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MEASURING THE EFFECT OF THE ECONOMIC ACTIVITY RATE ON THE UNEMPLOYMENT RATE USING PANEL DATA MODELS

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Abstract

In this research, the statistical method, Panel Data Models, was employed to measure the strength of the relationship between variables and analyze them, and to show the effect of the explanatory variable (X), which represents economic activity on the dependent variable (Y), which represents the unemployment rate in some Iraqi provinces.(Waist, Kerbala, Babylon, Najaf) for the period from (2005-2019),As the two variables were represented graphically to know the trend of the phenomenon and determine its events, and among the most important conclusions that were reached is that the summative regression model (PRM) is the best in that it is the most appropriate in representing the inverse relationship between the variable of unemployment rate and the variable of economic activity.

In addition to the presence of a significant impact of the variable of the unemployment rate and the variable of economic activity, the more jobs (economic activity) the unemployment rate will decrease. On this basis, a set of recommendations have been drawn up to take the necessary care and develop the phenomenon studied, the most prominent of which is the expansion of the study sample (number of sections) to include More than one Iraqi governorates, and the need for the Ministry of Labor to pay attention to creating job opportunities in order to contribute significantly to the elimination of unemployment.

Key Words: Unemployment, PRM, Panel Data Models, Economic Activity Rate

Introduction

Panel Data Models is considered one of the relatively modern methods used in analyzing phenomena whose data are in the form of cross sections linked with time, whereby the cross sectional data are analyzed for a dependent variable and

(k) from the explanatory variables, taking into consideration the time variable. (t), and it is noticed in recent times the frequent use of cross-sectional time-series analysis, which has received great and wide attention, especially in economic studies.

The research problem stems from the studied phenomenon as the increase in the unemployment rate as a result of the decrease in job opportunities requires researchers to prepare scientific studies to supplement the relevant authorities with solutions and proposals in order to improve the economic reality, as the research aims to find the best model to represent the relationship between the unemployment rate and economic activity. As well as measuring whether there is a significant effect of the variable of unemployment rate and economic activity in line with the population of the province, and for this reason, a number of Iraq's governorates (Wasit, Kerbala, Najaf, Babil) were tested to apply this study.

Unemployment

The phenomenon of unemployment has received great attention, and many studies have been published about it because of its economic and social importance, and the current definition of it is the involuntary disruption that is due to the lack of work. As the labor element, at its various levels, represents the most important element of production as it is capable of achieving interaction between the rest of the production elements to create commodity and service production and the work force is the necessary condition for achieving economic development and comprehensive progress in any country, And because the human being is the desired development tool and goal at the same time and in light of the current conditions of the Iraqi economy and the prevailing employment policies in it. Signs of the phenomenon of unemployment have emerged in it, and this means, of course, that there is some imbalance between the labor force supply in terms of its size and structural characteristics and the demand for the workforce in accordance with the requirements of development plans and the requirements of the economic and social development of the country at the level of the state sector and the private sector, That is, the economy does not function as a whole as it should, meaning that job opportunities are limited or very few and many people do not find work. Therefore, the measure of unemployment is to obtain a comprehensive indicator of the performance of the Iraqi economy and the conditions of the labor market in it. The process of diagnosing the phenomenon of unemployment in the Iraqi economy by determining the size of this phenomenon and the circumstances and reasons for its emergence and thus developing appropriate solutions and treatments for it, in order to reduce this phenomenon and prevent its exacerbation and avoid the negative effects resulting from it require more attention and focused studies on this phenomenon.

Sectional time seriesPanel data [7][8]

Time series cross-sectional data is defined as a technology that combines characteristics of both cross-sectional and time-series data,, As the cross-sectional data describes the behavior of a number of items or sectional units over a single period of time, while the time series data describes the behavior of one individual during a specific period of time, meaning that the panel data combines the advantages of each data,It is also possible to some degree to avoid the shortcomings in both of them, as what is meant by (Panel data) is cross-sectional views, such as (countries, governorates, companies, universities, ...) monitored

over a specific period of time, i.e. combining cross-sectional data with time at same time.

As the cross-sectional data takes into account the effect of changing time and the effect of changing the difference between the sectional units alike, which has led to its frequent use in recent times and considered it a modern method. The most important characteristic of longitudinal data is the following:

- Allows control over individual variations, which appear in the case of cross-sectional or temporal data
- It helps to control some variables that remain constant among individuals but change over time, such as national policies and international agreements.
- The data of the sectional time series (Panel data) carries more information than that of the sectional or time series. Therefore, it is possible to obtain estimates with higher confidence and that the problem of inter-correlation between variables is less severe than the time series data.
- Panel data is distinguished from others in that it has higher degrees of freedom and is more efficient.
- Panel data models provide a better possibility to study the dynamics of adjustment, which may be hidden by the sectional data, and are also suitable for studying periods of economic cases, such as unemployment, education level, growth, etc., and on the other hand, it is possible through the (Panel data) to link Show the behaviors of the sample's vocabulary from one point of time to another
- Panel data models contribute to reducing the possibility of the emergence of the problem of neglected variables, resulting from the characteristics of the unseen vocabulary, which is usually due to biased estimates.
- Panel data models are concerned with what is described (inconsistency or noticeable difference) of the sample vocabulary, whether sectional or temporal.
- • These models help prevent the commonly encountered Heteroscedasticity problem.

If we have k cross sections measured in T of time periods, the panel data model takes the following form:

$$Y_{\mathrm{it}} = \mathrm{B}_{0(\mathrm{i})} + \sum_{j=1}^{\mathrm{p}} \mathrm{B}_j \mathrm{Xj}_{(\mathrm{it})} + \epsilon_{\mathrm{it}} \dots\dots(1)\text{،}\quad i = 1\text{،}2\text{،}\dots\text{،}N$$

$$\mathrm{j}=1,2,\dots\dots,\mathrm{p}$$

$$\mathrm{t}=1,2,\dots..\mathrm{T}$$

Since p is the number of explanatory or independent variables, there are three basic models for regression of panel data, namely:

1- The Pooled Regression model [(5)]

This model is considered one of the simplest models of longitudinal data where all the parameters B0 (i) and Bi are constant and for all time periods (neglecting any effect of time) by rewriting the model in equation (1), we obtain an aggregate regression model with the following formula:

$$Y_{\text{it}} = \text{B}_0 + \sum_{j=1}^{\text{P}} \text{B}_\text{j}\text{X}_{\text{j (it)}} + \epsilon_{\text{it}} \qquad i = 1،2، \dots K \quad t = 1،2، \dots ،T \qquad \dots (2)$$

Since $V(\varepsilon_{it}) = \sigma_\varepsilon^2$ و $E(\varepsilon_{it}) = 0$The usual least squares method is used in estimating the model parameters in Equation (2) After arranging the values of the response variable and the explanatory variable (Greene 2012), we start with the first set of cross-sectional data and so on with the size of observations of (k * T).

2- Fixed Effects Model (FEM) [6]

This model takes into account the change of the slope from one unit to another for the cross-section observations within the studied sample, i.e. making the segment parameter B_0 vary from one group to another with the slope coefficients B_j remaining constant for each cross-sectional data set (i.e. we will deal with the heterogeneity in the variance between the groups.

And it is assumed that the parameters for k of the cross-sections are identical except for the fixed term in which it is likely to change during the cross-sections implicitly. Therefore, the model containing the p of the regression parameters, in the fixed effects model the goal is to know the behavior of each segment data separately. The fixed effects model is as follows:

$$Y_{\text{it}} = \text{B}_{0(\text{i})} + \sum_{j=1}^{\text{p}} \text{B}_\text{j}\text{X}_{\text{j (it)}} + \epsilon_{\text{it}} \qquad i = 1،2، \dots ،k \quad t = 1،2، \dots ،T \qquad \dots (3)$$

As: $V(\varepsilon_{it}) = \sigma_\varepsilon^2$ و $E(\varepsilon_{it}) = 0$ The term fixed effects means that the parameter B0 does not change over time, but that the change is only in the sums of the cross-sectional data for the purpose of estimating the model parameters in Equation 3 and to allow the segment parameter B0 to change between the groups and to avoid the case of complete linear multiplicity of the sectional using dummy variables of (N-1) then We use the regular least squares method. The fixed effects model is called the Least Squares Dummy Variable Model, and the model with Equation 3 becomes the following figure:

$$Y_{\text{it}} = \alpha_1 + \sum_{\text{d=2}}^{\text{N}} \alpha_\text{d}\text{D}_\text{d} + \sum_{j=1}^{\text{k}} \text{B}_\text{J}\text{X}_{\text{J (it)}} + \epsilon_{\text{it}} \text{،} i = 1،2، \dots ،k \qquad \dots . (4)$$

$$t = 1،2، \dots ،T$$

It represents the magnitude $\alpha_1 + \sum_{\text{d=2}}^{\text{N}} \alpha_\text{d}\text{D}_\text{d}$ The change in the sectional totals of the cutoff parameter *B0*

3- Random Effects Model (REM) [8]

The stochastic model is represented in the fact that the constant changes randomly and is known as the regression model constrained by the constant limit as a result of its assumption of the equal or constant limits of fixed boundaries in all fixed cross sections. One method of describing the behavior of random boundaries when treating cross sections and time series data is the integration of the hypotheses regarding the observations of the segments. The symptom, which states that the random boundaries are independent, but they do not achieve the hypothesis of homogeneity with the hypothesis of the time series data, which is

that the random boundaries are self-related and therefore the merging of time series and cross-section data leads to the emergence of the problem of heterogeneity more clearly in the cross-section data than in the series data This is a result of the fact that the cross-section data simulate the phenomenon in a fixed period of time, while the time series data take a long period of time during which the effects that appear in the short term may disappear. In addition, the problem of self-correlation and simultaneous covariance may appear

In the fixed effects model, the error term ε_{it} is normally distributed with a mean of zero and variance, and for the parameters of the fixed effects model to be correct and unbiased, it is usually assumed that the error variance is constant (homogeneous) for all the cross-sectional observations and there is no subjective correlation over time between each group of the sums of cross-sectional observations. In a specific time period, the random effects model is a suitable model in the event that there is a defect in one of the above hypotheses in the model.

Fixed Effects. In the random effects model the cut-off parameter $B0_{(i)}$ will be treated as a random variable having a mean of μ:

$$B_{0(i)} = \mu + v_i \text{،} \qquad i = 1\text{،}2\text{،} \dots \text{،}k \qquad \dots (5)$$

By substituting equation (5) into (3), we obtain the random effects model as follows:

$$Y_{it} = \mu + \sum_{j=1}^{k} B_J X_{J\,(it)} + V_i + \epsilon_{it} \qquad i = 1\text{،}2\text{،} \dots \text{،}N \quad t = 1\text{،}2\text{،} \dots \text{،}T \qquad \dots . (6)$$

Where Vi represents the error term in the i-sectional data set. The random effects model is sometimes called the error component model because the model in equation (6) contains two error components they.V_i وϵ_{it} The random effects model has the following properties:

$$(\varepsilon_{it}) = \sigma_{\varepsilon}^2 \text{ و } E(\varepsilon_{it}) = 0 \text{ ، } V(V_i) = \sigma_v^2 \text{ و } E(V_i) = 0$$

5- Selecting the appropriate model: [7] [8]

To determine the most appropriate model, diagnostic statistical tests are performed in two stages. In the first stage, a comparison is made between the aggregate model and the fixed effects model. If the results of the aggregate model are reached that they are better and more appropriate, we stop at this stage and consider the aggregate model as the most appropriate, while if the results indicate a preference. Adapting the fixed effects model to the aggregate model, we move to the second stage, which is the preference between the fixed effects model and the random effects model, and the first stage of evaluation between models is applied using the restricted F test that takes the following mathematical formula

$$F = \frac{(R_{FEM}^2 - R_{PEM}^2)/(k-1)}{(1 - R_{FEM}^2)/(kT - k - p)} \approx F(k - 1\text{،}kT - k - p)$$

As: k: the number of segments and here is the number of banks

T: the length of time

p: number of independent variables

R^2_{FEM} Coefficient of determination of the unconstrained model (FEM model)

R^2_{PEM} Coefficient of determination of the constrained model (PEM model)

When comparing the calculated value of F with the tabular value of F at a significant level (0.05) and with a degree of freedom (*k-1, kT-k-p*), if the calculated F is greater than the tabular F, we reject the null hypothesis and accept the alternative hypothesis, meaning that the appropriate model is the fixed effects model (FEM) .

Then the second stage is applied to the preference between the fixed effects model and the random effects model, using the Housman test, according to the following hypotheses:

H0: Fixed effects model is better than random effects model.

H1 random effects model is better than fixed effects model.

The test focuses on the fact that there is a correlation between the explanatory variables and the unobservable effects, and specifically tests the capabilities of the two models under the null assumption that the random effects estimation is consistent and efficient, against the alternative hypothesis that the random effects estimate is inconsistent and the test uses the H statistic that is distributed according to the X2 distribution and the degree of freedom of K is according to the following formula:

$$H = (\hat{B}_{\text{FEM}} - \hat{B}_{\text{REM}})'[VAR(\hat{B}_{\text{FEM}}) - VAR(\hat{B}_{\text{REM}})]^{-1}(\hat{B}_{\text{FEM}} - \hat{B}_{\text{REM}}) \sim$$

So that $VAR(\hat{B}_{\text{FEM}})$ Represents the covariance and covariance matrix of the fixed effects model parameters and $VAR(\hat{B}_{\text{FEM}})$ Represents the variance and covariance matrix of the parameters of the random effects model, and the random effects model is the appropriate model if the statistical value is greater than the tabular chi-square value, where if the statistical value is large, then this means that the difference between the two estimates is significant, and therefore the assumption of the nullity that the effects can be rejected The random effects are fixed, and the random effects model is accepted, but if the value is small and not significant, then the fixed random effects model is the appropriate model for the study data

Application aspect:

The application side includes statistical analysis, an applied study of the economic level in the governorates of Iraq for the period (2005-2019).

Sample description

In order to conduct statistical analysis, the research sample must be identified and identified, as the sample represented a study of the effect of (Y) the unemployment rate for the Iraqi governorates (Waist, Kerbala, Babel, Najaf) for the period of time (2005-2019) and the most prominent factors affecting productivity, which is economic activity (X), where the data were obtained from the Central Bureau of Statistics and were classified according to the requirements

of the double data analysis (Panel data), and the table below represents the research sample:

Table (1) represents the rate of economic activity and the unemployment rate at the governorate level for the years (2005-2019)

Kerbala		Waist		Governorate
Y	X	Y	X	
39.5	13.6	40.7	8.5	**2005**
40.9	11.7	42.6	8.2	**2006**
41.5	13.6	44.9	7.8	**2007**
43.6	10.2	45.7	5.7	**2008**
45.8	9.9	46	5.5	**2009**
47.5	8.6	49.1	4.9	**2010**
49.9	6.7	51.7	4.2	**2011**
50.5	5.2	55.7	3.8	**2012**
51.6	4.8	54.7	3.2	**2013**
52.9	4.7	52.6	3.9	**2014**
46.8	7.1	44.9	6.7	**2015**
43.8	7.1	44.9	10.8	**2016**
40.8	10.8	40.2	13.7	**2017**
38.1	12.9	39.7	15.3	**2018**
36.7	15.9	38.9	19.6	**2019**

Babylon		Najaf		Governorate
Y	X	Y	X	
38.1	9.9	41.2	8.5	**2005**
37.3	9.1	42.3	8.8	**2006**
37.1	9.7	39.2	8.2	**2007**
36.6	9.2	42.7	6.9	**2008**
39.8	5.3	46	6.1	**2009**
41.5	5.6	49.1	5.3	**2010**
43.1	5.7	51.7	4.8	**2011**
44.5	4.2	52	4.9	**2012**
44.6	4.8	54.7	51	**2013**
45.4	4.5	54.9	5.3	**2014**
40.8	6.1	44.9	6.7	**2015**
39	7.3	42.1	9.5	**2016**
38.8	10.8	40.7	11.9	**2017**
36.7	11.9	40.5	13.6	**2018**
37.2	12.7	41.8	15	**2019**

statistical analysis

In order to measure the effect of the independent variable, the rate of economic activity (x) on the dependent variable, the unemployment rate (y), and using the three longitudinal data models (PRM), (FEM), (REM), Eviews program was used and the results shown in the following tables were reached:

A- Estimating the impact of economic activity on unemployment using the PRM model:

Below is Table (2) showing the results of estimating the effect of the variable of economic activity on the unemployment rate using the PRM model

Dependent Variable: Y
Method: Pooled Least Squares
Date: 01/07/21 Time: 00:21
Sample: 2005 2019
Included observations: 15
Cross-sections included: 4
Total pool (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	4.468918	0.249504	17.91123	0.0000

R-squared	0.65. 0088	Mean dependent var	40.03333
Adjusted R-squared	0.64. 0281	S.D. dependent var	3.026811
S.E. of regression	15.95623	Akaike info criterion	8.394102
Sum squared resid	15021.47	Schwarz criterion	8.429007
Log likelihood	-250.8230	Hannan-Quinn criter.	8.407755
Durbin-Watson stat	0.286446		

Table (2) Results of estimating the impact of economic activity on unemployment using the PRM model

It is evident from the model estimated in the above table the significance of the coefficient of the variable (x) below the level of significance 0.05, because the probability value of the t-test of the coefficient of x of (0.000) is less than 0.05. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted which states that there is a significant effect of the variable X on Y, that is, there is a significant statistical impact relationship between economic activity and unemployment rate

B- Estimating the impact of economic activity on unemployment using the FEM model:

Below is Table (3) showing the results of estimating the effect of the variable of economic activity on the unemployment rate using the FEM model

Dependent Variable: Y
Method: Pooled Least Squares
Date: 01/07/21 Time: 00:20

Sample: 2005 2019
Included observations: 15
Cross-sections included: 4
Total pool (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	47.38069	0.615587	76.96833	0.0000
X	-0.943582	0.074561	-12.65516	0.0000
Fixed Effects (Cross)				
W--C	-9.87E-15			
K--C	-9.87E-15			
N--C	-9.87E-15			
B--C	-9.87E-15			

Effects Specification
Cross-section fixed (dummy variables)

R-squared	0.744368	Mean dependent var	40.03333
Adjusted R-squared	0.725777	S.D. dependent var	3.026811
S.E. of regression	1.585030	Akaike info criterion	3.838739
Sum squared resid	138.1776	Schwarz criterion	4.013267
Log likelihood	-110.1622	Hannan-Quinn criter.	3.907006
F-statistic	40.03828	Durbin-Watson stat	1.022789
Prob(F-statistic)	0.000000		

Table (3) Results of estimating the impact of economic activity on unemployment using the FEM model

It is evident from the estimated model in the above table that we note the significance of the coefficient of the variable (x) below the level of significance 0.05, because the probability value of the t-test for the coefficient of x of (0.000) is less than 0.05 and therefore rejects the null hypothesis and accepts the alternative hypothesis that states the existence of a significant effect of the variable X On Y, we also note the significance of the model through the value of F calculated below the level of significance (0.05) because the probability value for it has reached (0.000) and it is less than (0.05) and this means that the estimated model as a whole is significant, and the value of the coefficient of determination ((R2) It reached (0.744) and this means that the independent variable X explains (74%) of the changes occurring in Y, either the remaining percentage of (26%) is due to other variables not included in the model, while we note that there is a self-correlation of errors as we note that the value of Durban Watson (D.W. = 1.02).

C- Estimating the impact of economic activity on unemployment using the REM model:

Below is Table (4) showing the results of estimating the effect of the variable of economic activity on the unemployment rate using the REM model

Dependent Variable: Y
Method: Pooled EGLS (Cross-section random effects)
Date: 01/07/21 Time: 00:13
Sample: 2005 2019
Included observations: 15
Cross-sections included: 4
Total pool (balanced) observations: 60
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	47.38069	0.615587	76.96833	0.0000
X	-0.943582	0.074561	-12.65516	0.0000
Random Effects (Cross)				
W--C	0.000000			
K--C	0.000000			
N--C	0.000000			
B--C	0.000000			

Effects Specification	S.D.	Rho
Cross-section random	0.000000	0.0000
Idiosyncratic random	1.585030	1.0000

Weighted Statistics			
R-squared	0.744368	Mean dependent var	40.03333
Adjusted R-squared	0.739961	S.D. dependent var	3.026811
S.E. of regression	1.543493	Sum squared resid	138.1776
F-statistic	168.8888	Durbin-Watson stat	1.022789
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.744368	Mean dependent var	40.03333
Sum squared resid	138.1776	Durbin-Watson stat	1.022789

Table (4) Results of estimating the impact of economic activity on unemployment using the REM model

We note from the above table that the value of the variable (x) is significant, because the probability value of the t-test of the coefficient of x of (0.000) is less than 0.05. Therefore, it rejects the null hypothesis and accepts the alternative hypothesis that states that there is a significant effect of the variable X on Y. Through the value of F calculated below the level of significance (0.05) because the probability value for it has reached (0.000). It is less than (0.05), which means that the estimated model is significant. The value of the coefficient of determination ((R2) reached (74%), which means that The independent variable X explains (74%) of the changes occurring in Y, either the remaining percentage

(26%) is due to other variables not included. At the same time, we note that there is a self-correlation of errors as we note that Durban and Watson's value is (D.W. = 1.02).

D- Choosing the appropriate model:

To determine the most appropriate model, statistical diagnostic tests were conducted for the three models. It was found that in two stages, the first stage is the preference between the aggregate and fixed-effects models. If the results indicate the aggregate model's preference and suitability for the data, we stop at this stage and consider the aggregate model as the most appropriate. The results indicated the fixed effects model's preference and suitability over the aggregate model. We move to the second stage, which is the preference between a model

The fixed effects and the random-effects model, and the first stage of evaluation between the models is applied using the restricted F test that takes the mathematical formula described previously according to the previously mentioned relationship

Since the value of F calculated for this test was calculated and reached (1.153) and when compared with the tabular F value of (2.78), we note that it is smaller than it, meaning that the combative model is the best or most appropriate in the estimation

Conclusions:

1. Panel data models have proven their preference in determining the relationship due to its flexibility and diversity
2. The best model for representing the relationship between the economic activity variable and the unemployment rate variable is the summative regression model (PRM).
3. A state of severe unemployment was generated after 2005, as many factories were subjected to sabotage, and conditions improved in 2009 to 2014, and then things have deteriorated to our present time.

Recommendations

1. Expanding the study sample to include more Iraqi governorates where unemployment is high.
2. The necessity for the Ministry of Labor and Social Affairs to activate the employment offices by issuing a bulletin on the human resources requests received from the state and private sector agencies as well as the job offers submitted by the human resources and taking the necessary measures
3. Providing operating requirements for stalled factories by securing raw materials and other requirements to absorb a significant aspect of the unemployed labour force.
4. Encouraging the entry of Arab and foreign capital into the country by granting incentives and privileges to Arab and foreign investors and granting them exemptions that tempt them to invest in the country, as well as taking the same measures with regard to the Iraqi expatriates ... with obliging each investor to employ a certain percentage of Iraqi workers in the projects that are set up.
5. 5- Encouraging researchers to conduct studies and research in the economic sector, find out the most important obstacles and problems that he suffers from, and prevent and limit the spread of unemployment rates.

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