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The Analysis of The Relationship Between Unemployment And Inflation In Turkey By Var Model

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Abstract – The main point of this study is to analyse the relationship between unemployment and inflation in Turkey. The study investigation period is the years between 1988 and 2002. Vector Autoregressive Model (VAR) and impulse-response analysis are used in the study to explain the relationship. According to the results, there is a negative way relationship between unemployment and inflation. This result is a supportive of Philips curve. This conclusion is important for stating an optimal inflation target and therefore obtaining a natural unemployment rate.

Keywords **-**
Unemployment, Inflation, VAR Model.

1.Introduction

Observing if there is an economic order operates well or not can be done by looking whether there are opportunities for everyone who wants to work for a valid fee. Unemployment is one of the problems of modern industries. Unemployment is a social, not a personal problem because it is originated from the structure of industry based economic system and it is because of the economic policies if there are people who cannot find a job even if they want to work [22].

There are many inner and outer factors affecting the unemployment problem of countries. One important one of these factors is the relationship between unemployment and inflation. "Philips curve" is used for over half a century in order to explain this relationship.

Philips curve is one of the basic elements of macroeconomics. Structurally, it enables to state inflation rate as a function of unemployment rate [20]. The theory argues that in economies of low unemployment rate, the demand caused by high purchasing power rate raises the inflation

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rate whereas the economies of high unemployment rate promotes low purchasing power and is causes low inflation rates. Briefly, it foresees a negative way relationship between inflation and unemployment. In the studies after Philips Curve has been put forward, it is foreseen that the curve is valid in short term and expected inflation rates [5]. The relationship between inflation and unemployment has been studied through various quantitative methods in many studies [1], [8], [11], [17], [10], [12], [2], [6], [21], [20] carried out by Philips Curve which is still seen as a keystone in creating macroeconomics policies and suggestions have been made to macroeconomics policy makers by comparing with different theories.

In this study, we analysed the relationship between unemployment and inflation in Turkey's economy.

Turkey is a country in the process of development and its economy has undergone structural reforms since the beginning of the millennium in order to realize a sustainable development. Turkey is led by a strong political leadership in the last 10 years, which is not typical for the country. As a result of this political stability, Turkey has been ranked 17th in 2012 by its 800 billion dollars of Gross Domestic Product based on IMF's world's economic outlook.

In the study, we analysed the relationship between inflation and unemployment between the years 1988-2012. This is because this period contains recession, slowdown and upturn sessions in Turkey's economy. This situation may be more attractive when evaluated in terms of unemployment and inflation. The unemployment rate is 8.4% and inflation rate is 73.7% in 1988 in Turkey. Those rates are risen to high rates in 1990s. The increase oriented breakage in inflation and unemployment is notable in Turkey who is affected by USA centred global crisis just like many countries in 2008 and in the years 1994 and 2001 which are crisis years of Turkey. The recession caused by the business cycles and structural properties of the markets in crisis periods affects unemployment to an increasing trend [4]. In 2012, the unemployment rate is 9.2% and inflation rate is 7.5% in Turkey.

The study consists of four sections. The first section is about an introduction mentioning the importance of the topic, the second section is about econometric methods, the third section is about empiric findings and the last section is about conclusive information.

2.Method

We analysed the relationship between unemployment (UNEMP) and inflation (INF) in Turkey's economy in the period of 1988-2012 by Vector Autoregression Model (VAR) 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.

There is a negative way relationship between inflation and unemployment according to the Philips theory and it is hard to shape the functional structure of it. In other words, is inflation a function of unemployment or vice versa. As the similar interaction between economic relations are complex and versatile, it is a requirement for the equations used to foresee those relationships to be more than one, namely simultaneous equations are needed to be put in use. Simultaneous equation models are based on the two way-simultaneous relationships between explanatory and dependent variables [13]. There can be more than one equation in each mutual endogenous variable in this kind of models, examples of which can be seen in Equation 1 and Equation 2;

$$Y_{1i} = \beta_{10} + \beta_{12}Y_{2i} + \gamma_{11}X_{1i} + u_{1i} \quad (1)$$
$$Y_{2i} = \beta_{20} + \beta_{21}Y_{1i} + \gamma_{21}X_{1i} + u_{2i} \quad (2)$$

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}.

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 3;

$$\begin{vmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{vmatrix} \begin{vmatrix} Y_{1i} \\ Y_{2i} \end{vmatrix} = \begin{vmatrix} \beta_{10} \\ \beta_{20} \end{vmatrix} + \begin{vmatrix} X_{1i} & \gamma_{21} \\ \gamma_{11} & X_{1i} \end{vmatrix} + \begin{vmatrix} u_{1i} \\ u_{2i} \end{vmatrix} \quad (3)$$

A more brief form of this matrix is given in Equation 4;

$$Bz_t=\Gamma_0+\Gamma_1 z_{t-1}+e_t \quad (4)$$

This problem caused by simultaneous equation systems can be eliminated by VAR models put forward for the solution of this complex table. VAR models are frequently preferred in time series as they present dynamic relationships without any restrictions on structural model [15]. As the model does not require differentiation of variables as endogenous or exogenous on the basis of a economics theory, it differs from simultaneous equation systems. Moreover, as deferred values of dependent variables are present in VAR models, it is possible to make strong estimations for the future [16].

The VAR model can be expressed as in the Equation 5 and Equation 6 [23];

$$M_{1t} = \alpha + \sum_{j=1}^{k} \beta_j M_{t-j} + \sum_{j=1}^{k} \gamma_j R_{t-j} + u_{1t} \quad (5)$$
$$R_t = \alpha' + \sum_{j=1}^{k} \theta_j M_{t-j} + \sum_{j=1}^{k} \gamma_j R_{t-j} + u_{2t} \quad (6)$$

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 [3].

It is a question of debate that if it is necessary for the variables in VAR model to be stationary or not. The basic debate against to difference operation is that they cause a loss in the data about the co-movement. The common opinion about the situation is that variables in the system should be obtained from real data production procedures [9]. Recent empirical studies are aimed to test if the first differences of data set or level values are suitable for use. Statistical techniques are for to state if it is suitable to use level values of time series variables, namely to determine whether the data does change in the time span. It is highly important for the series to determine. The reason is that, the analysis of the predictions done by

nonstationary series should be evaluated differently from the predictions done by stationary series. In many occasions, predictions from nonstationary series put forward the results which are statistically untrue [23]. Oppose to difference operation even if it contains unit root and they express that the purpose of VAR analysis is not to estimate parameters but to state the relationships between variables. The determination of stationarity of the variables in the VAR model of this study is done by Augmented Dickey Fuller (ADF) unit root test.

In the (ADF) unit root test, the Equation (7) is estimated and it is tested if the parameter α (α=ρ-1) is statistically different from zero. The acceptance of parameter α is different from zero shows that the series is stationary in level [7].

$$\Delta Y_t = \beta_0 + \beta_1 t + \alpha Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (7)$$

In the Equation (7), parameter $\Delta Y_t = Y_t - Y_{t-1}$, βo stands for constant term, t stands for deterministic trend, k stands for latency length and ε_t stands for stochastic error term.

Finally in the study, the reactions of the variables towards each other against a one unit shock are put forward by impulse-response analysis. Impulse-response functions put forward the sensitivity of the dependent variables in VAR model against the shocks of other variables and therefore a one unit shock is applied to the error term for each variable in each equation and effects are observed on VAR system in the time span. In this case, g^2 units of impulse-response function can be created for g unit variables in the system [3].

3. Results

Variables clarified from unit roots are needed as a prerequisite in order to structure the VAR equation system. ADF unit root test results of the variables of the study are given in Table 1.

Table 1.Results of ADF Unit Root Tests

Variables	ADF statistics	
	Levels	First differences
INF	-1.752	-5.008[a] (0.003)
UNEMP	-2,350	-4.033[b] (0.022)
Critical values		
INF	-3.612	-3.622
UNEMP	-3.622	-3.622

ADF test use an intercept and trend and lag length has been chosen based on minimum AIC.
p-Values are one-sided [18]
[a,b] Implies significance at 0.01and 0.05 levels respectively, numbers in parentheses are the corresponding p-values.

Table 1 shows the results of the ADF test on the integration properties of INF and UNEMP for Turkey. Results of the ADF test indicate that the two series are non-stationary. However, first differences of these series lead to stationary situation. These indicate that the integration of INF and UNEMP for Turkey is of order one, i.e. I(1). Required terms for the structure of VAR model are provided by this way. VAR model results are given in Table 2.

Table 2.Results of VAR model

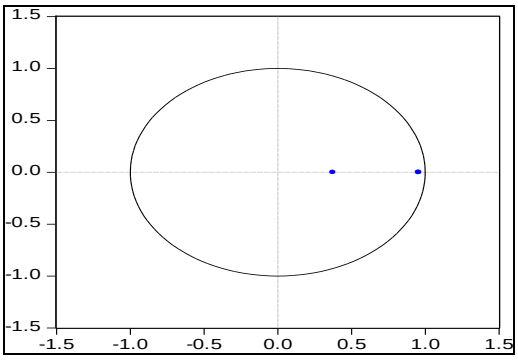
$INF = 14.911^{[0.407]} + \mathbf{0.905} * INF(-1)^{[6.801]} - 0.114 * UNENM(-1)^{[-0.427]}$
Adj. R-squared = 0,76 F-statistic =73,90
$UNEMP = 77.999^{[2.900]} - \mathbf{0.230} * INF(-1)^{[-2.357]} + \mathbf{0.424} * UNENM(-1)^{[-2.162]}$
Adj. R-squared = 0,69 F-statistic =26,69

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

According to the obtained results, there is a 5% of significant relationship between inflation and unemployment. This is a negative way relationship and it means that a 1 unit increase reduces 0,23 unit of unemployment.

On the other hand, it is required to test error terms and if the predicted model shows a stationary structure, after the prediction of the model. The model's being stationary or steady depends on the eigenvalue of the coefficient matrix. If the eigenvalues of the coefficient matrix are inside of the unit circle, the system is stationary and steady but if at least one of them is on or outside of the circle, the system is not stationary and shows an expanding characteristic [14], [19].

Fig. 1. Inverse Roots of AR Characteristic Polynomial



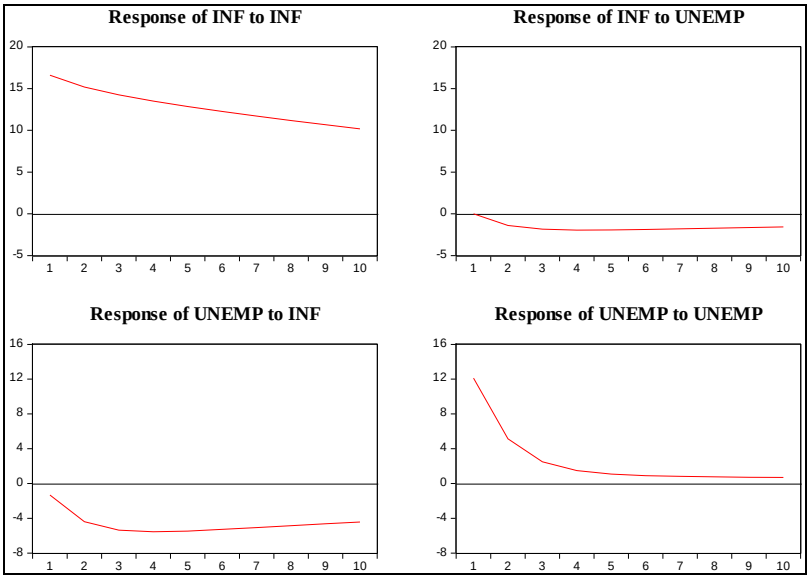
As it can be seen in Figure 1, the positions of inverse roots of AR characteristic polynomial in the unit circle show the model is stationary.

Breusch-Godfrey test is carried out in order to analyse if the VAR model contains an autocorrelation of high levels. The results of Lagrange Multiple (LM) statistics, which is used to state if the error codes in VAR model are related with each other, are analysed and no autocorrelation is seen in different deferred levels.

According to the results of the White test, which is used to state if error terms variance is fixed for the entire series, the error terms variance is fixed for the entire observations (Chi-Square 8.81 and p=0.72).

The results of the Impulse-Response analysis, which is applied to put forward the mutual interaction of unemployment and inflation, are shown in Figure 2.

Fig. 2. Impulse-Response Function Graphics between Unemployment and Inflation



As the Figure 2 is viewed, it is seen that the relationship between inflation and unemployment is in negative way. Even if its own deferred values give the maximal response against a one unit shock of inflation, inflation's response to unemployment is negative for the first three terms. The same situation is valid when it is interpreted looking by the aspect of unemployment. Unemployment's own deferred values give the maximal response for a one unit shock of unemployment. Besides, unemployment's response for inflation is in a notable decline in the first three terms.

4. Conclusion

In this study covering the period of between the years 1988-2012, a negative way relationship is assessed between unemployment and inflation in Turkey. This finding is a supportive of Philips Curve. When it is taken into consider in stating the phenomenon of inflation that wages are stated directly by the public and indirectly by the routing of the private sector, the trade-off between inflation and unemployment has been keeping its validity since the last sixty years. High inflation and unemployment has some social results as well as it has effects in macroeconomics results. High inflation causes a sided attitude in capital flow as well as a loss in purchasing power in personal revenue and the increasing requirement for external sources. Besides, it has effects even resulting in an income distribution gap. Unemployment phenomenon is a more perceivable situation in comparison with the direct effect of the inflation on society. It can cause corrupting social patterns, creating social unrests and dispersing family integrity. For this reason, it is seem to be a better method in application for the macroeconomics policy makers to take notice of the mutual interaction of these two factors instead of making a selection between them. It seems to be the best way to keep the inflation rate in an optimal and steady level by economical politics means and to state the natural unemployment level accordingly.

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