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ECONOMIC GROWTH AND UNEMPLOYMENT IN TURKEY: AN EMPIRICAL STUDY

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ABSTRACT

In this study we have investigated a series of unit root, co-integration and causality tests to ascertain the direction of causality between the economic growth and unemployment in Turkey for the period 1970-2003. Moreover, the information on co-integration (Johansen, 1988 and Johansen and Juselius, 1990) in variables is taken into consideration in specifying the correct model. The results show that short-run uni-directional causality running from economic growth to unemployment but not vice versa.

1. INTRODUCTION

The unemployment is a very serious economic problem in Turkey. Actually the employment situation in Turkey differs from the other countries on a large scale. The labor force is more agrarian and there is a considerable population movement to the urban areas. On the other hand, during the last 10 years there has been a significant economic stagnation in Turkey for some years. In general the decade of the 1990's in Turkey is characterized by liberation of the markets which opened a wide range possibilities bringing noticeable benefits for whole economy; but also the globalization increased the risk of the external shocks which in 1990's negatively affected the Turkish economy several times. The main purpose of this study is to study analyze the relationship between long-term growth and unemployment levels in Turkey, by using econometric methods.

2. THE EXISTING STUDIES ON THE ECONOMIC GROWTH AND UNEMPLOYMENT

The research about the topics of growth and unemployment has elicited an extensive academic attention since the works of Harrod (1956) and Domar (1947). In his original growth model, Solow (1956) assumed "disembodied" technical progress. He concluded that any improvements in technology instantaneously affected the productivity of all production currently employed (Zagler, 2000). Recently Gordon (1995) provided a common explanation to the productivity slowdown and high employment in US and the relatively high growth and unemployment in European countries. In his analysis, he found out a trade-off growth and unemployment in the short run, but the trade-off disappears in the long run due to a process of dynamic adjustment (Gordon, 1995).

The work by Postel-Vinay (1998) represents the steady state and dynamics of the standard matching model. The researcher indicates that the relationship between unemployment and growth may not be considered clear-cut. His model, allowing for endogenous capital accumulation and endogenous growth, also exhibits interesting dynamic features, and suggests some kind of asymmetry in the adjustment of employment over the cycle. A collection of numerical experiments finally shows that a linear approximation of the model may yield a dynamic scheme that is reasonably close to the one obtained with the nonlinear model, and that this feature is very robust to changes in particular assumptions made on the specification of various functions (Postel-Vinay, 1998).

Pehkonen in his study contributes to the discussion on possible changes in the functioning of the Finnish economy. The Finnish economy experienced dramatic changes in the early 1990s, and the collapse of the economy resulted in a 12% decline in GDP over the years 1991-1993, leading to a significant fall in the demand for labor and a rise in unemployment. Using the empirical analysis based on aggregate variables from the period 1975-1996, the author scrutinizes the stability of the employment/unemployment-output relation. He concludes that the relationship between aggregate-level employment/unemployment and output growth remained relatively stable throughout the investigation period (Pehkonen, 2000).

An another example in literature is of a contribution by Martin Zagler (2000). Zagler tests of two hypotheses which are a unique equilibrium rate of unemployment for a given rate of economics growth, and an identical number of exit and entries from unemployment, using microenomic panel data for the United Kingdom. The result shows a significant and negative relation between unemployment and economic growth, using fixed effects panel regression methods. In his research, the author implies that faster sectoral change, driven by higher rates of innovation and therefore by higher rates of economic growth, would foster structural

unemployment. This test rejects the neoclassical Solow model in favor of a framework, which includes sectoral shifts (Zagler, 2000).

Using a structural time series model which allows an attempt to model the underlying dynamics of productivity growth jointly with the effect of unemployment, Muscatelli and Tirelli (2001) studies investigates the empirical relationship between unemployment and growth in a number of OECD economies. In the research the authors demonstrate that there is a negative correlation between unemployment and labor productivity growth in the most economies. The results also provide little support for the theory that recessions may stimulate productivity growth (Muscatelli & Tirelli, 2001).

In another interesting contribution, De Groot (2001) develops a two-sector endogenous growth model with a dual labor market caused by the operation of trade unions. He analyzes the relationship between growth and unemployment depends on the institutional details of the labor market. According to the study, growth and unemployment, in general, are intimately related for two reasons. Firstly unemployment affects the scale of operation of the economy and thereby the growth rate. And second, growth affects inter-temporal decisions of workers about where to allocate on the labor market once they are laid off (De Groot, 2001).

The lastly, Tripier (2002) applied the measure of dynamic correlation developed by Croux, Forni and Reichlin (2001), apt to investigate the relations between labor productivity growth and unemployment for post war US economy. He claims that the approximately zero value of the static correlation coefficient between the raw series hides strong-run movements and positive at business cycle frequencies (Tripier, 2002).

3. METHODOLOGY AND DATA

3.1. Methodology

This study overcomes the spurious regression problem associated with non-stationary time series by means of unit root test, using of cointegration techniques within a multivariate system of equations which is developed by Johansen (1988) and applied by Johansen and Juselius (1990). The procedure suggested by Johansen (1988) basically depends on direct investigation of cointegration in the vector autoregressive (VAR) representation.

A pth- order vector autoregression, denoted VAR (p) can be explained as:

$$X_t = c + x_1 X_{t-1} + x_2 X_{t-2} + \ldots\ldots x_p X_{t-p} + \Delta Q_t + \varepsilon_t \qquad (1)$$

Where X_t = nx1 vector of variables Y and unemployment, c= nx1 vector of constants (1x1 in our case), $\pi = nxn$ matrices of autoregressive coefficients for i = 1, 2…p, and Q_t denotes the deterministic conditioning variables. To distinguish between stationarity by linear combinations and differencing, a reparametrisation of equation (1) is needed. Thus, the equation (1) can be rewritten equivalently as:

$$\Delta X_t = c + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \ldots\ldots \Gamma_{p-1} \Delta X_{t-p+1} + \Pi X_{t-p} + \Delta Q_t + \varepsilon_t \qquad (2)$$

Where

$$\Gamma_i = -(I - \pi_1 - \ldots . \pi_i) \; (i = 1\ldots, p-1) \qquad (3)$$

and

$$\Pi = -(I - \pi_1 - \ldots - \pi_p) \qquad (4)$$

The only difference between equation (2) and a standard VAR in differences is the error-correction term, ΠX_{t-p}. The system represented in equation (2) also contains information on both the short and long-run adjustment to changes in X_t , via the estimates of Γ_i and Π respectively. The transformation of a VAR model for $I(1)$ variables into equation (2) can be called a cointegrating transformation.

Thus, this methodology investigates whether the coefficients matrix methodology Π contains information about long-run relationships among the variables of the system. The non-stationary component Π can also be factorised to test the null hypothesis r of reduced rank or equivalently, the number of cointegrating relationships, that is

$$H_0: \Pi = \alpha \beta' \qquad (5)$$

If rank (Π) = r < n, then there are matrices β' and α of dimension nxr such that $H_0: \Pi = \alpha \beta'$ and there are r cointegrating relations among the elements of βX_t is interpreted as a matrix of cointegration vectors and provides the property that elements in $\beta' X_t$ are stationary even though X_t is non-stationary. On the other hand, the elements of α indicate the speed of adjustment of particular variables with respect to a disturbance in the equilibrium relation.

To test whether unemployment has an impact on the economic performance of Turkey from 1970-2003, it is employed the framework of Granger causality (see Engle and Granger, 1987). In this framework, unemployment influences the development process and ultimately economic growth. Under *ceteris paribus* conditions, it is hypothesized that unemployment is inversely related to economic growth.

The study tests Granger causality by using bivariate autoregressive models and testing whether a block of lagged variables is significant. The objective is to investigate whether

observations of a variable like unemployment is potentially useful for anticipating future movements in Y. In the context of Granger causality, it is hypothesized that unemployment (represented by U) causes economic growth (Y) with respect to a given information set that includes the relevant variables (*i.e* U and Y), if Y is better predicted by adding the past time series for unemployment than by using the past Y series alone.
The ECM used in this paper is specified as follows:

$$\Delta LU = \alpha_1 + \sum_{i=1}^{q} \delta_{y\,i} \quad \Delta LY_{t\text{-}i} + \sum_{j=1}^{r} \sigma_{\ yi}\, \Delta LU_{t\text{-}j} + \theta_1\, ECT_{t\text{-}1} + \varepsilon_{yt} \qquad (6)$$

$$\Delta LY = \alpha_2 + \sum_{i=1}^{m} \beta_{\ ei}\, \Delta LU_{t\text{-}i} + \sum_{j=1}^{n} \gamma_{\ ei}\, \Delta LY_{t\text{-}j} + \theta_2\, ECT_{t\text{-}1} + \varepsilon_{et} \qquad (7)$$

Where α_1 and α_2 are constants, DLY and DLU are first differences of GNP and unemployment respectively, m, n are the optimal lag length of series DLY and q, r are the optimal lags of series DLU, $ECT_{t\text{-}1}$ and $ECT_{t\text{-}1}$ are the error correction terms that are from the long-run co-integration regressions:
The inclusion of the error correction term in the equation (6) and (7) give an extra channel through which causality may be observed. The error-correction coefficient $ECT_{t\text{-}1}$ is expected to capture the adjustment of DLY and DLU to their long-run equilibrium. DLY and DLU are the first differences of the logarithm of Y and U. On the other hand, u_t is the error term where u_t zero mean, serially uncorrelated random distributance_term. Thus, given the foregone discussion, there are four possible outcomes when the determination of the causal ordering between Y and unemployment is the task at hand, namely uni-directional causality from unemployment to growth or vice versa: bi-directional causality between the two variables and finally lack of any causal ordering.

3.2. Data

The data for Turkey consists of the period of 1970-2003. All variables are transformed to natural logs denoted as LU and LY. It is used real GNP for this analysis. The GNP data are obtained from State Planning Organisation, *Economic and Social Indicators: 1950-2000* and various years. The GNP deflator (1987=100) was used to deflate variables. The source of the above time series is the State Planning Organization of Turkey (SPO) (2002). All time series are expressed in real terms. GNP is measured as real GNP and taken from SPO.

4. THE EMPIRICAL ANALYSIS

Before conducting causality test, the variables must be found to be stationary individually. If both are not stationary, they must be cointegrated. The series, say Y_t will be integrated of order d, that is, $Y_t \sim I(d)$, if it is stationary after differencing d times, so Y_t contains d unit roots. Testing for causality or co-integration between the two variables is done in three steps. The first step is to confirm the order of integration of the variables, since the causality tests are valid only if the variables have the same order of integration. This study uses the augmented Dickey-Fuller test (ADF) (1979). Table 1 presents the ADF test results for the log levels of and first differences of logs of Y and U**.** The result of the ADF test shows that the calculated values of LY and LU are -1.322 and -0.3648 respectively. These are less than the critical value of -3.65 and -2.95 at the 1% of and 5% significance level respectively. Thus, the time series for LY and LU are not stationary. Furthermore, we calculated ADF test for first differences.

TABLE 1. AUGMENTED DICKEY-FULLER TEST

Variable	Test statistics	Critical Value 1%	Critical Value 5%
LU	-0.3648	-3.65	-2.959
LY	-1.322	-3.65	-2.959
ΔLU	-4.691**	-3.65	-2.959
ΔLY	-3.981**	-3.65	-2.959

* *Denotes for 5% significance level.*** Denotes for 1% significance level.

The calculated values are -3.981 and for DLY and DLU respectively. These values are greater than the critical value of –2.95 at the 5% significance level. On the basis of Table 1 DLY and DLU are stationary in first differences. Hence, both DLY and DLU are I (0).
The second step indicates to test the co-integration using the Johansen maximum likelihood approach (Johansen, 1988 and Johansen and Juselius, 1990). If there is co-integration the either uni-directional or bi-directional, Granger causality must exist, at least in the I (0) variables. Table 2 indicates the results of co-integration using Johansen maximum likelihood approach employing maximum eigenvalue statistic for VAR=1. We report the results of co-integration

analysis obtained by the estimation (a) with the lag length k=1. The maximal eigenvalue (λ max) statistic rejects the null of no co-integration (r=0) but not the null of at most one cointegrating vector (r=1) so there appears to be a single cointegrating vector for the system. Table 2 gives the co-integration analysis, where Max denotes the associated maximum eigenvalues.

TABLE 2. JOHANSEN AND JUSELIUS CO-INTEGRATION TEST BETWEEN LY AND LU 1970-03

R	Trace Statistics	Probability (95%)
r=1	20.875	[0.039]*
r=2	4.7620	[0.321]

- This results are carried out by PC-Fiml 8 version. See Doornik, A. J. and Hendry, F. D. (1995) . Denotes for 5% significance level. LU =9.2901 +0.418LY

Following the detection of the cointegrating relationship between unemployment (LU) and GNP (LY), an ECM was set up for investigating short -run causality. In the ECM, the first difference of each endogenous variable (unemployment (DLU) or GNP (DLY)) was regressed on a one period lag of the co-integrating equation and lagged first differences of all the endogenous variables in the system.

Source of causation can be identified by testing for significance of the coefficients on the dependent variables in Equation (1) and (2). First by testing $H_0 : \delta_{yi} = 0$ for all i in Equation (1) or $H_0 : \beta_{ei} = 0$ for all i Equation (2), we evaluate Granger weak causality. This can be implemented using a standard Wald test.

Asafu- Adjaye (2000) interpreted the weak Granger causality as "short run "causality in the sense that the dependent variable respond only to short-term shocks to the stochastic environment. Another possible source of causation is the ECT in Equations (6) and (7). The coefficient on the ECTs represents how fast deviations from the long run equilibrium are eliminated following changes in each variable. If, for example, θ_1 is zero, then unemployment does not respond to a deviation from the long run equibilirium in the previous period. This can be tested using a simple t-test.

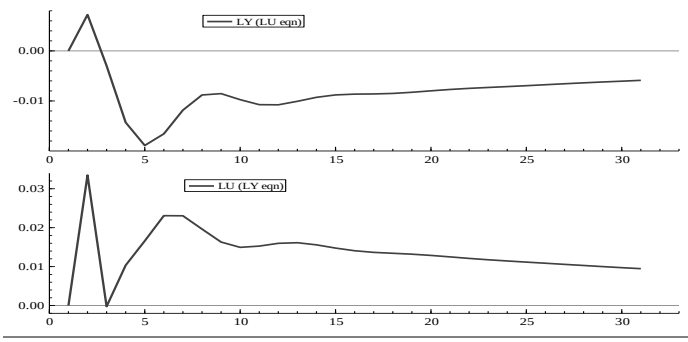
TABLE 3. GRANGER CAUSALITY TESTS

Dependent Variable	Source of Causation (Independent Variable)				
	Short-Run Causality		**Long – Run Causality**		
	ΔLU	ΔLY	ECT	ECT/ ΔLU	ECT / ΔLY
ΔLU	_____	2.8469 *	9.06641**	_____	3.90948*
ΔLY	1.61463	_____	0.000312	1.7778	_____

The appropriate lag lengths are chosen using Akaike's Information Criteria (AIC).
** Denotes for 5% significance level. ** Denotes for 1% significance level.*

In order to check whether the two sources of causation are jointly significant, in order to test Granger causality. This can be done by testing the joint hypotheses $H_0 : \theta_1 = 0$ and $\delta_{yi} = 0$ for all i in Equation (6) or $H_0 : \theta_2 = 0$ and $\beta_{ei} = 0$ for all in Equation (7). This is referred to as a strong Granger causality test. The joint test indicates which variable(s) bear the burden of short run adjustment to re-establish long run equilibrium, following a shock to the system (Asafu- Adjaye, 2000).

FIGURE 1. IMPULSE RESPONSE FUNCTION (IRF)



Moreover, we have impulse responses functions. Figure 1 shows the impulse response function (IRF). The time period of the IRF function spread over 30 years. The impulse response function traces over time the effects on a variable of an exogenous shock to another variable. The persistence of a shock tells us how fast the system adjusts back to equilibrium. The faster a shock dampens, the faster the adjustment. The response is

measured in terms of standard deviation. As we see from the first graph that there is a negative correlation between unemployment and GNP.

5. CONCLUSION

This study has investigated a series of unit root, co-integration and causality tests to ascertain the direction of causality between the growth of GNP (Y) and (U) unemployment in Turkey, employing the FPE (Final Prediction Error) method for determining the optimal lag length of the explanatory variables. Moreover, the information on co-integration in variables is taken into consideration in specifying the correct model. The main conclusion of this study is that there is a long-run equilibrium relationship, as detected by co-integration vectors, between Y and (U) unemployment. Furthermore, the short run causality test indicates that output is the cause of unemployment in Turkey. There is uni-direction causality between the variables. Employing Granger causality in a sample of Turkey, it is found uni-direction causal relation from economic growth to unemployment.

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