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Using a Model of Simultaneous Equations to Determine the Effect of Some Variables on Unemployment Rate in Iraq

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Abstract. Unemployment is a fatal disease that affects the economies of most countries, whether developed or developing. Societies must confront this dangerous disease because it has political, social and cultural repercussions and painful afflictions. It affects human dignity and livelihood, and it is necessary to search for all effective treatments at all levels, whether economic or financial or even educational. In this research, the two-stage least squares method was used in estimating the system of simultaneous equations, the rate of unemployment for the period (1988-2019), and for that purpose, the variables with a direct impact on the unemployment rate were used. Eviws.v9 program was used to obtain the results.

Keywords: Unemployment rate; immediate equations; method (2SLS)

AMS Mathematics Subject Classification (2010): 81T80

1. Introduction

Unemployment is one of the most prominent economic and social problems facing economic growth in Iraq at the present time because of its negative repercussions on the political, economic, social and security levels. The reason for unemployment in Iraq dates back to before 2003, due to the presence of structural and structural problems in the Iraqi economy because of the on-going wars and the blockade Economic.

Unemployment is one of the main problems that hindered progress and development in most societies and are faced by most countries of the world with different levels and progress and their economic, social and political systems [1,2].

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political, economic, social and security levels. The reason for unemployment in Iraq dates back to before 2003, due to the presence of structural and structural problems in the Iraqi economy because of the on-going wars and the blockade Economic [4]. In this work, we will address recent variables that affect the level of unemployment in Iraq, as well as use a statistical model to determine the most important factors that affect the unemployment problem.

1.1. The study problem

The problem of unemployment is a continuous growth in the number of individuals who are able to work and seek it without finding it, and that the State of Iraq is one of the countries that suffers from this problem, which requires knowledge of the factors (variables) that directly or indirectly affect unemployment.

1.2. The purpose of the study

The research aims to determine the impact of some variables (inflation, population, economic activity, and population growth) on the unemployment rate in Iraq for the period (1988-2019).

1.3. The study tools

In order to achieve the goal of the research, we relied on the method of simultaneous equations using the program Eviws.v9.

1.4. The research importance

The importance of research lies in studying the interrelationship between variables.

2. Theoretical aspect

The reality and trends of unemployment in Iraq for the period (1988-2019) :Through the available statistics on unemployment represented by the results of the multi-population years (1991-1988), the unemployment rate was somewhat stable, but in the years (1992-2004) it is clear that unemployment rates are constantly increasing, and the reason for this is due to the political and economic situation that Iraq has experienced from Wars and sieges, which caused an increase in the level of unemployment in Iraq, but in the years (2005 - 2018), it is clear that unemployment has decreased, as we note that in the year (2009-2011) it was somewhat stable if the unemployment rate reached 15.2 and the reason for this is to switch the mechanisms of collecting data for unemployment And the adoption of the question of unemployment in line with international standards, who was considered the person who works One hour's wages during the past week are not considered unemployed (National Population Policy Committee, 2012, 126). As for 2019, the unemployment rate is high to reach 14.8 due to the ISIS war on Iraq, and the following figure shows the difference in the unemployment rate for the period (1988-2019) [7,10].

Table 1: The unemployment rate in Iraq

the year	Unemployment rate	the year	Unemployment rate	the year	Unemployment rate
1988	3.6	1999	13.6	2010	15.2
1989	3.4	2000	17.4	2011	15.2
1990	3.9	2001	20.2	2012	11.1
1991	3.7	2002	22.4	2013	11.9
1992	5.5	2003	28.1	2014	10.6
1993	6.5	2004	26.8	2015	10.6
1994	7.5	2005	17.97	2016	10.8
1995	8.5	2006	17.5	2017	10.8
1996	10.5	2007	11.7	2018	11
1997	12.9	2008	18.23	2019	14.8
1998	13.9	2009	15.2	-	-

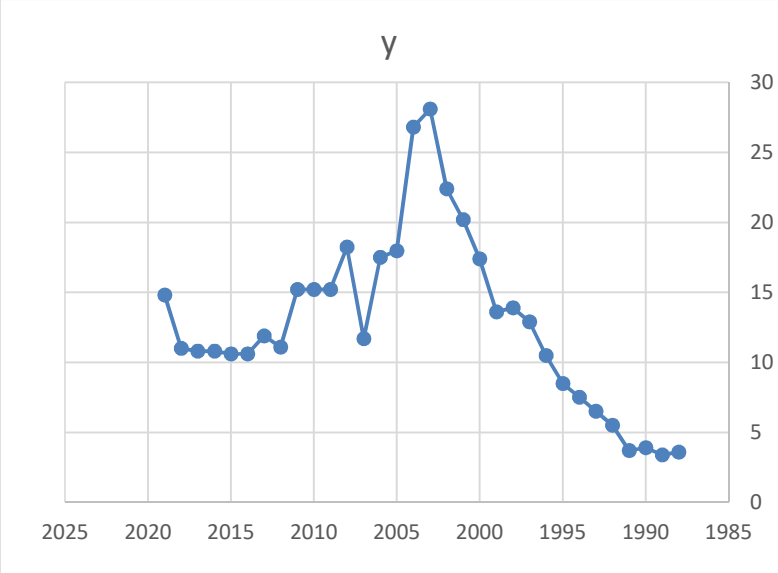

Figure 1: Graphical representation of the Iraqi unemployment rate for the period 1988-2019

2.1. System of immediate equations

Regression models are among the most simplistic mathematical relationships of practical reality, because these models assume a single direction of causation, meaning that the independent explanatory variable or independent explanatory variables affect the response variable (dependent) and are not affected by it. In reality, however, most relationships depend on the exchange of influence between the variables forming the model, as there are at least a number of variables that are determined in real time, that is, they affect and are affected by each other. In this case, it is not possible to use a model consisting of one equation to describe the relationship between the independent variable or the independent variables and the dependent variable, therefore it is necessary to use multi-equation models, and the most important of these models that involve interdependence between the variables is the system of immediate equations [3,4].

2.1.1. The concept of the system of instant equations

The system of simultaneous equations can be defined as "a group of equations that represent the relationships between response (dependent) and explanatory (independent) variables, so that the variables are affected by each other at the same tim.

2.2. Methods for estimating the system of simultaneous equations

Applying the OLS method in estimating the parameters of the immediate equations system will produce biased and inconsistent estimates, given the violation of the hypothesis that the observed values of the independent variable are not related to the successive values of random error. Which requires the use of other methods for estimation and according to the diagnostic status of each equation from the real-time system, so that these methods create estimates that have a good estimate of the parameters of the system of simultaneous equations [4, 5, 9, 10].

2.2.1. Concept of identification

Diagnosis means testing each of the system's equations to see if unique estimators can be obtained for the parameters. Diagnosed when there is no solution for estimating its parameters, as estimated values for structural parameters cannot be achieved), or diagnostic (the equation is diagnosed when accepting the solution, as estimated values for structural parameters can be reached). There are two cases of diagnostic equations, the first case: these are known as fully diagnosed equations and in which one can obtain single estimated values for the parameters of the structural model. As for the second case, it is known as equations that have an attribute above diagnosis and in which more than one estimated value can be obtained for the parameters of the structural model. To know the status of the diagnosis, it is necessary to pass the rank and order conditions [3, 4, 6].

2.2.2. Order condition

The first condition for the diagnosis of any structural equation is achieved when the number of variables excluded from it, but are included in the composition of other structural equations in the system, is equal to the number of equations in that system minus one, so if it is [8,10]:

K: The number of variables in the system

m: The number of internal variables in the structural equation at the test site

G: The number of variables, whether internal or external, the structural equation in question

As a diagnostic condition takes the following mathematical formula:

$$K - m \geq G - 1 \quad (1)$$

If it is:

1- $K - m \geq G - 1$ The equation is above diagnosis

2- $K - m \leq G - 1$ The equation is not diagnosed

3- $K - m = G - 1$ The equation is completely personalized

2.2.3. Rank condition

This condition is the confirmation of the rank condition, as all structural parameters are arranged in terms of all the variables of the immediate system in the form of an array, after which the parameters of the equation under test are deleted, then the resulting matrix is divided into all matrices with a degree G-1, if there is one specific on Less than partial matrices, i.e. not equal to zero, the equation is completely diagnosed, but if the determinants of partial arrays are equal to zero, then the equation is not diagnosed.

2.3. Real-time equations and OLS assumptions

From the assumptions about the random error limit of the explained variables, it must be independent. If there is an association between the limits of random error and the explained variables, the least squares (OLS) capabilities are biased. As there is a correlation between the limits of random error, from the following immediate equations [2, 6]:

$$y_1 = B_0 + B_1 y_2 + B_2 x_1 + B_3 x_2 + u_1 \quad (2)$$

$$y_1 = \alpha_0 + \alpha_1 y_2 + \alpha_2 x_1 + \alpha_3 x_2 + u_2 \quad (3)$$

Working through the system of simultaneous equations, we find the following:

1-If the random error term value increases in the first equation, the value of y_1 will increase.

2-If the value of y_1 increases, then x will increase.

3-But if the value of y_2 rises in the second equation, x will increase in the first equation.

That is, if the value of the random error limit increases in the first equation, then the value of y_2 in the same equation increases, i.e. if there is a correlation between the random

variable and the variable y_2 in the same equation. One of the assumptions of OLS is in breach. The results apply to simultaneous equations [3,7].

2.4. Two stage least square method (2SLS)

The two-stage least squares method is an important method for estimating a single structural equation in the system of simultaneous equations that bears a characteristic above the diagnosis and fully diagnosed, as it takes into account the impact of all independent variables on the dependent variable in the system, as it gives consistent and unbiased capabilities as well as Simple method in its calculations [2, 4].

This method is called by the same two stages, and it does not go through two stages. The first is in determining the internal variable in the equation required to estimate its parameters, then finding the shortened form of this variable and then using the method of ordinary least squares to find the estimated values of the reduced form, while the second stage is in finding the estimated values of Values for the internal variables in the structural equations, and then using the method of the regular minimum squares of the system of simultaneous equations. Also, the capabilities can be obtained (2SLS) method using the generalized last square method (GLS) and clarify these method mathematical formulas.
We assume that we have (n) observations and that the structural equation to be estimated in the system of immediate equations is as follow:

.

$$y_i = \alpha_i Y_i + B_I X_I + e_i \tag{4}$$

where

y_i is a vertical vector that views the internal variable representing the dependent variable in the first equation.

Y_i is an array with rank (n * m) of the explanatory response variables that appear with independent variables on the right.

X_i is an array with the rank (n * s) of the independent (explanatory) variables.

B_I, α_i are vectors for the response variable parameters and illustrative independent variables respectively.

e_i is a vertical vector of (n) random system errors structural equations
The formula can be repeated first equation as follow:

$$y_i = \gamma_i Z_i + e_i \tag{5}$$

where

$$Z_i = [Y_i \quad X_i] \quad ; \quad \gamma_i = \begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix}$$

And by multiplying by the second equation by the matrix (X`) we get

$$y_i \grave{X} = \grave{X} Z_i \gamma_i + \acute{X} e_i \tag{6}$$

The third equation is the system of equations including (n) of the parameters (γ_i.) Assuming that all independent variables are constant variables, the matrix of the vector variance is random errors $\acute{X}e_i$ then:

$$var(\acute{X}e_i) = E(\acute{X}e_i e_i X) = \sigma_{ii}(X\acute{X}) \quad (7)$$

Since σ_{ii} is the standard deviation of (n) of random errors, and by applying the general minimum squares method (GLS) to the third equation we get:

$$\acute{Z}_i(\sigma_{ii}\acute{X}X)^{-1}\acute{X}y_i = \acute{Z}_i X(\sigma_{ii}\acute{X}X)^{-1}\acute{X}Z_i \quad (8)$$

Of which we derive the 2SLS method of my agencies

$$\hat{\gamma} = [\acute{Z}_i X(\sigma_{ii}\acute{X}X)\acute{X}Z_i]^{-1}\acute{Z}_i X(\sigma_{ii}\acute{X}X)^{-1}\acute{X}y_i \quad (9)$$

The covariance matrix of (γ^) is

$$var(\hat{\gamma}) = \sigma_{ii}[\acute{Z}_i X(\sigma_{ii}\acute{X}X)\acute{X}Z_i]^{-1} \quad (10)$$

The capabilities of the two-stage minimum squares method (2SLS) are biased in small samples. This bias tends to fade with increasing sample size, and estimates of this method are consistent.

2.4.1. The properties of the two-stage least squares

1- Distinguished 2SLS capabilities. They are consistent but remain biased in small samples.
2- You must confirm the variables adopted in the reduced form, as we perform good consistency tests.
3- If the variables were previously united and interconnected, then the model will not be good.

3. The practical side

The applied aspect includes the estimation stages of the immediate model that represents the relationship between the internal variables(lnX_1, y_1) and the external variables (lnX_2 , lnX_3 , lnX_4 , lnX_5) .

3.1. Description of the template

To represent the relationship between internal and external variables for research, a system of simultaneous equations has been proposed in which conditions of the system of simultaneous equations are met [4,5,7]

Table 2: Test of rank condition, immediate equations ($K - m = G - 1 = 3$)

Equa -tion	Parameters					
	B0	B1	B2	B3	B4	B5
1	-63.33925^{*} 0.001	11.62318^{**} 0.000	0.354939 0.46	16.86302^{*} 0.001	-4.970704^{**} 0.0005	-
2	-80.60106 0.20	-	3.332534 0.3	19.64813 0.24	-2.212425 0.63	3.058543^{*} 0.003
3	-119.6351 0.7	-	3.332534 0.3	31.21733 0.07	-1.198581 0.8	3.058543^{*} 0.003

$$y_1 = B_0 + B_1 lnX_1 + B_2 lnX_2 + B_3 lnX_3 + B_4 lnX_4 \quad (11)$$

$$lnX_1 = B_0 + B_1 y_1 + B_3 lnX_3 + B_4 lnX_4 + B_5 lnX_5 \quad (12)$$

$$y_1 = B_0 + B_1 lnX_1 + B_3 lnX_3 + B_4 lnX_4 + B_5 lnX_5 \quad (13)$$

As the internal variables:

y_1 :Unemployment rate

$\ln X_1$: Inflation rate

Independent variables:

$\ln X_2$: Economic activity rate

$\ln X_3$: Represents the population

$\ln X_4$: Represents the rate of growth

$\ln X_5$: The rate of oil exports

3.2 Diagnosis

We notice from Table (2) that all equations of the immediate model are completely diagnosed because of a universe.

Table 3: Results

Equation	k-m	G-1	Result
1	3-6	1-4	Diagnosed
2	3-6	1-4	Diagnosed
3	3-6	1-4	Diagnosed

4. Estimator

After completing the process of diagnosing a real-time model, we work to estimate the equations of the real-time model using the EVIEWS V.9 program, and the results are as shown in tables (2, 3).

We note from Table (3) that the equation (1) has reached the value of the fixed term)B0 = -63.33925^{*}(with a significant level (α = 0.001) which is less than (0.05) which indicates the significance of the constant term, i.e. the y-section must be present In the model, we also note that most of the explanatory variables of the same equation were significant except for the variable x_2 where the parameter (B2 = -63.33925^{*}) reached the level of significance α = 0.46, which indicates the effect of no significant effect in the first equation.

As for equation (2), the boundary value is constant (B0 = -80.60106) and at a significant level (α = 0.2) which is greater than (0.05), which indicates the non-significance of the fixed term, meaning that it is not affected by the presence of the y-section in the model. One was not significant except for the variable x_4 where parameter (B5 = 3.058543) reached the level of significance α = 0.003 which indicates the effect of significance in the second equation.

Also, the equation (3) reached the value of the fixed term (B0 = -119.6351) and at a significant level (α = 0.7) which is greater than (0.05), which indicates the lack of significance of the fixed term i.e. it is not affected by the presence of the y-section in the model. Also, we notice that most of the explanatory variables of the equation The third was insignificant except for the variable x_4 where the parameter (B5 = 3.058543) reached the level of significance α = 0.003 which indicates the effect of significance in the third equation.

The determination parameter of the first equation was (R^2 = 0.95), and this indicates that the explanatory variables were able to explain 0.95 of the changes in the dependent variable and the remaining of the changes are due to the explanatory variables not included in the model, which were combined with a random error as the test value (F = 130.0635) with a significant level (α = 0.000)) which is less than 0.05 and this indicates the presence of one or more explanatory variables that have a significant effect on the dependent variable.

As for the second equation, the determination coefficient reached (R^2 = 0.49). This indicates that the explanatory variables were able to explain 0.95 of the changes in the dependent variable and the remaining of the changes are due to the explanatory variables not included in the model, which were combined with random error, as the value of the test (F = 6.318425) with a significant level (α = 0.001) which is less than 0.05 and this indicates the presence of one or more explanatory variables that have a significant effect on the dependent variable.

As for the third equation, the determination coefficient reached($R^2 = 0.95$). This indicates that the explanatory variables were able to explain 0.95 of the changes in the dependent variable and the remaining of the changes are due to the explanatory variables not included in the model, which were combined with a random error as the value of the test (F = 5.761190) with a significant level (α = 0.003) which is less than 0.05 and this

indicates the presence of one or more explanatory variables that have a significant effect on the dependent variable [7,9].

Table 4: Results of the sample competency test

Equation	Standard Statistical		
	R^2	F	Sig
1	0.95	130.0635**	0.000
2	0.49	6.318425*	0.001
3	0.39	5.761190*	0.003

5. Conclusions and recommendations

5.1 Conclusions

1- The high unemployment rates in Iraq after a year (2003) as a result of the events.
2- Inadequate or planning between the labor market and education outcomes, which caused an increase in the graduate rates in the applied and humanitarian branches, which requires the market need.
3- There is no relationship between inflation and the unemployment rate in Iraq during the research period.
4- The most variable that contributes to reducing unemployment is the variable of economic activity if economic activity contributes in a large percentage to reducing the unemployment rate.
5- The most variable that increases the unemployment rate is the population growth rate if it contributes to increasing the unemployment rate.
6- The system was unable to provide new job opportunities for those who are able to work, for several reasons, including the weakness of the private sector in economic activity and the declining ability of the public sector to employ, which led to an increase in the level of unemployment.

5.2. Recommendations

1- The necessity of coordination between education outcomes and the need of the market and limiting school dropouts in order to supplement the labor market with competencies of educated youth.
2- Operating the various economic sectors other than the oil sector, which are considered semi-suspended, so the agricultural and industrial sectors can play a major role in eliminating unemployment.
3- Adopting a population policy to reduce high growth rates.
4- Attention to training and rehabilitation of the unemployed.

5- Activating the role of the private sector and giving more attention to contributing to the employment of new manpower.
6- The liberalization of the Iraqi economy has resulted in the dominance of the oil sector and the employment of oil revenues in favour of public investment in basic development projects and general social services programs.

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Conflict of interest. The authors declare that they have no conflict of interest.

Authors' Contributions. All the authors contributed equally to this work.

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