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Evaluation as Econometrics of the Relationship between Unemployment and Economics Growth in Turkey (Okun's Law Case)

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Abstract – In this study, relationship between unemployment and economic growth in Turkey was investigated. The study, which was carried out in the period 1988-2012, was evaluated. In order to explain relationship between unemployment and economic growth, Vector Autoregressive Model, Jhonsen Cointegration Analysis and Granger Causality/Block Exogeneity Test were used. As a result, a relationship between unemployment and GDP in Turkey was determined as foresee of Okun's Law and direction of relationship can periodically vary. Affected employment of economic growth is known to be linked to certain conditions. According to this situation economic growth must be explained and unemployment cannot be prevented with a high growth rate which case should be considered. That balanced of nature unemployment rate with optimal growth rate can be evaluated as rational foresight.

Keywords *- Unemployment, Economic Growth, Vector Autoregressive Model, Okun's Law.*

1. Introduction

Economic indicators such as the change in unemployment rates and economic growth-recession are very important for the economy of countries. Many of the developing and developed economies implement programs for solving such problems. Unemployment is considered as a more important problem especially for developing countries. The indicators of economy and especially unemployment rate undergo a fast change with many shocks emerging in transition economies [5].

There are many internal and external factors affecting countries' unemployment problem. Among these factors, economic growth-recession and unemployment relationship is a very important issue. This relationship can be explained with "Okun's Law", one of economic principles.

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Countries generally benefits from indicators like GDP as economic growth criterion. The relationship between economic growth and unemployment is based on making contribution to economic growth by creating new employment areas.

This relationship foresees a negative relationship between unemployment and growth rates known as "Okun's Law" in literature [17]. In many empirical studies carried out regarding Okun's Law, it is known that increase and decrease rates of unemployment are symmetrical in growth and recession periods occurring during cyclical fluctuation. However, in recent studies, it has been revealed that increase effect in unemployment rate of decreases in real output shows an asymmetrical structure in recession periods with falling effect in unemployment rate of increases in real outputs in growth periods [3], [15], [9], [8], [18], [2].

In absolute evaluation from the end of 1980s thought as the first years of Turkey's transition to liberal economy until today, unemployment and GDP have followed a positive course. In 1988, unemployment was 8.40% and GDP was 63 980 855 $, and in 2012 unemployment was 9.20% and GDP was 438 476 381 837 $. As a result of the evaluations made according to deflated values, unemployment showed 9.52% increase and GDP showed increase at the rate of 7.7 times in 2012. In 1994 and 2001 which were crisis years in Turkey and in 2008 in which Turkey was also affected negatively like many countries in the world by the USA centered global crisis, a growth breakage takes attention. In crisis periods, employment slows down or stops with the recession occurring because of structural features of markets and economic fluctuations, young population just penetrating into the market cannot benefit from business opportunities and this causes the increase of unemployment rate [4].

In this study, the progress of DGP in Turkey in the last 25 years and unemployment rate and their relationships during this progress were tried to be linked to "Okun's Law" in economy literature. Although there are many studies regarding Okun Law in literature, there aren't enough studies about Turkey. It was aimed to put forth the current situation by interpreting the finding obtained quantitively and make some suggestions to macroeconomic policymakers.

2. Method

We analyzed the relationship between unemployment (UNEMP) and Gross Domestic Product (GDP) in Turkey's economy in the period of 1988-2012 by Vector Autoregression Model (VAR) Johansen Cointegration Analysis and Impulse-Response Analysis. The data belonging to the variables of the mentioned period were collected from World Bank and TURKSTAT and converted those data into real growth rates basing on the year 1988.

Unit root test was performed to the converted data. Unit root test is a method adopted in order to put forth random walk behavior of the related variables within the course of time and theoretically obtained as in Equation 1 [6];

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

The suchlike interaction between economic relations is complicated and multi-directional. Therefore, there are various equations used to estimate these relations and the use of simultaneous equation systems becomes compulsory. It can be stated before explaining VAR model that it is the continuation of a simultaneous equation model and put forth by the

development of simultaneous equation model. Simultaneous equation models are based on the ground that there is two way-simultaneous relation between explanatory variable and dependent variable [7]. In such models, there can be more than one equation and there should be at least one equation for each mutual endogenous variable and it can be given as in Equation 2 and 3;

$$Y_{1i} = \beta_{10} + \beta_{12}Y_{2i} + \gamma_{11}X_{1i} + u_{1i} \tag{2}$$

$$Y_{2i} = \beta_{20} + \beta_{21}Y_{1i} + \gamma_{21}X_{1i} + u_{2i} \tag{3}$$

Y_1 and Y_2 are mutual dependent or endogenous variables and contingent, X_1 is an exogenous variable, u_{1i} and u_{2i} are contingent disruptive terms and contingent. EKK application here will cause incoherent predictions unless it is shown that Y_2 is distributed independently from u_{1i} and Y_1 is distributed independently from u_{2i}[7].

Those equations in the examples are known as structural equations as y_t affects x_t and x_t affects y_t directly. These equations are required to be converted into brick equation models in order to be used. Those equations can be written according to matrix algebra as they are in Equation 4;

$$\begin{vmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{vmatrix} \begin{vmatrix} Y_{1i} \\ Y_{2i} \end{vmatrix} = \begin{vmatrix} \beta_{10} \\ \beta_{20} \end{vmatrix} + \begin{vmatrix} X_{1i} & \gamma_{21} \\ \gamma_{11} & X_{1i} \end{vmatrix} + \begin{vmatrix} u_{1i} \\ u_{2i} \end{vmatrix} \tag{4}$$

A briefer form of this matrix is given in Equation 5;

$$Bz_t=\Gamma_0+\Gamma_1 z_{t-1}+e_t \tag{5}$$

[19] argued that it won't be a right approach to make endogenous and exogenous variables differentiation and he put forth VAR model and it can be expressed as in Equation 6 and Equation 7;

$$M_{1t} = \alpha + \sum_{j=1}^{k} \beta_j M_{t-j} + \sum_{j=1}^{k} \gamma_j R_{t-j} + u_{1t} \tag{6}$$

$$R_t = \alpha' + \sum_{j=1}^{k} \theta_j M_{t-j} + \sum_{j=1}^{k} \gamma_j R_{t-j} + u_{2t} \tag{7}$$

Presumptively, as M_1 affects R, the same situation is true from R through M_1. "u"'s signify contingent error terms in Equation 5 and 6 and it is possible to foresee each equation by EKK method. All of the shared error components in VAR model, which has two variables as it is in the Equations 5 and 6, are connected to the first variable in the model [1].

Cointegration analysis giving opportunity for variables whether they move together in the long term was performed after setting up VAR model. While performing Cointegration analysis, multiple equation approach developed by [11], [13], [12] was used. In this approach, all variables in the model are used as endogenous variable and variable selection isn't needed for normalization. The final condition of the model is given in Equation 8;

$$\Delta Z_t = \sum_{i=1}^{p} \pi_i \Delta Z_{t-i} + \pi Z_{t-p} + e_t \quad (8)$$

In this equation, the rank of π matrix is equal to the number of independent cointegrated vectors. If rank (π)=0, π matrix in the last equation becomes zero matrix. First-order differential of the equation becomes VAR model. If rank is (π)=n, vector process is stationary. If rank is (π)=1, cointegrated vector number is equal to one. In the equation πZ_{t-p} is equal to error correction factor. As a result, if 1<rank(π)<n, there are many cointegrated vectors.

3. Results

In the research, the relationship between unemployment and GDP AND the validity of Okun Law in economic theory within 25 year period were investigated. It is thought that it will be beneficial to analyze the theory with simultaneous equation systems.
Stationarity analysis considered as the first step was handled within 25 year time span in order to put forth this foresight in more details with some quantitative solutions in which VAR equation system can be basically evaluated.

The results of ADF unit root test for stationarity analysis regarding unemployment and GDP variables are given in Table 1.

Table 1. Augmented Dickey-Fuller Unit Root Test Results

Variables	ADF statistics	
	Levels	First differences
UNEMP	-2,3501	-4.0334[a] (0.0221)
GDP	-2,5215	-5,3487[b] (0.0014)
Critical values		
UNEMP	-3.6222	-3.6222
GDP	-3.6121	-3.6222

ADF test use an intercept and trend and lag length has been chosen based on minimum AIC.
p-Values are one-sided [14]
[a,b] Implies significance at 0.01and 0.05 levels respectively, numbers in parentheses are the corresponding p-values.

When unit root test results calculated at level and first differences are analyzed, it is seen that unemployment and GDP variables show a random walk characteristics at the level. In order to analyze autoregression in VAR equation systems variables are expected to be at the same level as also foreseen by the theory. From this point of view, it is seen that t-statistics calculation values of variables whose first differences are taken are bigger than t-statistics critical values and they are meaningful at 5% level. In this way, VAR model could be set up and the relationship between variables could be analyzed.

VAR model which was formed by using the obtained lag length is presented in Table 2.

Table 2. VAR Model

UNEMP = 54,8588$^{[3,2537]}$ + **1,0990***UNEMP(-1)$^{[5,1087]}$ - **0,7589***UNEMP(-2)$^{[-2,9967]}$ + **0,1316***GDP(-1)$^{[2,6514]}$ -**0,0951***GDP(-2)$^{[-1,9154]}$

Adj. R^2=0,73 F=15,79

GDP= -159,5112 + **0,8279***GDP (-1)$^{[3,2449]}$ + 0,0570*GDP(-2)$^{[0,2235]}$ + 1,7934*UNEMP(-1)$^{[1,6227]}$ + 0,3853*UNEMP(-2)$^{[0,2962]}$

Adj. R^2=0,95 F=97,69

VAR test, lag length has been chosen based on minimum SIC
t-statistics in [ ]

The correlations between GDP and unemployment for the estimated VAR model are given in Table 2. According to this, when unemployment-GDP as dependent variable, 1 and 2 lagged value of explanatory variable unemployment and 1 and 2 lagged value of GDP are used in the model, the mathematical form of the model is as in Table 2.

According to the obtained result, when GDP is considered as a function of unemployment, a meaningful relationship at 5% and 10% level can be seen between unemployment-lagged values and GDP-lagged values. This relationship is positive in first year lags and negative in second year lags. According to this relationship, 1 unit increase in the value of GDP belonging to two periods before decreases unemployment 0.0951 unit. 0.07589 unit decrease is observed in unemployment rate in the current year as a result of 1 unit increase in the value of unemployment. When GDP is evaluated as dependent variable, in the current year GDP shows 0.8279 unit increase in the face of one unit increase in GDP value of the previous period.

The results of Johansen Cointegration Analysis made in order to identify the relationships of the variables in the long term are given in Table 3.

Table 3. Johansen Cointegration Test According to Trace and Max-Eigen Statistics

Hypotheses	**Eigenvalue**	**Trace Statistics**	**5% Critical Value**	**Possibility**
None *	0,4880	19,0861	18,3977	0,0401
Maximum 1 *	0,2128	5,0264	3,8414	0,0250
Hypotheses	**Eigenvalue**	**Max.-Eigen Statistics**	**5% Critical Value**	**Possibility**
None	0,4880	14,0596	17,1476	0,1333
Maximum 1*	0,2128	5,0264	3,8414	0,0250

* at 5% level

When Table 3 is analyzed, while there are 2 cointegration vectors between variables according to Trace Statistics, there is 1 cointegration vector according to Max-Eigen Statistics. According to the results of Cointegration Analysis obtained with VAR equation system, if variables are integrated at I(1) level (if every variable isn't stationary on its own) at least one of the variables should be Granger cause of another [1995].

VAR Granger Causality Analysis results analyzed by the help of VAR model in order to put forth the relationship between unemployment and GDP are given in Table 4.

Table 4. VAR Granger Causality Test Results

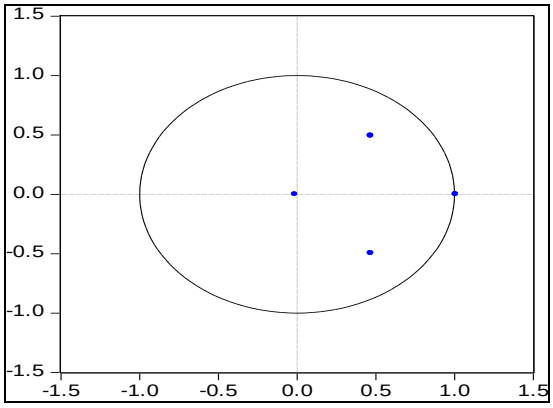
Hypotheses	Chi-square	Probability
GDP→ The Cause of Unemployment	9,5978	0,0082
Unemployment→ The Cause of GDP	5,8064	0,0548*

*at 10% level

When Table 4 is analyzed, according to the results of Granger Causality Analysis, two way relationship was observed between unemployment and GDP as a result of the handled relationships of variables. According to this, in 1988-2012 period, it is possible to mention about the mutual affection in GDP and unemployment fluctuations in Turkey.

An important criterion in the analysis of VAR modellings is the stationarity of the system. In order to put forth this, reciprocal roots of AR polynomial are expressed as either in figure or table. Reciprocal roots of AR polynomial are given in Figure 1.

Figure 1. Inverse Roots of AR Characteristic Polynomial



When Figure 1 is analyzed, it is seen that as a result of the test performed through error terms the model shows a stationary structure. The stationarity or stability of the model depends on the eigenvalue of coefficient matrix. As shown in Figure 1, if all eigenvalues of coefficient matrix are in the unit circle the system is stationary or stable but if at least one of the eigenvalues is on or outside of the unit circle the system isn't stationary or stable or it shows a characteristics expanding gradually [10],[16].

Breusch-Godfrey Test which was performed in order to analyze whether the formed VAR model included a higher-order autocorrelation is given in Table 5.

Table 5. Breusch-Godfrey Test for Ordered Autocorrelation Research

Lag	LM Statistics	Probability
1	4,264749	0,8931
2	6,357857	0,7036
3	8,559707	0,4789
4	13,58139	0,1380
5	6,270278	0,7126

6	6,423040	0,6969
7	8,177274	0,5164
8	12,08031	0,2088
9	4,109869	0,9040

The results of Lagrange Multiple (LM) used for determining whether error terms in the estimated VAR model are interrelated were analyzed and it was seen that there was no autocorrelation at 9 lag level.

The results of White Test performed for determining whether error terms variance is stable for the whole series are given in Table 6.

Table 6. The Results of White Test for Heteroscedasticity Test

Chi-Square	**df**	**Probability**
29,9382	24	0,1868

When Table 6 is analyzed, it is seen that chi-square value is 29,9382 and p=0,1868. It can also be stated that the variance of error term is stationary for all observations because "p" value is p>0,05. In other words, there isn't a relationship between the present and past values of error terms in the established model. This shows that there isn't any deviation from the prediction regarding the error term in regression models.

4. CONCLUSION

In this study, covering the period between 1988 and 2012, the unemployment and the changes in GDP were associated with Okun's Law among economic theories. The variables linked as suggested by the theory were analyzed through simultaneous equation method among econometric models and the quantitative findings were interpreted. VAR model was used in simultaneous equation analyses and the stationarity of the variables were evaluated by means of ADF unit root test. Afterwards Johansen Co-integration Analysis and Granger Causality Analysis were carried out accordingly.

A seasonal negative relationship was detected between unemployment and GDP as foreseen by Okun's Law and a meaningful quantitative relationship was observed. The relationship between GDP increase and unemployment rate can be different during economic recession and growth periods. The breakdowns in economic indicators that took place in Turkey in 1994, 2001 and 2008 prove this theory. For this reason, Okun's Law should be considered as within the frameworks of a rule or theory rather than a fundamental milestone in economies. One of the most significant reasons why this relationship was directly effective in Turkey is the aforementioned seasonal changes. The swift changes which occurred in 2000s and different economic policies implemented in parallel with the fact that the increase in GDP couldn't catch up with the decrease in unemployment rate reflect the change of this economic cycle. The factors such as introduction of new products and services, and the changes in export effected employment; however this caused the companies in post-crisis recovering process to be more cautious, thus prevented the positive influence on the employment

increase. Therefore, in spite of the increase at output level it didn't result in the same level of increase in employment. This result indicates that a fast economic growth process alone is not a sufficient way for fighting against unemployment. Macroeconomic policy makers should take into consideration that the reflection of economic growth on employment depends on some conditions, this should be explained by meditating on the circumstances thoroughly and a high growth rate can't prevent unemployment. Reaching to the natural unemployment rate with optimum growth rate can be considered as a right route.

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