A Time Series Analysis of Turkish Unemployment

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Abstract
This study analyzes the effects of various macroeconomic shocks on unemployment in Turkey by using a structural VECM model. For this purpose, firstly, the Johansen Cointegration Test has been applied to employment, real wages, productivity, prices and unemployment rate variables. The Johansen Cointegration Analysis has revealed two long run relationships which can be interpreted as a "Labor Demand" and a "Wage Setting" relation. Secondly, a Structural VECM model has been described by means of restrictions obtained from the Cointegration Analysis and theoretical model. Based on the results of the Impulse-Response Analysis of the Structural VECM model, we conclude that technology, wage and labor supply shocks are significant effects on Turkish unemployment in the long run.

Keywords: The Cointegration Analysis, the Impulse-Response Analysis, the Structural VECM Model, Unemployment.

Introduction

Employment and unemployment are two of the most critical macroeconomic variables both in developing and developed countries. In almost all OECD and the EU countries, as well as in many developing countries, unemployment seems to have a persistently high level. In addition, employment and unemployment in Turkey are issues related to the economic and social structure as well as the macro economic policies. Recently, most of the discussions on the problems of Turkish economy have focused on the rising unemployment[1]. As relating to unemployment, the effects on the labor market of economical developments are very important as well. In addition, the unemployment rate in Turkey is affected by macro economic shocks and, especially, after the 2000-2001 economic crises in Turkey, unemployment rate seems to have a persistently increasing trend. This persistent rise in Turkish unemployment can be seen as an indicator of that unemployment rate will not return to pre-shocks level. This so-called the hysteresis hypothesis has played a critical role in the explanation of the persistent high unemployment rates. Furthermore, this notion based on the degree of hysteresis can be used to explain some elements of both structural and non-structural unemployment[2]. In this respect, determining the causes of high

[1] The population of Turkey is almost 70 million. 30 % of this population consist of children under the age of 15. Furthermore, the working population (15-64) is around average of the EU countries. The older population in Turkey (65 +) is lower respect to average of the EU countries. However, labor force participation rates have a decreasing tendency in Turkey (in 2005, 48.5%). This rate is around 70% in the OECD and the EU countries. General unemployment rate in Turkey is almost 10.1% in 2005. (According to Turkish Statistical Institute)

[2] See for more information about Hysteresis in Unemployment; Johansen, K., 2002, p:1-24, Camarero, M., Carrion-i-Silvestre, J.L., Tamarit, C., 2004, p:1-27, Mikhail, O., Eberwein, C. J., Handa, J., 2003, p:1-17, Fritsche, U. and Logeay, C.,

and persistent unemployment, the effects of the shocks of technology, wage, price, labor demand and labor supply on unemployment rate and relative contributions of these shocks in rising unemployment rate are crucial issues that need to be studied in Turkish economy.

The paper is organized as follows. Section 2 presents the theoretical and the econometric modeling framework briefly; Section 3 presents the Unit Root Test, the Cointegration Analysis and the results of the Structural VECM Model which also contains the impulse- response analysis. A summary of the main results are given in Section 4 also.

Model[3]

The theoretical model for the empirical analysis is the augmented Blanchard and Quah (1989) Model by Dolado and Jimeno (1997). The aim of this theoretical model is to determine the type of the shocks affect the equilibrium of labor force market and the importance of these shocks on unemployment rate. The possible shocks are identified as shocks to technology, price, wage, labor demand, and labor supply. The theoretical model consists of three equations:

$$y = \varphi(d - p) \tag{1}$$
$$y = e + \theta \tag{2}$$
$$p = w - \theta + \mu \tag{3}$$

where y, p, e, w and (d-p) denotes the logs of output, price level, employment, nominal wages and real aggregate demand, respectively(Linzert, T. 2001, p:49).

According to Dolado and Jimeno (1997), the supply side of the theoretical model is supplied with the following equations:

$$l = c(w - p) - bu + \tau \tag{4}$$
$$w = w^* + \varepsilon_w + \gamma_1\varepsilon_d + \gamma_2\varepsilon_p \tag{5}$$
$$w^* = \arg\left\{e^e = (1 - \lambda)e_{-1} + \lambda l_{-1}\right\} \tag{6}$$

Equation 4, 5, 6 show a labor supply (l) function, wage setting function (w), and the targeted nominal wage (w*), respectively (Linzert, 2001, p:5; Brüggemann, 2003, p:5,6). The stochastic processes affecting the evalution of shocks are specified by:

$$\Delta d = \varepsilon_d \tag{7}$$
$$\Delta \theta = \varepsilon_s \tag{8}$$
$$\Delta \mu = \varepsilon_p \tag{9}$$
$$\Delta \tau = \varepsilon_l \tag{10}$$

Where $\varepsilon_d, \varepsilon_s, \varepsilon_p, \varepsilon_l$ are uncorrelated shocks to demand, technology, prices and labor supply (Linzert, 2001, p:5; Brüggemann, 2003, p:6; Dolado and Jimeno 1997, 1281-1307).
Solution of the model is given by following equations:

2002, p:1-22., Cross, R., Darby, J., Ireland, J., Piscitelli, L., 1998, p:1-39., Dreger, C. and Reimers, H.E, 2006, p:1-18, Raurich, X., Sala, H., Sorolla, V., 2004, 1-39, TUSIAD publication 1999, p:1-14.

[3] This part of the paper heavily draws on the works on Dolado and Jimeno 1997, p:1281-1307, Linzert, T., 2001, p:1-24, Brüggemann, R., 2003, p:1-29.

$$\Delta e = \phi(1-\gamma_1)\varepsilon_d + (\phi-1)\varepsilon_s - \phi(1+\gamma_2)\varepsilon_p - \phi\varepsilon_w \quad (11)$$

$$\Delta y = \phi(1-\gamma_1)\varepsilon_d + (\phi)\varepsilon_s - \phi(1+\gamma_2)\varepsilon_p - \phi\varepsilon_w \quad (12)$$

$$\Delta w = \gamma_1\varepsilon_d + \gamma_2\varepsilon_p - \phi\varepsilon_w \quad (13)$$

$$\Delta p = \gamma_1\varepsilon_d - \varepsilon_s + (1+\gamma_2)\varepsilon_p - \phi\varepsilon_w \quad (14)$$

$$\Delta u = (1-b)^{-1}\left\{-\phi(1-\gamma_1)\varepsilon_d + [\phi(1+\gamma_2)-c]\varepsilon_p + (1+c-\phi)\varepsilon_s + \varepsilon_l + \phi\varepsilon_w\right\} \quad (15)$$

(Linzert, 2001, p:5; Brüggemann, 2003, p:6)

To analyze these structural shocks, the Structural VAR Analysis process is used in empirical analysis.

$$A(L)x_t = v_t \quad (16)$$

Where x_t is a vector of time series, A(L) is a matrix of polynomials in the lag operator L, and v_t is a vector of i.i.d. residuals with covariance matrix $\sum_V$ (Linzert, 2001; p:6, Brüggemann, 2003, p:2-5, Aminsano and Giannini, 1997). To recover the structural shocks from the residuals of the reduced form ECM estimate, the residuals, v_t are assumed to be linear combinations of the structural disturbances, ε_t;

$$v_t = C\varepsilon_t \quad (17)$$

Where C is assumed to be an invertible matrix (Linzert, 2001, p:6). The common trends literature distinguishes between permanent and transitory effects. In particular, in a system with r cointegration relations, only k=K-r shocks can have permanent effects. To exactly identify permanent shocks we need k(k-1) additional restrictions. Similarly, r(r-1)/2 restrictions identify the transitory shocks. There, r shows number of cointegration relations. (Brüggemann, R., 2003, p: 3)

In this paper, the restrictions which are derived from the theoretical model represented by equations (1)-(6) to exploit the absence of permanent effects of some shocks on some variables. Also, as stated in Dolado and Jimeno (1997, p:1297), the main model is over-identified and there are many just-identifying assumptions resulting from the underlying assumptions of the model such CRS in production function, partial indexation of wages to shocks etc. However, we need nine long-run identifying restrictions, which can be derived from the structure of the model in Equations. (11)- (15) and one contemporaneous restriction to impose ten restrictions on the matrix C.

To derive these restrictions based on equations (11)-(15), following the Linzert (2001, p: 7), we subtract the employment from the real output and the price from the wage equation. Then, we get following equations:

$$\Delta(y-e) = \varepsilon_s \quad (18)$$

$$\Delta(w-p) = \varepsilon_s - \varepsilon_p \quad (19)$$

$$\Delta p = -\varepsilon_s + (1+\gamma 2)\varepsilon_p + \varepsilon_w + \gamma 1\varepsilon_d \quad (20)$$

$$\Delta e = (\psi-1)\varepsilon_s - \psi(1+\gamma 2)\varepsilon_p + \psi\varepsilon_w + \phi(1-\gamma 1)\varepsilon_d \quad (21)$$

$$\Delta u = (1-b)^{-1}\left\{(1+c-\phi)\varepsilon_s + [\phi(1+\gamma 2)-c]\varepsilon_p + \varepsilon_l + \phi\varepsilon_w - \phi(1-\gamma 1)\varepsilon_d\right\} \quad (22)$$

The long-run restrictions are the following (Dolado and Jimeno 1997, p: 1297 and Linzert, 2001, p:7):

- ε_d (aggregate demand shock) has no permanent effect on productivity (y-e) and real wages (w-p), because, by CRS, only productivity shocks increase productivity in the long-run, while productivity and price push shocks only affect the permanent component of real wages.
- Since productivity shocks increase productivity and real wages by the same amount, ε_s (productivity shock) has no permanent effect on the wage share.
- ε_w has no permanent effect on productivity and real wages, because of the same reasons explained with regard to ε_d.
- ε_l (Labor supply shock) does not affect prices (p) and productivity (y-e) in the long-run, since outsiders do not affect the wage determination process.

The short-run restriction is that ε_d (Labor Demand shock) doesn't have any effect on real wages within the initial quarter.

Empirical Analysis

In this section, we try to study the results of the Unit Root Tests, the Cointegration Analysis and to interpret the Impulse-Response Analysis of a Structural VECM model.

Data

In the study we have used monthly data for employment, real wage, productivity, consumer price indexes and unemployment rate variables for the period from 1988:10 until 2004:03[4]. Furthermore, Consumer Price Indexes (1987:100) have been obtained from the Central Bank of the Turkish Republic (www.tcmb.gov.tr), whereas the employment, real wages, productivity and unemployment rates have been secured from ESTIM (Economic Research and Consulting). In addition, employment and unemployment rate variables have been adjusted seasonally, and the natural logarithms of all the variables have been used.

The Unit Root Test and the Cointegration Analysis

The time series figures of employment (E), real wage (W), productivity (PR), consumer price indexes (P) and unemployment rate (U) variables in level are shown in Figure 1.

[4] We used this sample period, because we only could find the all related data for this examination period.

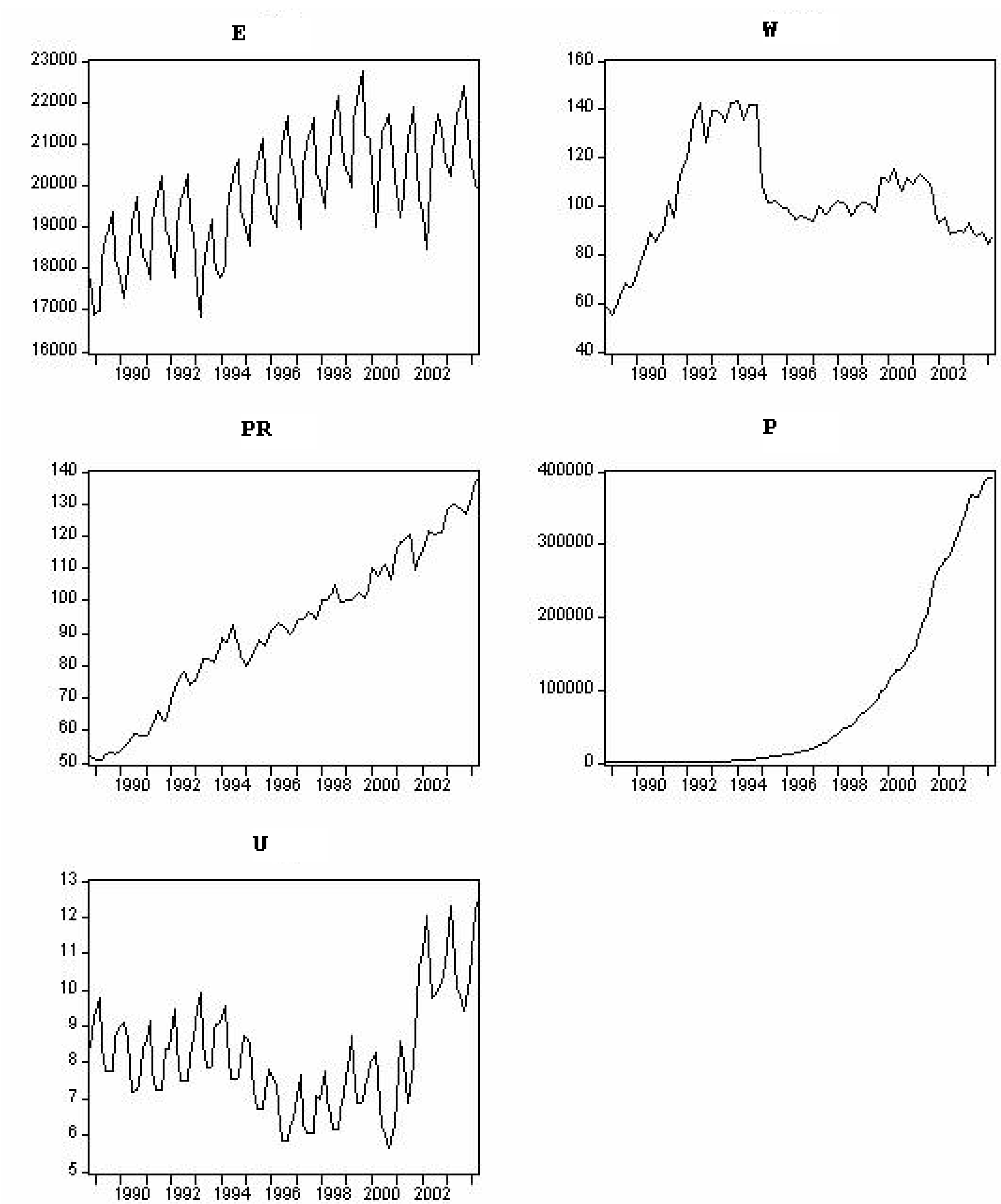

Figure 1: The Figures of the Time Series in the Level

As displayed in Figure 1, the variables of E, W, PR, P and U aren't mean stationary. As evidence of this evaluation, the results of the Augmented Dickey Fuller(ADF) and the Phillips Perron (PP) Unit Root Tests are displayed in Table 1[5].

Table 1: The Results of The Unit Root Tests

[5] In the study, the results of the preliminary analysis such as the Unit Root Tests and the unrestricted-Restricted Cointegration Analysis have been obtained by Eviews 5.1, and the Structural VECM Model Estimation has been obtained by JMulti 4.15.

Variables	Test Statistics
E_SA	PP(4)=-1,597561(0,4818) ADF(0)=-1,553521(0,5043)
DLE	PP(3)=-11,73712(0,000)* ADF(0)=-11,78140(0,000) *
W	PP(4)=-2,085487(0,2509) ADF(7)=-2,425532(0,1362)
DLW	PP(18)=-6,331906(0,0000) * ADF(6)=-3,150609(0,0247) **
PR	PP(5)=-2,897729(0,1657) ADF(10)=-2,444524(0,3555)
DLPR	PP(25)=-5,541342(0,0000) * ADF(9)=-3,539917(0,0080) *
P	PP(6)=1,301081(0,999) ADF(2)=1,020125(0,999)
DLP	PP(15)=-8,683724(0,000) * ADF(0)=-7,985844(0,000) *
U_SA	PP(8)=-0,727962(0,8359) ADF(1)=-0,335623(0,9158)
DLU	PP(7)=-11,69687(0,000) * ADF(0)=-11,21587(0,000) *
*, ** denotes significance at the 1%, 5% level respectively. In addition, p values are provided in parentheses.	

Column 1 in Table 1 indicates the time series in the level and the first differences (of their logarithms), Column 2 supplies the test statistics of ADF and PP Unit Root Tests. The results of both test types suggest that all the variables are integrated of order one, i.e. I(1). Therefore, it is necessary to determine whether the variables are cointegrated.

Prior to the test for the number of cointegration relations and cointegration situation, we set up an initial VAR model to determine lag order of the cointegration test. VAR lag Order Selection Criteria are displayed in Table 2.

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	491.9442	NA	2.81e-09	-5.502195	-5.412473	-5.465807
1	2367.602	3624.151	2.32e-18	-26.41358	-25.87525	-26.19525
2	2496.622	242.0039	7.18e-19	-27.58895	-26.60201*	-27.18868*
3	2521.199	44.71174	7.23e-19	-27.58417	-26.14863	-27.00197
4	2565.365	77.85051	5.84e-19	-27.80073	-25.91657	-27.03659
5	2616.015	86.42000	4.39e-19	-28.09056	-25.75780	-27.14448
6	2642.574	43.81594	4.35e-19	-28.10818	-25.32681	-26.98017
7	2682.252	63.21516	3.72e-19	-28.27403	-25.04405	-26.96408
8	2737.144	84.35465*	2.69e-19*	-28.61180*	-24.93321	-27.11991
9	2758.325	31.35230	2.86e-19	-28.56865	-24.44145	-26.89481

According to Table 2, the values of LogL, LR, FPE and AIC information criteria indicate that 8 lag orders are appropriate[6]. This lag order has

[6] Criteria; LR(Likelihood ratio test criteria), FPE (Final Prediction Error Criteria), AIC (Akaike Information Criteria), SC (Schwarz Information Criteria), HQ (Hannan-Quinn Information Criteria).

been applied for the cointegration test and the structural VECM model[7]. The next step is to estimate the Standard VAR (8)[8] model as beginning. In particular, the question will focus on whether there are any cointegration relations in data series of employment (E), real wage (W), productivity (PR), consumer price indexes (P) and unemployment rate (U). The Johansen Cointegration Test has been applied to reveal the long run behavior of the variables of interest[9]. The results of the test are displayed in Table 3.

Table 3: The Johansen Cointegration Test Results

Hypothesis								
H_0	H_1	Eigen value	Trace Stat.	5% Critical.	p value.	Max. Eigenvalue Stat.	5% Critical	p value
r=0	r>0*	0,256023	118,2983	76,97277	0,0000	52,34683	34,80587	0,0002
r=1	r>1*	0,172925	65,95148	54,07904	0,0031	33,60520	28,58808	0,0104
r=2	r>2	0,089278	32,34628	35,19225	0,0983	16,55255	22,29962	0,2608
r=3	r>3	0,064024	15,79372	20,26184	0,1843	11,71130	15,89210	0,2034
r=4	r>4	0,022801	4,082422	9,164546	0,4000	4,082422	9,164546	0,4000

(* denotes significance at the 1% level)

According to the unrestricted Johansen Cointegration Test, the results of the Trace and the Maximum Eigenvalue Tests indicate two cointegration relations. The Results of the test have supported two cointegration relations evaluated as "the Labor Demand" and "the Wage Setting", denoted by the theoretical model. The cointegrating vectors need to be identified for the financial interpretation of E, W, PR, P and U variables in the long run. To fill the role required, before the Structural VECM estimation, the restricted cointegration relations which are useful in terms of an economic interpretation have been researched.

In the restricted cointegration analysis, just-identification of the cointegration relations makes it necessary to impose one normalization and additional (r-1)[10] restrictions on each cointegrating vector[11]. In the literature, the Labor Market theory embodies numerous studies which confirm a labor demand and a wage setting relation[12].

Theoretically, these relations are provided by[13]:

a) The Labor Demand Relation

$$LE_t = \beta_{1,0} + \beta_{1,1} LW_t + \beta_{1,2} LPR + \beta_{1,3} LP_t + \beta_{1,4} Z_t + v_{1,t}$$

Where Z_t represents all other variables that have an influence on the labor demand.
b) The Wage Setting Relation

$$LW_t = \beta_{2,0} + \beta_{2,1} LPR + \beta_{2,2} LU_t + \beta_{2,3} Z_t + v_{2,t}$$

[7] See Kim and Liew (2004, p:1-8), Ivanov and Kilian (2001, p:1-30) as guide to lag order selection.

[8] Residual Serial Correlation LM Test Results of the Standard VAR(8) model have been given in Appendix 1.

[9] The Johansen cointegration Test has been implemented with (intercept (No Trend) in CE no intercept VAR)

[10] r is number of the cointegrating vector.

[11] Linzert 2001,p.9.

[12] See for more information, Linzert 2001, Hansen 2000, Anderson and Hylleberg 1998, Bean 1994, Dolado and Jimeno 1997.

[13] Linzert 2001, p.9-10, Hansen 2000, p.439-454.

Where Z_t identifies all other variables that have an influence on the wage setting. The results of the restricted cointegration analysis are given in Table 4.

Table 4: The Results of the Restricted Cointegration Analysis

Just-Identified Cointegrating Vector						
	LE	LW	LPR	LP	LU	C
$\beta_{LD,1}$	9,203301 (2,30174)	1 (0,0000)	-3,685480 (1,35064)	0,033337 (0,16558)	0 (0,0000)	-77,94695 (23,4738)
$\beta_{WS,1}$	0 (0,0000)	1 (0,0000)	-0,470414 (1,60558)	-0,174238 (0,17712)	-2,970644 (0,49116)	8,078211 (5,32757)
Over-Identified Cointegrating Vector						
$\beta_{LD,2}$	0 (0,0000)	1 (0,0000)	-4,905233 (1,42337)	0,365262 (0,15622)	0 (0,0000)	15,52338 (4,92167)
$\beta_{WS,2}$	0 (0,0000)	1 (0,0000)	1 (0,0000)	-0,351631 (0,05236)	-3,830824 (0,67260)	5,354890 (1,89078)

* Standard errors are provided in parentheses. The LR statistics is χ^2 distributed.

$\chi^2(2) = 11,72861$

$p = 0,002839$

In Table 4, the first hypothesis is to find a labor demand relation, whereas the second hypothesis is to locate a wage setting relation. Therefore, in both, the cointegrating vector normalizes the real wage variable coefficient to unity.

The unemployment rate variable from the first cointegration relation and the employment variable from the second cointegration relation have been eliminated. It is assumed that employment doesn't affect the labor demand, and all other variables participate in the equation unrestrictedly. In the same way, it is assumed that employment doesn't affect the wage setting, and all other variables participate in the equation unrestrictedly. In Table 4, the results of over-identification restrictions for parameters have also been displayed. Furthermore, in the over-identification restrictions in addition to just-identification, in the first cointegration relation, it is assumed that unemployment and employment variables don't affect the labor demand. In addition, in the second cointegration relation, while it is assumed that employment doesn't affect the wage setting, the coefficient of productivity is prescribed as 1. Moreover, both cointegration relations have normalized the real wage coefficient to unity.

According to over-identification vectors, the Labor demand and the Wage Setting relations are defined as:

$$LE_t = LW_t + 4{,}905233LPR_t - 0{,}365262LP_t - 15{,}52338 + ec_t^1$$

$$LW_t = LPR_t + 3{,}830824LU_t - 5{,}354890 + ec_t^2$$

The labor demand relation indicates positive relation between employment and real wages, and between employment and productivity. Yet, it indicates the negative relation between employment and prices. Additionally, the wage setting relation indicates a positive relation between real wages and productivity, and between real wages and unemployment.

The Structural VECM Model of Unemployment in Turkey

In this section, a structural VECM model has been estimated by restrictions identified from the theoretical model and from the results of the cointegration analysis, and the results of the impulse-response analysis of this structural VECM model have also been obtained.

In the study, K(K-1)/2=5(5-1)/2=10 additional linearly independent restrictions are theoretically needed to identify explicitly the structural shocks. In a five-dimensional system with two cointegration relations, only three shocks can have permanent effects. (k=K-r)=5-2=3

In addition, firstly, k(k-1)/2=3(3-1)/2=3 additional restrictions to accurately identify the permanent shocks, and secondly, r(r-1)/2=2(2-1)/2=1 additional restriction for contemporaneous shocks are highly desired[14]. The results of the cointegration analysis denote that the Labor Demand and the Wage Setting Relations are stationary. From the theoretical model, it can be said that the shocks of the Wage Setting and the Labor Demand don't have a permanent effect on other variables. This situation can be expressed by zero in the columns related to the identified long-run impact matrix. Similarly, it has been assumed that the unemployment rate doesn't have a permanent effect on productivity and prices. Furthermore, productivity doesn't produce a permanent effect on prices in long run, and employment in no way has any effect on real wages in the short run.

As such, the restrictions for the long run impact matrix (β') and the contemporaneous impact matrix (A_0) can be interpreted as:

$$\beta' = \begin{bmatrix} 0 & 0 & * & * & * \\ 0 & 0 & * & * & * \\ 0 & 0 & * & * & 0 \\ 0 & 0 & 0 & * & 0 \\ 0 & 0 & * & * & * \end{bmatrix} \qquad A_0 = \begin{bmatrix} * & * & * & * & * \\ 0 & * & * & * & * \\ * & * & * & * & * \\ * & * & * & * & * \\ * & * & * & * & * \end{bmatrix}$$

If the standard VECM model is estimated by restrictions imposed for β' and A_0 matrixes, the estimations of the long run impact matrix (β') and the contemporaneous impact matrix (A_0) can be obtained as[15]:

$$\beta' = \begin{bmatrix} 0 & 0 & 0{,}0004 & 0{,}0033 & -0{,}0073 \\ 0 & 0 & 0{,}0153 & -0{,}0055 & 0{,}0189 \\ 0 & 0 & 0{,}0125 & 0{,}0030 & 0 \\ 0 & 0 & 0 & 0{,}0173 & 0 \\ 0 & 0 & 0{,}0142 & -0{,}0142 & 0{,}0387 \end{bmatrix}$$

$$A_0 = \begin{bmatrix} 0{,}0051 & -0{,}0011 & 0{,}0039 & 0{,}0018 & -0{,}0026 \\ 0 & 0{,}0056 & 0{,}0038 & 0{,}0052 & 0{,}0054 \\ -0{,}0037 & -0{,}0015 & 0{,}0051 & -0{,}0017 & 0{,}0000 \\ -0{,}0055 & -0{,}0060 & -0{,}0034 & 0{,}0140 & -0{,}0042 \\ -0{,}0031 & -0{,}0110 & -0{,}0053 & -0{,}0031 & 0{,}0149 \end{bmatrix}$$

[14] Brüggemann 2003, p.11-12.; Linzert 2001, p.11; Lütkepohl 2005, p.4-9; Krusec 2003, p.18-19.

[15] The Standard Error Matrixes of the Long Run and the Short Run Impact Matrixes have been given in Appendix 2.

The fifth row of the long run impact matrix (β') shows the long-run response of unemployment to a labor demand, wage, technology, price and labor supply shocks. The Long-run effects on unemployment of the shocks of the Wage Setting and the Labor Demand are zero. Furthermore, the long-run effect on unemployment of the shocks of technology and labor supply is positive, and the effect of price shock is negative.

Impulse-Response Analysis

The Impulse-Response Analysis of the structural VECM model has been realized to research long run effects on unemployment of structural shocks.

The Impulse-Response Functions (Figure 1- Figure 6) which display the unemployment's response to all other variables in the system have enabled a general financial interpretation related by the long run relation among unemployment and other variables.

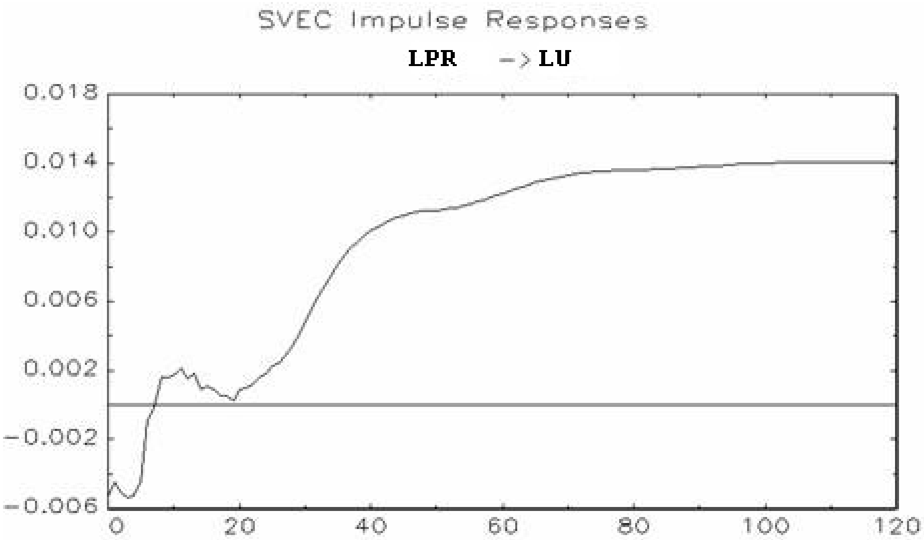

Figure 2: Response of Unemployment to Technology Shock

When the unemployment's response to technology shock, which is displayed in Figure 2, has been researched in the short run, it has been observed that technology shock has a negative effect on unemployment expanding out approximately to the eighth period. Furthermore, in the long run, it can be deduced that technology shock causes an increase in unemployment, and this effect is stationary in the very long run. Adjustment to new equilibrium takes roughly 3 years. In addition, the positive effect of technology on unemployment in the long run has also supported the direction of relation in the long run impact matrix.

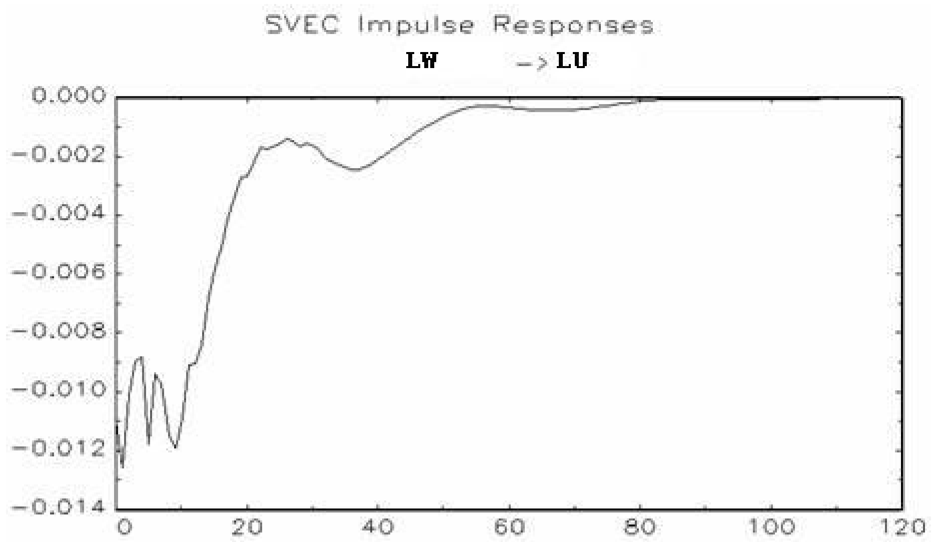

Figure 3: Response of Unemployment to Wage Shock

Figure 3 displays the effect of wage shock on unemployment. In the short run, a decreasing negative effect on unemployment up to almost fifth period, and an increasing negative effect on unemployment approximately to the tenth period can be observed in Figure 3. Moreover, starting from the tenth period, this negative effect has decreased substantially.

According to the figure, it can be said that this negative effect has disappeared and approached zero in the long run. This result underlines that wage shock doesn't have an effect on unemployment in the long run. Wage shocks can be compensated by increasing productivity in the long run. Furthermore, the result concerns the long run restriction imposed on wage variable from the theoretical model.

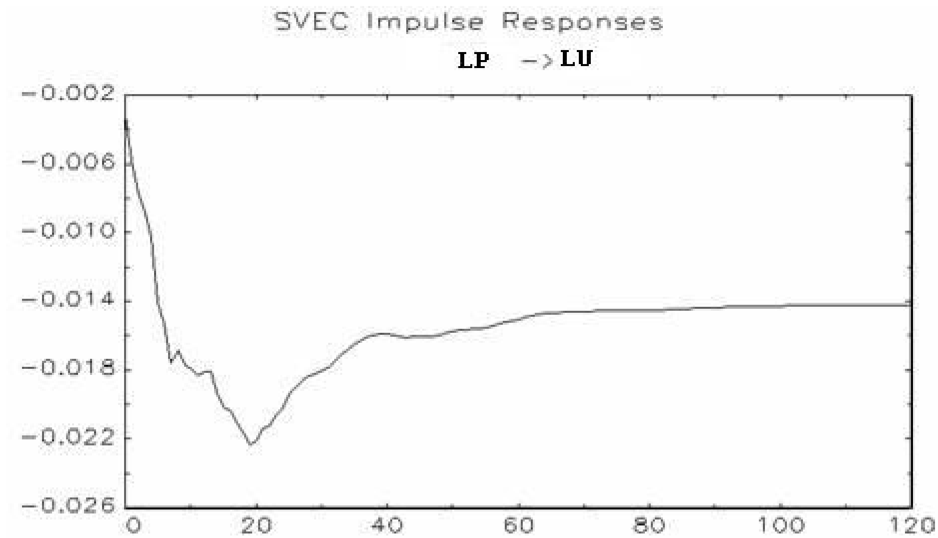

Figure 4: Response of Unemployment to Price Shock

Figure 4 displays the effect of price shock on unemployment. According to Figure 4, the negative effect of price shock on unemployment has showed a increase tendency approaching approximately the twentieth period. After this period, the decreasing negative effect of price shock is stationary in the long run. In addition, adjustment a new equilibrium takes about 3 years. This negative effect also supports the direction of relation in the long run impact matrix. It can be said that the price shock is an important factor for increasing unemployment.

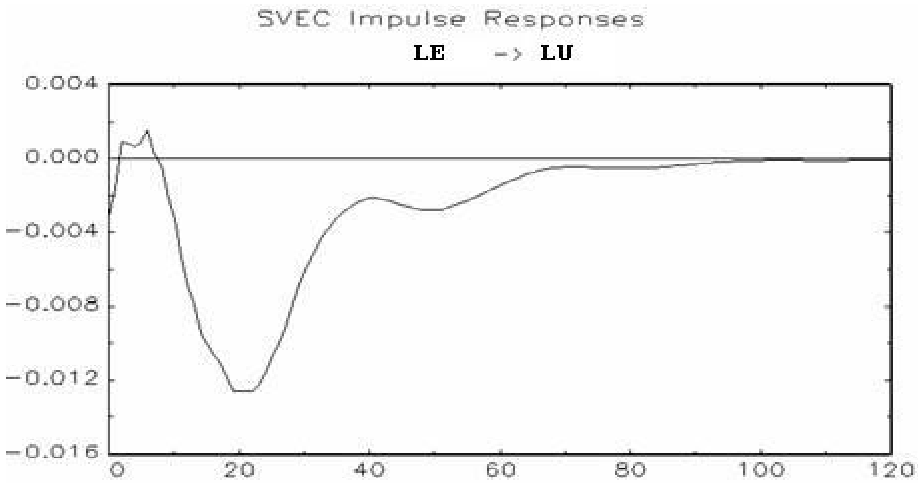

Figure 5: Response of Unemployment to Labor Demand Shock

From figure 5, the negative effects of Labor Demand on unemployment are observed. Reaching to almost the twentieth period, the negative effect of labor demand shock on unemployment has increased significantly. After this period, this negative effect has tended to decrease, and disappeared in the long run. As a result, the labor demand shock doesn’t have an important effect on unemployment in the long run. This result is tied with the restriction which is shown by zero in the long run impact matrix, and is imposed on employment variable from the theoretical model.

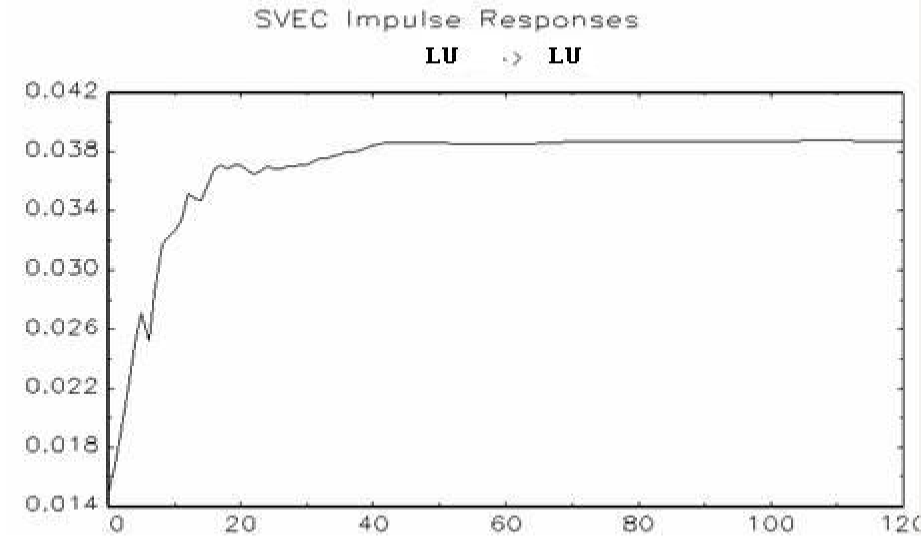

Figure 6: Response of Unemployment to Labor Supply Shock

Figure 6 shows the effect of the labor supply shock on unemployment. Figure 6 points out that the labor supply shock has a positive effect on unemployment in the long run. Furthermore, adjustment to new equilibrium takes 3 years. In addition, this positive effect has supported the direction of relation in the long run impact matrix. It can be said that the labor supply shock has contributed towards an increase in unemployment only for a short period; however, the effect of labor supply shock has remained stationary in the long run.

According to the results of the Impulse-Response Analysis of Structural VECM Model, we can easily argue that technology, price and labor supply shock are determinants which affect unemployment in the long run (but this effect is stationary after a period, adjustment takes roughly 3 years).

Also, wage and labor demand shocks are determinants which affect unemployment in the short run.

This study also discloses that wage and labor demand shocks are less important determinants to explain variations in unemployment in the long run.

Conclusion

In this study, we analyze unemployment dynamics in Turkey, particularly focusing on determining the long run effects of various macroeconomic shocks on unemployment. For this purpose, employment, real wage, productivity, consumer price indexes and unemployment rate variables for the period from 1988:10 until 2004:03 have been used, and a structural VECM model has been estimated. According to the results of the Phillips Perron and the Augmented Dickey Fuller Unit Root Tests used in the beginning of the study, it has been recognized that all variables are I(1). In this situation, the Johansen Cointegration Analysis has been applied. The results of the Cointegration Analysis have shown that all variables are cointegrated. Furthermore, the cointegration vectors have revealed two long run relationships which are interpreted as the Wage Setting and the Labor Demand. Moreover, the Structural VECM Model has been obtained by restrictions in the long run impact matrix by using the theoretical model and the results of the Cointegration Analysis.

The Impulse-Response Analysis of the Structural VECM Model displays that technology and labor supply shocks have a positive effect on unemployment in the long run, and price shock has a negative effect on unemployment in the long run. Also, wage and labor demand shocks have a negative effect which greatly decreases because of restrictions in the long run, and wage shock and labor demand shock have no permanent effect on unemployment. Moreover, the results indicate that adjustment to new equilibrium takes roughly 3 years. Also, it can be argued that wage and labor demand shocks are the main determinants of unemployment which create negative effects on unemployment in the short run. On the other hand, the technology, price and labor supply shocks are important determinants of unemployment in the long run.

The persistent rise in Turkish unemployment is mainly due to fact that Turkish economy can’t create new job opportunities, supported by jobless growth hypothesis. So, the satisfactory new job areas should be provided. In addition, high technology consumer goods should be produced and exported. Also, the reforms with the supply side should be undertaken in order to prevent costly deflationary policies in terms of unemployment. Furthermore, new policies which aim to create an effective labor market should be followed to combat with unemployment. Consequently, an active policy similar to the EU’s supported by sufficient growth, economic stability and flexible working will be able to solve problems related to employment and unemployment.

References

Amisano, G. and Giannini, C., 1997, Topics in Structural VAR Econometrics, *2nd edn, Springer Verlag*.
Andersen, T., M. and Hylleberg, S., (1998), “Wage Adjustment and Employment Persistency”, *Macroeconomic Dynamics*, 2, pp.472-491.
Bean, C., R., 1994, “European Unemployment: A survey”, *Journal of Economic Literature,* 32, pp.573-619.
Brüggemann, R., 2003, “Sources of German Unemployment: A Structural Vector Error Correction Analysis”, *Discussion Paper 19*,

Sonderforschungsbereich 373, Humboldt-Universität zu Berlin. Revised version (November 2003), pp.1-29.
Camarero, M., Carrion-i-Silvestre, J.L., Tamarit, C., 2004, "Testing for Hysteresis in Unemployment in OECD Countries. New EvidenceUsing Stationary Panel Tests with Breaks", *Col-Leccio'd'Economia*, p:1-27.
Cross, R., Darby, J., Ireland, J., Piscitelli, L., 1998, "Hysterisis and unemployment a Preliminary Investigation", http://fmwww.bc.edu/cef99/papers/cross.pdf, p:1-39.
Dolado, J.,J., and Jimeno, J., F., 1997, "The causes of Spanish Unemployment: A structural VAR approach, *European Economic Review*, 41, pp.1281-1307.
Dreger, C. and Reimers, H.E., 2006, "Hysterisis and Persistence in the Course of Unemployment: The EU and US Experience", DIW Berlin, German Institute for Economic Research, *Discussion paper 572*, p:1-18.
Fritsche, U. and Logeay, C, 2002, "Structural Unemployment and the Output Gap in Germany: Evidence from an SVAR Analysis within a Hysterisis Framework", p:1-22.
Hansen, G. 2000, "The German Labour Market and the Unification Shock", *Economic Modelling*, 17, pp. 439-454.
Ivanov, V. and Kilian. L., 2001, "A Practitioner's Guide to Lag-Order Selection for Vector Autoregressions", *CEPR Discussion Papers*, No. 2685, pp.1-30.
Johansen, K., 2002, "Hysteresis in Unemployment: Evidence from Norvegian Counties", Norwegian University of Science and *Technology working paper No:6*, p:1-24.
Khim, V. and Liew, S., 2004, "Which Lag Length Selection Criteria Should We Employ?", *Economics Bulletin*, Vol:3, No.33, pp.1-9.
Krusec, D., 2003, "The effects of fiscal policy on output in a structural VECM Model framework: The case of four EMU and four non-EMU OECD, *European University Institute*, Florence, mimeo, pp.1-30.
Linzert, T. 2001, "Sources of German Unemployment: Evidence from a Structural VAR Model", *ZEW Discussion Paper No. 01-41*, pp.1-24.
Lütkepohl, H., 2005, "Problems Related to Over-identifying Restrictions for Structural Vector Error Correction Models", Economics Working Papers ECO2005/15, *European University Institute, pp.1-12.*
Mikhail, O., Eberwein, C.J., Handa, J., 2003, "The Measurement of Persistence and Hysteresis in Aggregate Unemployment", p:1-17. http://129.3.20.41/eps/mhet/papers/0311/0311002.pdf
Raurich, X., Sala, H., Sorolla, V., 2004, "Unemployment, growth and fiscal policy: new insights on the hysteresis hypothesis", *Department d'Economia Aplicada*, Document De Treball, p:1-39
Turkish Industrialist's and Businessmen's Association, 1999, *TÜSİAD Publication, No:-T/99-6/259*, ISBN:975-7249-85-8, p:1-16.

Appendix 1: VAR Residual Serial Correlation LM Test

VAR Residual Serial Correlation LM...
H0: no serial correlation at lag order h
Date: 07/05/07 Time: 10:30
Sample: 1988M10 2004M03
Included observations: 178

Lags	LM-Stat	Prob
1	29.77808	0.2327
2	20.65747	0.7115
3	82.39762	0.0000
4	33.57552	0.1173
5	33.81994	0.1118
6	86.57867	0.0000
7	12.97657	0.9768
8	34.38319	0.1000
9	59.88046	0.0001
10	39.56384	0.0323
11	17.83731	0.8492
12	89.45353	0.0000

Probs from chi-square with 25 df.

Appendix 2: The Standard Error Matrixes of the Long Run and the Short Run Impact Matrixes

Estimated A matrix

0.0051	-0.0011	0.0039	0.0018	-0.0026
0.0000	0.0056	0.0038	0.0052	0.0054
-0.0037	-0.0015	0.0051	-0.0017	0.0000
-0.0055	-0.0060	-0.0034	0.0140	-0.0042
-0.0031	-0.0110	-0.0053	-0.0031	0.0149

Bootstrap standard errors:

0.0023	0.0019	0.0031	0.0020	0.0016
0.0000	0.0020	0.0035	0.0019	0.0027
0.0034	0.0031	0.0010	0.0013	0.0021
0.0050	0.0053	0.0041	0.0071	0.0042
0.0060	0.0071	0.0104	0.0051	0.0065

Bootstrap t-values:

2.1694	-0.5761	1.2352	0.8791	-1.6312
0.0000	2.8235	1.0913	2.6627	1.9629
-1.1023	-0.4651	5.2844	-1.2664	0.0014
-1.1043	-1.1242	-0.8169	1.9692	-1.0108
-0.5252	-1.5457	-0.5124	-0.6065	2.2808

Estimated long run impact matrix

0.0000	0.0000	0.0004	0.0033	-0.0073
0.0000	0.0000	0.0153	-0.0055	0.0189
0.0000	0.0000	0.0125	0.0030	0.0000
0.0000	0.0000	0.0000	0.0173	0.0000
0.0000	0.0000	0.0142	-0.0142	0.0387

Bootstrap standard errors:

0.0000	0.0000	0.0018	0.0036	0.0039
0.0000	0.0000	0.0082	0.0131	0.0101
0.0000	0.0000	0.0050	0.0099	0.0000
0.0000	0.0000	0.0000	0.0551	0.0000
0.0000	0.0000	0.0119	0.0171	0.0207

Bootstrap t-values:

0.0000	0.0000	0.2014	0.9243	-1.8739
0.0000	0.0000	1.8693	-0.4196	1.8739
0.0000	0.0000	2.4914	0.3061	0.0000
0.0000	0.0000	0.0000	0.3138	0.0000
0.0000	0.0000	1.1952	-0.8295	1.8739