) that the levels of those time series are unstable, That is, the mean and variance of the data depend on time, in addition to a false correlation and problems in standard analysis and inference [9], Which two classes of stable or static data, and they are [10]:

1 Non-static time series of the type TS (Trend line STAIONARY): They are series that show a deterministic static, and the least squares method is mostly used in order to return it stable, and it is represented by the following equation:

$$Y_t = f(t + \epsilon t) \tag{3.0}$$

NS. Non-static time series of type DS: These are the series that show random non-static in the order of the general Trend line, and in general, the first difference equation is used in order to restore its stationary, and it is represented by the following equation:

$$Y_t = Y_{t-1} + \beta + \epsilon t \tag{3.1}$$

A number of tests can be used in the model to verify whether or not time series has unit roots, i.e. to determine whether or not the time series is stable or quiescent, including the Pilips & Perron, 198 (PP) method, and the Extended Dickey-Fuller test (ADF). (Augmented Dickey -Fuller) and (PP) may differ from (ADF), in that it does not contain lagging values for the differences and what takes into account the first correlation in the time series using the non-parametric correction, and allows the presence of a mean equal to zero and a linear time Trend line.

4 The Augmented Dickey-Fuller Test

Derived by researcher Dickey-Fuller in 1981, who used it to determine whether or not the time series is stable.

It is the most important method used to detect the stationary of the time series is the Dickey-Fuller test discovered in (1981) to test the stationary of the time series and determine the degree of its integration.

- The formula (without a fixed term and general direction) as, [11]

$$\Delta Y_t = (p - 1)Y_{t-1} + \sum_{i=1}^m p_i \Delta Y_{t-1} + \epsilon_t \tag{4.0}$$

- The second formula (with Null Trend line), as following:

$$\Delta y_t = \alpha + (p - 1)y_{t-1} + \sum_{i=1}^m p_i \Delta y_{t-1} + \epsilon_t \tag{4.1}$$

- The third formula with a fixed term and a general Trend line), and as in the following model:

$$\Delta y_t = \alpha + \beta t + (\rho - 1)y_{t-1} + \sum_{j=1}^k \rho_j \Delta y_{t-1} + V_t \tag{4.2}$$

where α is the constant term, T is the general direction, and K is the duration of the slowdown.

5 Co-integration Test

Co-integration means a state of association or association between two or more time series, so that fluctuations in one of them cancel out fluctuations in the other in such a way that the value between their ratios is fixed over time.

In order for the economic interpretation of the hypothesis that indicates the existence of a causal relationship (regardless of its direction) between two variables to be acceptable, so that the data of these variables are integrated (integrated) of one degree I(1), which means that the long-term relationship between the two variables (Y_t, X_t) It is significant so that the error term is stable from degree zero $\mu_t=0$ and free from the unit root, and it can be said that the co-integration refers to the method of obtaining equilibrium or The long-memory relationship between stable variables , or it indicates existence of method An adjustment that prevents the increase in the error relationship of the long-run relationship. Verifying the stationary of the time series of the basic variables is after determining the degree of their integration through the use of the Extended Dickey Fuller Test (ADF) and the characterization of the long-run relationship requires a co-integration test for the basic variables included in The standard model, and the tests used to analyze the co-integration of the time series are as follows: [7].

5.1 Engle-granger test with two stages

This test is the result of a study and a common methodology presented by Engel and Kranger in 1987 to test the co-integration of economic variables, as this test is limited to two variables, and this test is conducted according to the following steps:

- Refer to the unit root tests to determine the stationary of the time series. When the series is stable at its level, that is, when the calculated value (t) of the equation (UT-1) is greater than the tabular value of (t) we reject the null hypothesis and accept the alternative hypothesis which states that The stationary of the time series, i.e. the existence of joint integration and a long-term equilibrium relationship, while when the time series is unstable at its original level and does not stabilize until after taking the first, second or third difference to it, i.e. the series is integrated of the same rank, the regression of the relationship between variables of this series by method of least squares (OLS), are as follows:

$$Y_t = \alpha_0 + \alpha_1 X_t + \mu_t \tag{5.0}$$

The residual μ_t , which measures the estimated relationship in the short run from its parallel path in the long run, is calculated according to the following formula:

$$\mu_t = Y_t - \alpha_0 - \alpha_1 X_t \tag{5.1}$$

The co-integration of the study variables is tested using the two-stage Engel and Kranger method by estimating the equation (the co-integration regression equation) using the least squares (OLS) method.

After that, obtaining the residuals of the specific regression μ_t , which results from the regression of the long-run parallel relationship, as a process of one of the stationary tests is performed on the residuals of the regression, as in the following formula:

$$\Delta \hat{\mu}_t = \hat{\alpha}_0 + \Delta \hat{\mu}_{t-1} + \hat{\alpha}_1 \hat{\mu}_{t-1} + e_t \tag{5.2}$$

After obtaining the calculated (t) value, we compare it with the critical value of it from the tables calculated by (Engel-Cranger). So, the null hypothesis is accepted ($H_0: \beta_1=0$), which means that the series of residuals is unstable, that is, it contains a unit root, the matter Which makes us conclude that there is no co-integration between Among the variables of the studied series, but in case of accepting the alternative hypothesis ($H_1: \beta_1 \neq 0$), this means the stationary of the residual series, that is, it is free from the unit root, that is, the time series of the variables forming the model are characterized by the feature of integration The joint, that is, their association with a long-term equilibrium relationship, which makes the Error Correction Model (ECM) more suitable for estimating the relationship between them: [12].

It is worth noting here that the Engel and Kranger test suffers from several problems, including the following: [13].

1. Inaccuracy of the assumption based on availability of a single integration relation among the variables, the shadow of a model consisting of a large number of equations.
2. Determining the path of joint integration (one direction) and for two variables only, represents a major limitation in the presence of more than two variables and with the reciprocal relationship.
3. It is assumed that there is only one dependent variable, while the rest of the variables are considered independent variables.

5.2 Johansen and juelius test

This test was developed by both Johannes in (1993) and Geselsius in (1991) to avoid the shortcomings in the Engel and Kranger test, as it is proportional to small samples, as well as its proportionality to determine the integrative relationship between two or more variables, and most importantly This is used to determine the number of co-integration vectors between time series, and to determine the co-integration vectors within the framework of his hypothesis (Johansen & Juselius) proposes two statistical tests: [14].

First: Trace test: It takes the following form:

$$\lambda_{\text{trace}} = -T \sum_{j=r+1}^n \log(\lambda_j) \tag{5.3}$$

Second: Maximum Eigen root value test

When rejecting the null hypothesis (number of integration vectors $r =$) if the calculated value of the maximum possibility rate is greater than the tabular (critical), as we accept the other hypothesis ($r + 1$) that indicates that is at least one vector of co-integration and vice versa.

6 VAR Autoregressive Vector

It happens in economics that some explanatory variables may not be variables affecting the approved variable, so it is good, but they are often dependable variables. Thus, we have an instantaneous equation that includes internal and external variables.

Sims (1980) criticized the decision to distinguish between variables suggested if there is relation between a number of variables, so all the variables must be deals as in the same method. AS, there should be difference between them [15].

If there are suspicious that the variable in the model is described as external, each variable must be treated symmetrically, for example the time series y_t which is affected by the current and previous variables of x_t and the time series being a time series affected by the current value and the previously specified values For the time basket y_t in this case the simple bivariate form is:

$$y_t = \beta_{10} + \beta_{12}x_t + \gamma_{11}y_{t-1} + \gamma_{12}x_{t-1} + u_{yt} \tag{6.0}$$

$$x_t = \beta_{20} + \beta_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}x_{t-1} + u_{xt} \tag{6.1}$$

Where we assume y_t, x_t is stable, u_{yt}, u_{xt} is a non-self-correlated error term, and is characterized as white noise. Equations (13) and (14) form a first-order autoregressive vector model because the longest deceleration period is one. These equations are not reduced form equations where y_t has a direct effect (contemporaneous on x_t given by β_{21} and x_t has a direct effect on β_{12} given β_{12} , by rewriting the system using matrices we get the following:

$$\begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} u_{yt} \\ u_{xt} \end{bmatrix} \tag{6.2}$$

In addition:

$$Bz_t = \Gamma_0 + \Gamma_1 z_{t-1} + u_t \tag{6.3}$$

Where:

$$B = \begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix}, z_t = \begin{bmatrix} y_t \\ x_t \end{bmatrix}$$

$$\Gamma_0 = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix}, \Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \text{ and } u_t = \begin{bmatrix} u_{yt} \\ u_{xt} \end{bmatrix}$$

Multiplying both, sides of the equation by β^{-1} us get:

$$z_t = A_0 + A_1 z_{t-1} + \varepsilon_t \tag{6.4}$$

Where:

$$A_0 = B^{-1}\Gamma_0, A_1 = B^{-1}\Gamma_1, \quad \varepsilon_t = B^{-1}u_t$$

For simplicity, the symbols a_{i0} can be used for the i element of the vector A_0 and a_{ij} the element from the i row and column j of the matrix A_1 and e_t represents the i element of the vector e_t . Using these symbols, the VAR model can be written as follows:

$$Y_t = A_{10} + A_{11}Y_{t-1} + \gamma A_{12}X_{t-1} + \varepsilon_{1t} \quad (6.5)$$

$$X_t = A_{20} + A_{21}Y_{t-1} + A_{22}X_{t-1} + \varepsilon_{2t} \quad (6.6)$$

On separate between the unique var relapse vector model (13) (14) and the framework that we acquired. in equation (18) (19) the first is called a primitive or structural system, while the second is VAR system in a standard form. It may be essential will note that the lapse expression ε_{1t} and ε_{2t} consists of two terms, u_{yt} and u_{xt} , which indicate that $\varepsilon_t = B^{-1}u_t$

$$\varepsilon_{1t} = (u_{yt} + \beta_{12}u_{xt}) / (1 - \beta_{12}\beta_{21}) \quad (6.7)$$

$$\varepsilon_{2t} = (u_{xt} + \beta_{21}u_{yt}) / (1 - \beta_{12}\beta_{21}) \quad (6.8)$$

Then u_{yt} and u_{xt} is error term, it follows that both ε_{1t} and ε_{2t} are white error processes.

7 Characteristics of the VAR model [16]

The VAR model has some good properties, including:

1. A simple and easy model that does not include finding the distributions within it.
2. Estimation is easy as every equation is estimated using the least squares method
3. VAR model gives better predictions than the simultaneous equation models.

However, VAR have been subject to some criticism, including:

1. Not based on economic theory. There is no limitation on the estimated model parameters. Through the model, we find the following variables based on economic theory.
2. He lost degrees of freedom by using several delays. Finally, by obtaining the coefficients, it is difficult to translate the results due to the lack of theoretical background.

In the modern economy, the pulse response function describes the economy's response over time to external shocks and is modeled in the context of VAR models. Shocks are treated as external variables from a macroeconomic point of view, including government spending, taxes and other fiscal policy variables. Change in the money base and other variables in monetary policy, change in productivity, technological changes. The response pulse function describes the reaction of internal variables over time such as production, consumption, investment, unemployment at the time of the shock and subsequent time periods [17].

We faced difficulty is the definition of collisions, the general view is we want to collisions the structural error, when error found in equations (13) and (14). But we notice only the reduced form error in equation (17) (18), which consists of a set of structural errors. Therefore, structural errors must be separated. This is known as the identification problem. There are many ways to do this, and they can be referred to in more advanced books.

8 Granger Causality Test [18]

Causality in economics is different in its meaning from causation in any other uses. Refers to the ability of one variable to predict (and thus cause) the other variable. Assume that there are two variables y_t, x_t that affect each other with a distributed lag. The relationship between the two variables can be captured by the VAR model. In this case we can say:

1. y_t cause x_t
2. x_t cause y_t
3. There is a bidirectional reaction (causality between variables)
4. The two variables are independent.

The appropriate method must be found, which allows discovering the relationship of causation and effect between them.

Granger (1969) derived test for defining causation: if the variable y_t is said to cause Granger y_t . If x_t can be forecast using the decelerated values of the variable y_t . We will follow with a Granger causality test and then a second phase test by Sims (1972).

Granger's causality test for two stable variables y_t, x_t includes in the first step an estimation of the autoregressive model VAR:

$$y_t = a_1 + \sum_{i=1}^n \beta_i x_{t-i} + \sum_{j=1}^m \gamma_j y_{t-j} + \varepsilon_{1t} \quad (8.0)$$

$$x_t = a_2 + \sum_{i=1}^n \theta_i x_{t-i} + \sum_{j=1}^m \delta_j y_{t-j} + \varepsilon_{2t} \quad (8.1)$$

We suppose that both ε_{1t} and ε_{2t} are unrelated and have white error. In this form we will gate it:

1. Lag variable x in (8.0) from statistics view point different about zero as a set. And the y deceleration in (8.1) is from statistics view point different from zero; then x_t causes y_t .
2. The y lags in (8.1) from statistics view point different from zero as a sum, and the x lags in (8.0) and the lags in (8.0) are not statistically different from zero, in which case y_t causes x_t
3. All combinations of x and y are from statistics view point different from zero in equation (8.0) and (8.1) and thus there is a two-way reaction.
4. Both sets of x and y are not statistically different from zero in equation (8.0) and (8.1) and therefore both x and y are independent of each other.

The Granger causality test includes the following procedures, first, the VAR model is estimated by equations (8.0) and (8.1). The significance of the coefficients is checked and then the deletion test is applied first for the x lags in equation (8.1). Then the results of the removal test we arrive A result of the direct causation stand of previous cases [19].

For sure the analysis and for the case of a unit, we will test (8.0) and then apply the method to (8.1)

Step 1: Estimate the y_t regression over the y lags

$$y_t = a_1 + \sum_{j=1}^m \gamma_j y_{t-j} + e_{1t} \quad (8.2)$$

Then the Residual sum of squares for this regression is obtained and it is called RSSR

Step 2: The y_t regression is estimated on the y lags as well as the x idlers in the following form:

$$y_t = a_1 + \sum_{i=1}^n \beta_i x_{t-i} + \sum_{j=1}^m \gamma_j y_{t-j} + e_{1t} \quad (8.3)$$

Then it gets an RSS for that regression (unconstrained regression) and it's called RSSu

Step 3: The null hypothesis determines the alternative hypothesis:

$$H_0: \sum_{i=1}^n \beta_i = 0 \text{ or } x_t \text{ does not cause } y_t$$

$$H_1: \sum_{i=1}^n \beta_i \neq 0 \text{ or } x_t \text{ does cause } y_t$$

Step 4: Calculate the value of the F-statistic for the Wald test on the coefficients constraints given thus:

$$F = \frac{(RSS_R - RSS_U)/m}{RSS_U/(n-k)} \tag{8.4}$$

where $F_{m,n-k}$, $k=m+n+1$

Step 5: If the calculated F value exceeds the critical (tabular) F value, we reject the null hypothesis.

9 Dynamic Vector Error Correction Model(DVECM) [19]

This model is based on a methodology capable of examining the issue of static time series, and misleading correlation, and it implicitly assumes the available log-memory among variables in (Co-integration). If it turns out that the variables in the model have a stable and long-term relationship, this does not prevent the existence of short-term imbalances, and therefore the DVECM variables error correction model mechanism came as a means to correct short-term deviations in the variables from the long-term equilibrium relationship. (Engle and Granger, 1987).

DVECM is estimated through two steps:

- 1- Estimating the coefficients of the co-integration vector between the variables
- 2- We use the error term resulting from the co-integration

If the variables are complementary and of the same degree, then there is a long-term relationship, and therefore the error correction vector model can be estimated by the following formula:

$$\Delta LNM = \alpha_0 + \sum_{i=1}^n \beta_{1i} \Delta LNDT_{t-1} + \sum_{i=1}^n \beta_{2i} \Delta LNIDT_{t-1} + \sum_{i=1}^n \beta_{2i} \Delta EC_{t-1} + \varepsilon_t \tag{9.0}$$

10 Applied Aspect

The data was used, represented by a two variable, the first is the number of deaths due to the Corona virus, and the second the percentage of platelets per microliter of blood, which was obtained from the Ministry of Health / Baghdad Health Department, Karsh Yarmouk General Teaching Hospital. A patient who died due to corona virus using the statistical program E-Views 12 to estimate the autoregressive vector and the dynamic error correction vector, as follows:

10.1 Time series stationary test

The stationary of the study variables was tested based on the Augmented Dickey-Fuller test to search for the stationary of the time series and whether they suffer from the unit root test, as well as determining their integration rank, and after conducting the test on the time series, The results shown in Table (3) were obtained:

Table 3. Expanded dickey-fuller (ADF) unit root test results

Significance	p-value	Integrated degree	Critical value	ADF	Equation	Variable
At level						
Non-Significance	0.9945	Non	-2.908420	-0.081364	Fixed term)DEADS(
Non-Significance	0.9422	Non	-3.482763	-0.900611	Trend line & Fixed term	
Non-Significance	0.9998	Non	-1.946072	0.454692	No Trend line& No Fixed term	
Non-Significance	0.2918	Non	-3.511532	-3.574433	Fixed term	
Non-Significance	0.8337	Non	-2.874444	-3.7688	Trend line &)platelets(

Significance	p-value	Integrated degree	Critical value	ADF	Equation	Variable
Significance Non-Significance First difference	0.3528	Non	-2.846548	-1.826494	Fixed term No Trend line & No Fixed term	
Significance	0.0	Integrated(1)	-3.788206	-8.848343	Fixed term)DEADS(
Significance	0.0	Integrated(1)	-2.556666	-7.245578	Trend line & Fixed term	
Significance	0.0	Integrated(1)	-2.567888	-8.810244	No Trend line & No Fixed term	
Significance	0.0	Integrated(1)	-3.211676	-7.724529	Fixed term)platelets(
Significance	0.0	Integrated(1)	-2.485665	-8.279785	Trend line & Fixed term	
Significance	0.0	Integrated(1)	-3.846446	-7.289221	No Trend line & No Fixed term	

We note from the results of the time series stationary test in Table (2) that the two variables included in the model were unstable at their original level, and for the purpose of achieving the stationary of these variables, the first difference was taken for them and found that they stabilized at the level of significance (1%) in the presence of a fixed term or a limit Fixed and general direction or without a fixed limit and without general direction. Since all the variables are still at the first difference I(1), and accordingly, it can be said that the data have a first-order co-integration, and then the presence or absence of co-integration (Co-Integration) will be tested, and then the model representing the time series will be estimated.

10.2 Co-integration test

Tables (4) and Table (5) show the results of the co-integration quality test, as follows:

Table 4. shows the results of the co-integration quality test according to the Engle-Granger methodology

Sig.	Z	Sig.	tau	Variables
0.9778	-0.942769	0.7899	-0.252249	DEADS
0.2842	-13.98556	0.6578	-2.753345	PLATELETS

Table 5. Co-integration examination results according to Johansen test

Sig**	Criticalregion	trace	Eigen values	Hypothesized
0.8775	15.49471	5.976879	0.096254	None
0.8379	3.941445	0.005640	8.78E-06	Atmost1

We note from the results of Table (5) that the probabilistic values (Sig.) of (tau) and (Z) statistics were greater than the level of significance (1%). We also note from Table (6) that there are no co-aggregations at the level of significance of 0.05 because the effect test indicates This indicates that there is no co-integration because λ_{trace} is less than the critical value at the significance level of 0.05 in the first and second cases, and this indicates that the null hypothesis that states the existence of a co-integration relationship for the time series is not rejected.

10.3 Autoregressive vector model (VAR)

After it was found that all the variables included in the model stabilized in (1) difference with level of (5%) with presence of a fixed term or a fixed term and a trend line or without fixed term and without a trend line. Since all the variables are still at the first difference I(1), it can be said that the data are integrated at the first rank, and after making sure that there is no joint integration between the variables, now the steps for estimating the autoregressive vector model and the error correction vector model come as follows:

10.3.1 determining the number of Lags Intervals

To determine the number of lag periods, we will use the comparison criteria, and the results are as shown in Table (6) as follows:

Table 6. The criteria for determining the number of time lags for the VAR model

HQIC	SC	AIC	L
68.88237	69.02725	67.95461	0
68.78345	68.81691	67.59987	1
68.89013	68.80942	67.44483	2
68.25144	68.35822*	66.85642	3
68.01221*	68.40611	66.76112*	4
68.23371	68.61582	66.82728	5

We note from Table (6) that the results indicate the need to take four time lags when estimating the autoregressive vector model.

10.3.2 Granger causality test

Table (7) shows the results of the Granger causality test:

Table 7. Results of the Granger causality test

Sig.	F-Statistic	Obs	Null Hypothesis:
0.6341	0.64351	60	DPLATELETS does not Granger DDEADS DDEADS does not Granger Cause
0.1004	2.06049		DPLATELETS

From Table (7) it is clear that the DEADS variable does not cause the variable Platelets with four time lags at the 0.01 significance level, as we accept the null hypothesis which says that the DEADS variable does not cause the Platelets variable. As well as the variable Platelets does not cause the variable DEADS with four time lags at 1% error since we accept the hypothesis that says that the variable Platelets does not cause the variable DEADS.

10.3.3 Estimation of the VAR model

Considering the results of the sepia test in Table (7) and the values of the criteria for determining the time-deceleration period in Table (6), and in order to reconcile them, we choose four time lags when estimating the autoregressive vector model, the Table (8) gives the results of VAR (4).

Table 8. Estimated coefficients for the VAR model

	Ddeads	Dplatelets
DDEADS(-1)	0.919511 (0.14135) [6.43440]	-0.184525 (0.21905) [-0.79664]
DDEADS(-2)	-0.93308 (0.19454) [-4.79622]	0.126485 (0.30149) [0.41953]
DDEADS(-3)	0.923438 (0.23684) [3.89894]	-0.119219 (0.36704) [-0.32481]
DDEADS(-4)	4.340869 (2.11153) [2.05579]	9.292502 (3.27226) [2.83978]
DPLATELETS (-1)	-0.071842 (0.08939)	0.783566 (0.13853)

	Ddeads	Dplatelets
DPLATELETS (-2)	[-0.80367] 0.053731 (0.10337)	[5.65619] -0.701284 (0.16019)
DPLATELETS (-3)	[0.51981] -0.067926 (0.10182)	[-4.37791] 0.579361 (0.15780)
DPLATELETS (-4)	[-0.66709] -0.04285 (0.08642)	[3.67154] -0.152856 (0.13392)
M	[-0.49585] 432215.1 (482759.)	[-1.14138] 530353.4 (748137.)
R ²	[0.89530] 0.572324	[0.70890] 0.722198
Adj. R ²	0.459572	0.522351
Sum sq. resids	4.71E+12	2.21E+14
S.E.	2263043.	3922898.
F	8.443212	10.22852
Loge-likelihood	-867.6787	-899.1878
AIC	31.92111	30.49212
SC	23.22273	33.2228
Mean	793522.2	1962228.
S.D.	5374842.	7842291.
Determinant error covariance		3.13E+25
Deter. error covariance adj		2.12E+25
Deter. error covariance		-1916.767
Loge-likelihood		67.71625
AIC		67.34551

$$DDEADS = M(1) * DDEADS(- 1) + M(2) * DDEADS(- 2) + M(3) * DDEADS(- 3) + M(4) * DDEADS(-) + M(5) * DDPLATELETS (- 1) + M(6) * DPLATELETS (- 2) + M(7) * DPLATELETS (- 3) + M(8) * DPLATELETS (- 4) + M(9)$$

$$DPLATELETS = M(10) * DDEADS(-1) + M(11) * DDEADS(-2) + M(12) * DDEADS(- 3) + M(13) * DDEADS(- 4) + M(1 4) * DPLATELETS (- 1) + M(1 5) * DPLATELETS (- 2) + M(16) * DPLATELETS (- 3) + M(17) * DPLATELETS (- 4) + M(1 8)$$

After determining the estimated equations according to the fourth-order autoregressive model, we estimate these equations according to the least squares method, as shown in Table (9).

Table 9. Estimated coefficients according to the least squares method of the VAR model (4)

	Coe.	Standard Error	T test	Sig.
M(1)	0.99855	0.132181	5.334242	0.00124
M(2)	-0.97533	0.145675	-5.777256	0.08966
M(3)	0.91844	0.623453	2.679444	0.00022
M(4)	4.56543	2.389563	2.007654	0.00211
M(5)	-0.056333	0.067894	-0.671611	0.20686
M(6)	0.043131	0.102321	0.716832	0.50346
M(7)	-0.085543	0.114422	-0.367874	0.40563
M(8)	-0.035275	0.056432	-0.229797	0.72153
M(9)	532125.2	522799.2	0.793412	0.44358
M(10)	-0.123211	0.416222	-0.896665	0.44566
M(11)	0.117864	0.282486	0.619322	0.56753
M(12)	-0.216622	0.357225	-0.222467	0.67746
M(13)	7.345542	3.222223	3.557444	0.00255

	Coe.	Standard Error	T test	Sig.
M(14)	0.675543	0.236132	6.653345	0.00001
M(15)	-0.564444	0.261283	-5.382792	0.00023
M(16)	0.542211	0.252226	4.846356	0.00014
M(17)	-0.225286	0.113905	-2.168533	0.22563
M(18)	432352.5	842232.2	0.804654	0.34811

$$DDEADS = M(1) * DDEADS(-1) + M(2) * DDEADS(-2) + M(3) * DDEADS(-3) + M(4) * DDEADS(-4) + M(5) * DPLATELETS(-1) + M(6) * DPLATELETS(-2) + M(7) * DPLATELETS(-3) + M(8) * DPLATELETS(-4) + M(9)$$

R ²	0.768663	MD. var	9927862.1
AdjR ²	0.565544	S.D var	65498032
SE of regression	4573075	SS. Error	5.86E+15
Durbin Watson	1.987755		

Equation: DPLATELETS

$$= M(10) * DDEADS(-1) + M(11) * DDEADS(-2) + M(12) * DDDEADS(-3) + M(13) * DDEADS(-4) + M(14) * DPLATELETS(-1) + M(15) * DPLATELETS(-2) + M(16) * DPLATELETS(-3) + M(17) * DPLATELETS(-4) + M(18)$$

R ²	0.786655	MD. var	32628983
AdjR ²	0.768776	S.D var	68349619
SE of regression	5217768	SS. Error	1.37E+14
Durbin Watson	2.789965		

This is because it achieved the least standard error and the value of its coefficient of determination is not high, which indicates that the regression is not false. It is an equation.

10.3.4 Estimated Model Quality Test

1- Residual Tests:

In order to verify the validity of the estimated model, it must be ensured that the residuals are subject to a normal distribution and that they are not self-correlated, as follows:

The probability distribution of residuals: using the Jarque-Bera test, the results of which are shown in Table (10):

Table 10. Test for the normal distribution of residuals for the VAR model (4)

Sig.	D OF F	Jarque -Beraa	Unit
0.7786	2	0.8065	1
0.6779	2	0.3354	2

The results in Table (10) indicate that the residuals have a normal distribution, as the values of (Prob.) are all larger than 5%, so we do not accept the null hypothesis, meaning that the residuals of the VAR(4) model varies naturally.

2- The residual autocorrelation test: using the Lingu-Box test, the results of which are shown in Table (10):

Table 11. Of the residual autocorrelation test for the VAR model (4) between corona virus deaths and platelet count

D of F	Sig.	Q-Stat	Sig.	Q-Stat	Lag
Non*	Non*	0.135647	Non*	1.027627	1
Non*	Non *	0.331122	Non*	1.225124	2
Non*	Non *	1.602422	Non*	0.586451	3
Non*	Non *	2.284601	Non*	2.142584	4
Non*	Non *	2.637667	Non*	2.462655	5
4	0.5469	3.065877	0.5839	2.843812	6

Table (10) showed that there is no auto-correlation between the errors at 5% error. This indicates the quality of estimate model.

3- The inverted unitary roots test for the validity of the model: This test provides the overall stationary of the model.

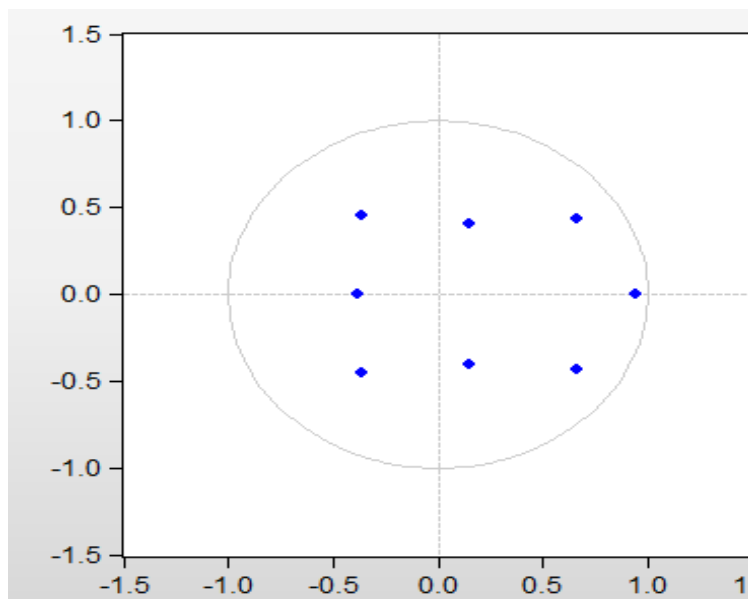


Fig. 1. Results of the reciprocal of the single roots test for the validity of the model

We notice from Fig. (1) that all points are within the limits of the target in the circle and their value is less than or equal to 1, and therefore the VAR model as a whole is stationary.

10.4 Dynamic vector error correction model (DVECM)

10.4.1 determining the number of lags intervals

To determine the number of time lags for the error correction model (DVECM), it will be based on the specified lags according to the autoregressive vector model, which confirmed the need to take four time lags when estimating the error correction vector model.

10.4.2 Estimation of the DVECM model

Considering the criteria for determining the time-deceleration period, we will choose four time lags when estimating the error-correction vector model with one vector. tabl e (8) gives estimating values the EVCM model (4) as follows:

Table 12. Estimated Coefficients of the EVCM Model

Conteq:	Conteeq1	
DDEADS(-1)	1	
DPLATELETS (-1)	-3.14E-18	
	-3.11E-05	
	[-1.21445]	
M	0.088568	
error Corre.	(DDEADS)	(DPLATELETS)
Conteq 1	-0.6772	208344
	-0.23337	-493385
	[-3.22700]	[0.42227]
(DDEADS(-1))	0.425982	-118111
	-0.16998	-359357
	[2.50610]	[-0.32867]
(DDEADS(- 2))	0.071637	-226948
	-0.17451	-368937
	[0.41050]	[-0.61514]
(DDEADS(- 3))	0.304932	-84138.2
	-0.14142	-298985
	[2.15619]	[-0.28141]
(DDEADS(- 4))	-0.2941	-17781.8
	-0.14154	-299238
	[-2.07786]	[-0.05942]
(DPLATELETS (- 1))	-2.10E-08	0.005744
	-7.20E-08	-0.15209
	[-0.29175]	[0.03776]
(DPLATELETS (- 2))	4.06E-08	-0.86357
	-7.20E-08	-0.15215
	[0.56472]	[-5.67579]
(DPLATELETS (- 3))	-3.11E-07	0.014265
	-5.12E-07	-0.251342
	[-1.28571]	[0.03709]
(DPLATELETS (-4))	4.62E-07	-1.23134
	-6.32E-07	-1.32152
	[0.33232]	[-1.69821]
M	-0.0113	23121.11
	-0.21678	-758227
	[-0.03425]	[0.04224]
R ²	0.678854	0.687282
Adj. R ²	0.567322	0.562101
Sum sq. resids	452.467	1.27E+14
S.E.	3.78665	6622241
F	6.56775	7.652153
Loge-likelihood	-124.1456	-862.3222
AIC	5.456643	35.01123
SC	5.457977	35.4589
Mean	0.000001	0.000001
S.D.	2.567933	7764229
Deter. error covarianceadj		1.97E+14
Deter. error covariance		1.34E+14
Loge-likelihoode		-1088.82
AIC		38.9762
SC		39.76475

Thus, DVECM (4) model can be written as follows:

$$(DDEADS) = M(1) * (DDEADS(-1) - 3.14E - 18 * DPLATELETS (-1) + 0.088568 + M(2) * (DDEADS(-1)) + M(3) * (DDEADS(-2)) + M(4) * (DDEADS(-3)) + M(5) * (DDEADS(-4)) + M(6) * (DPLATELETS (-1)) + M(7) * (DPLATELETS (-2)) + M(8) * (DPLATELETS (-3)) + M(9) * (DPLATELETS (-4)) + M \tag{10}$$

$$(DPLATELETS) = M(11) * (DDEADS(-1) + 3.14E - 18 * DPLATELETS (-1) + 0.088568 + M(12) * (DDEADS(-1)) + M(13) * (DDEADS(-2)) + M(14) * (DDEADS(-3)) + M(15) * (DDEADS(-4)) + M(16) * (DPLATELETS (-1)) + M(17) * (DPLATELETS (-2)) + M(18) * (DPLATELETS (-3)) + M(19) * (DPLATELETS (-4)) + M(20)$$

After determining the estimated equations according to the fourth-order error correction vector model, we estimate these equations according to the least squares method, as shown in Table (13).

Table 13. Estimated coefficients according to the least squares method of the DVECM model (4)

	Coefficient	Std Error	T-Statistic	Sig .
M(1)	-0.76312	0.236374	-3.21745	0.0013
M(2)	0.426153	0.169988	2.506403	0.0239
M(3)	0.071942	0.174209	0.412137	0.6813
M(4)	0.314993	0.141412	2.156682	0.0336
M(5)	-0.29379	0.141541	-2.07564	0.0407
M(6)	-2.10E-08	7.19E-08	-0.29171	0.7712
M(7)	4.11E-08	7.20E-08	0.571742	0.5689
M(8)	-2.05E-08	7.17E-08	-0.28544	0.7759
M(9)	0.244099	0.151432	2.153431	0.0231
M(10)	-0.01962	0.35297	-0.0556	0.9558
M(11)	208344	493385.1	0.422275	0.6738
M(12)	-118111	359357.1	-0.32867	0.7431
M(13)	-226948	368936.7	-0.61514	0.5399
M(14)	-84138.2	298984.7	-0.28141	0.7793
M(15)	-17781.8	299238	-0.05942	0.9527
M(16)	0.005744	0.152093	0.037765	0.9723
M(17)	-0.86357	0.152149	-5.67579	0.0001
M(18)	0.00562	0.151517	0.037088	0.9705
M(19)	-0.15134	0.151517	-0.9988	0.3205
M(20)	32261.14	746226.9	0.043232	0.9656
Determinant residual covariance		1.34E+14		

Equation: (DDEADS) = M(1) * (DDEADS(-1) - 3.14E - 18 * DPLATELETS (-1) + 0.088568 + M(2) * (DDEADS(-1)) + M(3) * (DDEADS(-2)) + M(4) * (DDEADS(-3)) + M(5) * (DDEADS(-4)) + M(6) * (DPLATELETS (-1)) + M(7) * (DPLATELETS (-2)) + M(8) * (DPLATELETS (-3)) + M(9) * (DPLATELETS (-4)) + M(10)

R ²	0.313562	MD. var	0.00001
AdjR ²	0.526145	S.D var	2.43477
SE of regression	1.457865	SS. Error	231.12355
DurbinWatson	2.143388		

Equation: (DPLATELETS) = M(11) * (DDEADS(-1) - 3.14E - 18 * DPLATELETS (-1) + 0.088568 + M(12) * (DDEADS(-1)) + M(13) * (DDEADS(-2)) + M(14) * (DDEADS(-3)) + M(15) * (DDEADS(-4)) + M(16) * (DPLATELETS (-1)) + M(17) * (DPLATELETS (-2)) + M(18) * (DPLATELETS (-3)) + M(19) * (DPLATELETS (-4)) + M(20)

R ²	0.569464	MD. var	0.00000
AdjR ²	0.578112	S.D var	7864229
SE of regression	5625143	SS. Error	1.86E+11
DurbinWatson	0.968122		

This is because it achieved the least standard error and the value of its coefficient of determination is not high, which indicates that the regression is not false.

1. A real and apparent increase, as we note that the corona virus mortality coefficient is statistically significant, so the absolute value calculated for t is greater than the tabular value.
2. The value of the coefficient of determination of (0.57) is not a high value, which indicates that the regression is not false. That is, (57%) of the changes in the deaths of the Corona virus were due to the percentage of platelets in the blood, and the remaining percentage (43%) is due to other variables outside the limits of the current study.
3. The calculated F value is greater than the tabulated F value, which means the significance of the estimated model.

10.4.3 Testing the quality of the error-correction model

1- Residual self-correlation test (LM-TEST): This test is one of the most important criteria used to detect the presence of autocorrelation in the residual series. Table (10) shows the results of this test:

Table 14. of the residual autocorrelation test of the error correction model

Sig	LMStat	Lag
0.65443	3.5681533	1
0.33454	6.5691765	2
0.47997	1.6754443	3
0.21355	1.7891444	4
0.99865	1.5472665	5

We notice from Table (14) that all the probabilistic values are not significant because each value is larger than (0.01), and thus the nullhypothesis which states that there is no auto-correlation between the errors , which indicates the quality of the estimated model, is not rejected.

2- Heterogeneity test (White-TEST): This test reveals the stationary of the value of the variance of the random error, and Table (15) shows the results of this test.

Table 15. The homogeneity test of the error correction model

Joint test:		
Sig.	D f	Chi-sq
1.0001	99	37.08432

Through Table (13) we note that the probability value is greater than 5%, and therefore the null hypothesis is not rejected, which states that the residual series has a homogeneous variance, and therefore the estimated model does not suffer from the problem of autocorrelation or from the problem of heterogeneity of variance.

2- The inverted unitary roots test for the validity of the model: This test provides the overall stationary of the model, and Fig. 2 Shows that.

We notice from Fig. 2 that all points are within the limits of the target in the circle and their value is less than or equal to 1, and therefore the DVECM model as a whole is stable.

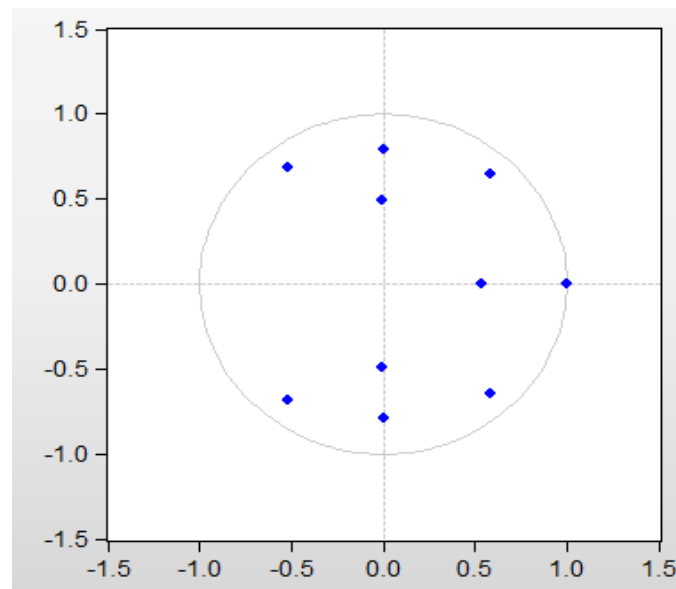


Fig. 2. The results of the reciprocal of the single roots test for the validity of the model

11 Results and Discussion

We can see from the results of the analysis of the autoregressive vector and the dynamic error correction vector the Non-stationary of the time series data at its original level, and it's stationary at the first difference, meaning that the degree of its integration was of the first degree. Estimation of the autoregressive vector model (VAR) at four time lags, as well as the vector error correction model (DVECM). Significance of a typical autoregressive vector and an error correction vector, as the F value was (5.622, 7.56325), respectively, larger than the critical value of the F at 1%.. the coefficient of determination of the autoregressive vector model (VAR) is stable and not highly elevated, which amounted to (0.55), meaning that the platelet ratio variable explains (55%) of the changes in deaths due to the Corona virus, and the remaining (45%) is due to other variables that were not taken into account in this study. There is a direct relationship through the equation of the autoregressive model (VAR) between corona virus deaths and platelet ratio at the first (C1), second (C2), third (C3) and fourth (C4) slowdown periods. Corona virus deaths (DEADS) are defined by the equation for the error correction model (DVECM) in the long and short term. Corona virus deaths (DEADS) are known through the equation for the error correction model (DVECM) in the short term with a constant and four time delays in relation to the platelet ratio and the first differences.

8. The error correction coefficient through the equation for the error correction model (DVECM) achieves the necessary sufficient condition, which is negative because it represents the effect of adjustment, that is, the force of return or attraction towards equilibrium from the short to the long term. The inverse negative force of the error correction coefficient is what corrects the path and returns it. From its deviant position to its trajectory, from the short-term to the long-term and moral, so 75.3% of the errors can be corrected in a period of time in case to return to the equilibrium position, and the period of time needed here by the error correction coefficient in order to know the deviation Corona virus deaths from short to long term are approximately one and a half years (1/0.7532). Also, the value of the correction factor is statistically significant, as the calculate value of T is larger than its tabular value in absolute value. There is a direct relationship through the equation for the error correction model (DVECM) between the mortality of the Corona virus and the proportion of platelets in the blood in the long term, which is logical as a result of the increase in the impact of Corona virus deaths by a high rate of blood platelets and therefore the increase in Corona virus deaths.

12 Conclusion

The estimation using the error correction vector (DVECM) is better than the estimation using the vector autoregressive (VAR) because the standard error value of the equation estimated under (DVECM) amounting to (2.661) is less than the standard error of the model (VAR) which is (317055), as well as the AIC standard of

(38.98) and Schwartz's criterion of (39.76) for the (EVCN) model is less than the AIC criterion of (66.71605) and Schwartz's criterion of (67.4555) for the (VAR) model, as well as the coefficient of determination of the (DVECM) model of (0.52) is less than the coefficient of determination of the model (VAR) of (0.55), which indicates the regression of a true and non-false (DVECM) model.

Competing Interests

Authors have declared that no competing interests exist.

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Appendix A

Lists of abbreviation:

1-	Vector Auto-Regressive.	(VAR)
2-	Dynamic Vector Error Correction Model.	(DVECM)
3-	Error Correction Vector.	(DVECM)
4-	the partial autocorrelation functions.	(PACF)
5-	the autocorrelation functions.	(ACF)
6-	Trend line stationary.	(TS)
7-	Ordinary least squares.	(OLS)
8-	the Error Correction Model.	(ECM)
9-	Expanded Dickey-Fuller.	(ADF)

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