

Macroeconomic Variables and Unemployment: The Case of Turkey

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ABSTRACT: This study investigates the response of unemployment to selective macroeconomics shocks for the period of 2000:Q1-2010:Q1. It finds that positive shocks to growth, growth in export and inflation reduce unemployment. On the other hand, shocks to exchange rate, interbank interest rate and money supply increase unemployment. The results are consistent with Phillips curve and Okun's Law suggestion. Namely, negative relationship between output and unemployment and positive relationship between unemployment and inflation are found. Also, this study finds consistent results with earlier literature.

Keywords: Macroeconomic variables; Vector Autoregressive Model; Impulse-response function

JEL Classification: E24; C22

1. Introduction

The shocks to output extract influence on unemployment through the relationship between output and unemployment implied by Okun's Law. This relationship might be changed in terms of magnitude, but it implies as positive shocks to output reduce unemployment. Economy's output and unemployment are related through, as mentioned, Okun's Law but the recent study of Daly and Hobijn (2010) show that this relationship between output and unemployment is not the one predicted by Okun's Law for the United States: Decline in output created by recent crisis is found to be two times more unemployment than the one that Okun's Law suggests to be.

In the literature, there are various factors that have effect on unemployment. Cascio (2001) investigates monetary policy and unemployment relationship for 11 OECD countries over 1979:Q1-1998:Q4 by using Vector Autoregressive (VAR) model. According to Cascio (2001), monetary shocks influence unemployment but they differ from country to country. Namely, local factor(s) is/are important how a labor market is influenced. Karanasou and Sala (2010) investigate driving forces behind unemployment for Australia over time and find that reasons behind unemployment differ according to period investigated. For example, 1970's driving force behind unemployment is oil shock while in 1990s and 2000s; interest rate is important driving force. Yet, currently, the most influential factor is the tight foreign demand due to global crisis. Further, another recent study on unemployment by Valletta and Kuang (2010) shows that the recent increase in unemployment is conjectural rather than structural for the United States. In general, conjectural fluctuations, like fluctuation in exchange rate, international interest rate, and decline in foreign demand are the shocks that extract influence on unemployment. Ravn and Simonelli (2007) find that monetary policy shocks extracted influence on unemployment for the United States over 1953:Q3-2003:Q1. Djivre and Ribon (2003) study monetary policy influence on unemployment, inflation and exchange over 1990-1999 for Israel and they found that tight monetary policy shocks increase unemployment.

There is no many macro empirical studies on unemployment in Turkey. Further, in studies regarding Turkey's unemployment, structural breaks have not been considered so as they have not been introduced in VAR specification. This study considers possible structural breaks in the series in order to assess dynamic relationships around impulse-response functions.

For Turkey, Berument et al. (2006, 2009) and Berument (2008) investigates macroeconomic policy shocks on unemployment by using VAR models. The general conclusion derived from those studies is that positive income shocks reduce unemployment. Aktar and Ozturk (2009) study interaction among macroeconomic variables for Turkey and find that positive income shocks create

statistically significant negative effect on unemployment. They, also, find that export is not statistically significant influence on unemployment. Dogrul and Soytas (2010) investigate relationships among unemployment, oil price and interest rate and find that interest rate shocks left long-term impact on unemployment even though initial impact on unemployment is negative and insignificant.

In short, the macroeconomic policy variables thought to extract influences on unemployment are economic growth, interbank interest rate, inflation rate, growth in export, exchange rate and growth in money supply and the period of study is determined by availability of the data set, which there is not quarterly data available before 2000. The study uses quarterly data that consist of the period between 2000:Q1 and 2010:Q1 in order to explore macroeconomic shocks effects on unemployment. The results indicate that positive shocks to growth, growth in export and inflation reduce unemployment. On the other hand, positive shocks to exchange rate, interbank interest rate and money supply increase unemployment. The findings are consistent with Phillips Curve and Okun's Law suggestion. Namely, negative relationship between output and unemployment and positive relationship between unemployment and inflation are found.

The rest of this paper consists of three sections. Next section introduces the methodology used in this paper. The second is that data used in the study are briefly discussed and empirical analysis follows this brief discussion. The last one provides the concluding remarks.

2. Econometric Methodology

To investigate the effects of macroeconomic variables, this study considers the vector autoregressive (VAR) model,

$$y_t = \sum_{i=1}^p \Phi_i y_{t-i} + \Psi D_t + \varepsilon_t, \quad t = 1, \dots, T \quad (1)$$

where $y_t = (y_{1t}, y_{2t}, \dots, y_{mt})'$ is an $m \times 1$ vector of jointly determined dependent variables, D_t is an $q \times 1$ vector of deterministic and/or exogenous variables, and $\{\Phi_i, i=1, 2, \dots, p\}$ and Ψ are $m \times m$ and $m \times q$ coefficient matrices. In this model $E(\varepsilon_t) = \mathbf{0}$, $E(\varepsilon_t \varepsilon_t') = \Sigma$ for all t , where $\Sigma = \{\sigma_{ij}, i, j=1, 2, \dots, m\}$ is an $m \times m$ positive definite matrix, $E(\varepsilon_t \varepsilon_{t'}) = \mathbf{0}$ for all $t \neq t'$ and $E(\varepsilon_t | \mathbf{w}_t) = \mathbf{0}$. Under the assumption of all the roots of $|I_m - \sum_{i=1}^p \Phi_i z^i| = 0$ fall outside the unit circle, y_t would be covariance-stationary and Equation (1) can be rewritten as the infinite moving average representation as seen in equation (2).

$$y_t = \sum_{i=0}^{\infty} B_i \varepsilon_{t-i} + \sum_{i=0}^{\infty} Z_i D_{t-i}, \quad i = 1, \dots, T \quad (2)$$

In which the $m \times m$ coefficient matrices B_i can be obtained using the following recursive relations $B_i = \Phi_1 B_{i-1} + \Phi_2 B_{i-2} + \dots + \Phi_p B_{i-p}$ for $i = 1, 2, \dots$, with $B_0 = I_m$ and $B_i = \mathbf{0}$ for $i < 0$, and $Z_i = B_i \Psi$. The generalized impulse response function is given by equation (3).

$$\psi_j^g(n) = \sigma_{jj}^{-1/2} A_n \sum e_j, \quad n = 0, 1, 2, \dots, \quad (3)$$

Equation (3) measures the effect of one standard error shock to the j th equation at time t on expected values of x at time $t+n$ (Pesaran and Shin, 1998).

3. Data and Empirical Analysis

This paper uses quarterly data that consist of the period over 2000:Q1 to 2010:Q1 in order to investigate the effects of macroeconomic shocks on unemployment. Initial investigation by taking quarterly average indicates that all variables contain seasonality, so that all series are deseasonalized by using Troma/Seats method in order to conduct further study on data. Later, Graphics of all variables are investigated and by doing so, the behaviours of the series over time are explored and whether there is any structural break in series is observed. Because in the case of structural break(s), the techniques based on unit root tests are not healthy for further investigation, this issue is further discussed after unit roots in series are checked.

The list variables used in this study after seasonal adjustment are unemployment rate, real Gross Domestic Product (GDP) growth (real GDP is seasonally adjusted real GDP divided by seasonally adjusted GDP deflator so that real GDP growth is $LN(\text{real GDP}_t / \text{real GDP}_{t-1}) * 100$, where $t=1,2,\dots,T$), export growth ($LN(\text{export}_t / \text{export}_{t-1}) * 100$, where $t=1,2,\dots,T$), exchange rate (amount of dollar is bought by one Turkish Lira), interbank interest rate, inflation ($LN(\text{CPI}_t / \text{CPI}_{t-1}) * 100$, where $t=1,2,\dots,T$ and CPI stands for Consumer Price Index) and the last variables is the growth in money supply (growth in M1 is $LN(M1_t / M1_{t-1}) * 100$, where $t=1,2,\dots,T$).

Figure 1. Seasonally Adjusted Time Series Plots

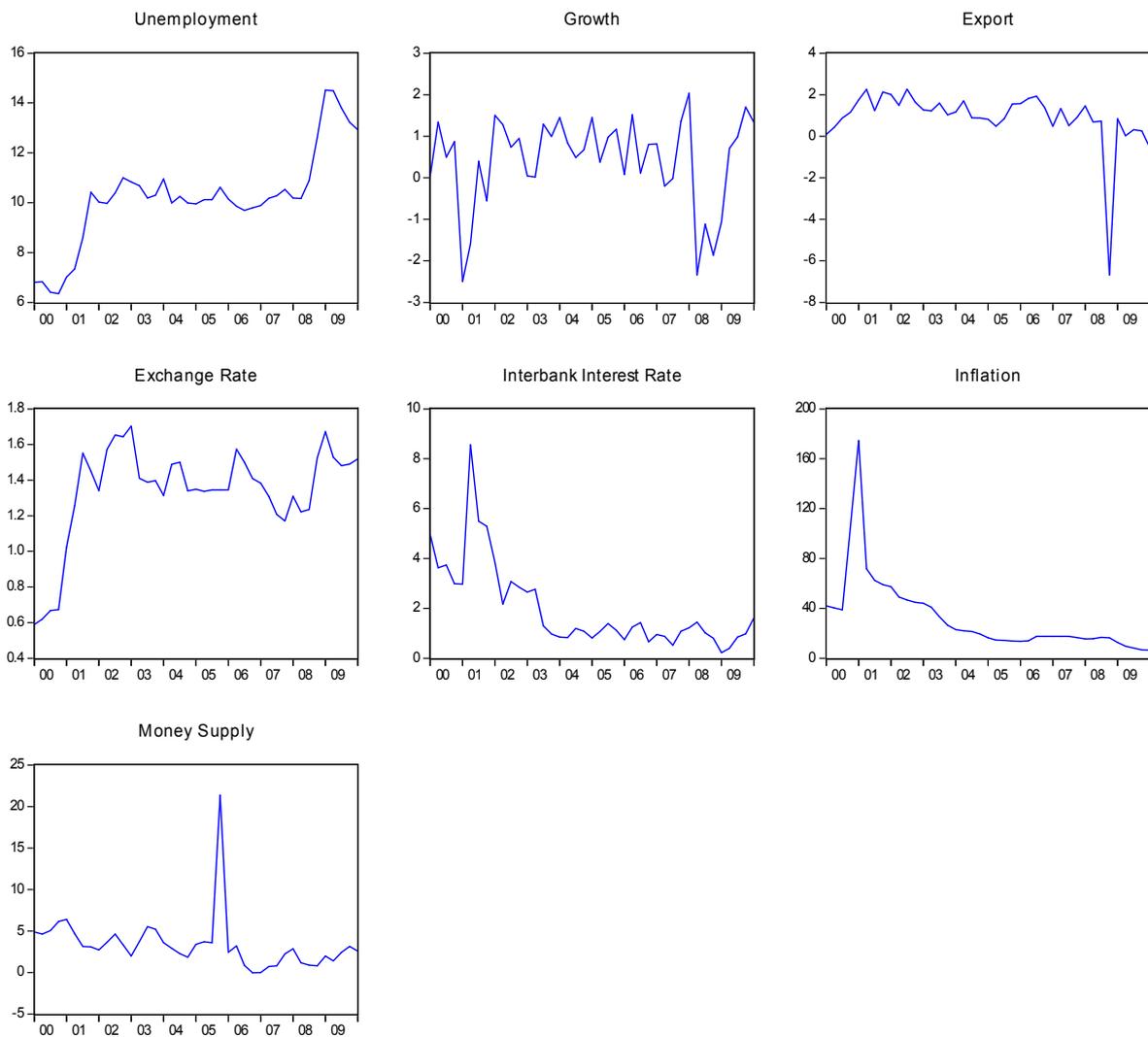


Figure 1 shows the seasonally adjusted series used in this study and all variables are collected from database of the Central Bank of Turkey. On the left-hand side of the top row of Figure 1, the unemployment rate series is shown. Unemployment from 2000 to the beginning of 2002 looks like an upward trend and, after that, it fluctuates between 10% and 11% until 2008. Unemployment after 2008 starts increasing dramatically as it happens before 2002. In the second quarter of 2009, it settles down between 13-14 %. Unemployment variable indicates behaviour in that there are structural breaks. Unemployment rate between 2002 and 2008 differs from earlier and later periods. Hence, for two periods, it can be seen from analysis of the graph of that unemployment series have structural breaks.

From the graph given in the middle of the top row of Figure 1, the behaviour of economic growth can be seen over time. In this period, there have been two economic crises that Turkish economy has faced with. Those were 2001 and 2008 economic crisis. In the periods other than crisis,

growth rate fluctuates between 0% and 2%. In contrast, the growth rates in crisis periods drop to, as much as, -2.5 percent.

The graph given on the right hand-side of the top row of Figure 1 is growth in export that has faster growth rate and an upward trend between 2000 and mid-2001. On the other hand, export growth after mid-2001 has downward trend. The fast export growth initially might be related to devaluation undertaken in that period. The serious drop observed in 2008 is very much related to decline in international demand. After 2008, the export returns close to its before-crisis level. If the crisis is not taken into consideration, deseasonalized export growth after 2001 slows down according to Figure 1.

On the left-hand side of the middle row of the Figure 1, the graph of exchange rate can be seen and when it is investigated, a policy change can be clearly observed to happen in 2001. In this year, Turkish Lira became free-floating currency.

At the middle of the Figure1, the graph of interbank interest rate shows fast increase in interest rate due to liquidity shock in the spring of 2000. Due to rapid flow of capital out, the devaluation became inescapable result in that period (Butkiewicz and Ozdogan, 2009). This is the first thing that gets our attention. Second, this fast increase is followed by a fast decline after the beginning of 2001. Lastly, the fast drop trend slows down at the end of 2001.

Inflation rate, on the left hand-side of the middle row of Figure 1, declines from 5% to 3% due to policy implemented throughout 2000s (see, Butkiewicz and Ozdogan, 2009; and Yeldan, 2002 for the policies followed). The influence of the 2001 crisis strikingly is shown in data, inflation picks up and becomes 8.5%. Further, in the same year, as its increase, very fast decline in inflation rate is observed. In 2002, inflation goes down even more and get lower than the 2001 crisis level, less than %2. Inflation rate in 2003 looks better than earlier year and it goes down below 1% and up until 2009, it stays below 1%. Due to economic downturn in 2008, inflation even goes to 0.2%. In 2009, it starts to increase again and it comes close to 2% in the beginning of 2010.

When the graph of deseasonalized growth in money supply (M1) in the bottom row of the Figure 1 is investigated, a big jump in 2005 is a striking situation: Money supply jumps about 23%. In other times, growth in money supply fluctuates between 1% and 7%.

After deseasonalization of series, Augmented Dickey-Fuller (ADF) unit root tests suggested by Said and Dickey (1984) are applied to all variables. ADF tests results are seen in Table 1 below. ADF tests are implemented in both level and first-difference. According to ADF unit root tests, growth, export growth, exchange rate and money supply growth are all I(1) series. On the other hand, as mentioned above, unemployment, interest rate and inflation rate have all structural breaks in visual inspection. Here, somebody should note that unemployment rate and inflation rate, unlike the other variables, are not stationary at level, but stationary at first difference. Further, interest rate is not stationary at both levels and first difference.

As explained above, there are two structural breaks in unemployment data and one in both interest rate and inflation data. Perron (1989) indicates that 1929 Great Depression and 1973 Oil Supply Shock extracts permanent effects on economy and creates structural change. Perron (1989) develops a unit root test that takes those structural changes into consideration. According to Perron's method, structural changes in economy are exogenous and known in advance. On the other hand, Zivot and Andrews (1992) (hereafter ZA) take Perron's test statistics differently and they questions whether structural break is determined exogenously or endogenously. ZA investigate endogenous structural break and, in their case, the time of structural break is not known exactly. In Addition, Lumsdaine and Papell (1997) develop a unit root test that allows two structural breaks in a series. In Lumsdaine and Papell (1997) test, ZA test is extended to allow two structural breaks. In parallel to Lumsdaine and Papell (1997) test, Lee and Strazicich (2003) (hereafter LS) develops a test based on Lagrange Multiplier and it allows two endogenous structural breaks.

In Graph 1, all of the seasonally adjusted series are seen to have structural breaks. When the graphs of the series are examined in detail, except for economic growth and unemployment, they can clearly state that export growth, exchange rate, interbank interest rate, inflation and money supply variables have a single structural break in both constant term and trend term. As explained above, the unemployment series has two structural breaks while the economic growth series has a single break at constant term. In the second and third columns of Table 1, ADF test results are seen and those test results are not valid in the case of structural break(s). Therefore, to unemployment rate, export growth, exchange rate, interbank interest rate, inflation and money supply, the unit root test developed by ZA,

which allows a single break at both constant and trend, is applied. The test is also applied to the economic growth with allowing a break for the constant term. The test results are seen in the fourth and fifth columns of Table 1. The fourth column of Table 1 provides structural time determined by ZA test endogenously. With the exception of unemployment series, the evidence from ZA tests rejects the null hypothesis that series is nonstationarity at 5 percent significant level.

Table 1. Unit Root Tests

Variables	ADF test ^a		Zivot-Andrews mint-statistics ^b		Lee-Strazicich t- statistics ^c	
	Level	First Difference	TB1	mint- statistics	TB1 TB2	t-statistics
Unemployment Rate	-1.944	-4.220*	2004:Q2	-3.583	2002:Q4 2008:Q2	-6.612*
Growth Rate	-4.388*	-8.813*	2008:Q2	-6.677*		
Export Growth	-5.110*	-3.874*	2008:Q4	-6.549*		
Exchange Rate	-3.790*	-3.440*	2001:Q3	-6.549*		
Interest Rate	-1.691	-1.819	2003:Q3	-5.457*		
Inflation Rate	-1.064	-5.501*	2004:Q3	-15.772*		
Growth in Money Supply	-5.168*	-10.320*	2006:Q3	-6.274*		

Notes: *shows that it is statistically significant at 5% level.
^a Test contains constant term; testing hypothesis has variable unit root and one-sided test; the critical values for 1%, 5% and 10% significant level are -3.605, -2.936, and -2.606 respectively.
^b Testing hypothesis has variable stable/no unit root and it is one-sided test; the critical value for %5 significant level is -4.42 for only allowing for break in intercept and -5.08 for allowing for break in both intercept and trend.
^c Test contains both constant and trend terms; testing hypothesis has variable unit root and one-sided test; the critical value for %5 significant level is -5.28.

When the dynamics of Turkish economy after 2000 are taken into consideration, each structural break characterizes each breaking period well. As discussed above, existence of two structural breaks for two different periods is emphasized in unemployment series. Due to this reason, the result of ZA test for unemployment series is consistent with the dynamics of the series. As the dynamics of the unemployment series are accounted into consideration, the LS test, which allows two structural breaks at a constant term, is applied. Namely, the LS test allows level shifts for two different periods and it is applied to unemployment series. LS unit root test results are shown in the sixth and seventh columns of Table 1. The sixth column of Table 1 provides break points and the seventh column of Table 1 gives LS t-test statistics. The break dates seen in the sixth column of Table 1, 2002: and 2008:2, are quite consistent with dynamics of Turkish Economy after 2000. The results in Table 1 reject the null hypothesis of nonstationarity for unemployment at 5 percent significant level.

Once the dynamics of Turkish Economy are taken into consideration, the ZA and LS tests, which are consistent with those dynamics and their results accounting for structural break/breaks for each series are thought, each series used in the study is stationary at level. This result indicates that there is no stochastic trend in unemployment, economic growth, export growth, exchange rate, interest rate, inflation and money supply growth series.

VAR processes can be well used for application for small and moderate samples in describing data generation process. In general variables are handled endogenously in those models and they allow capturing rich dynamics within data. Further, statistical techniques are used to put restrictions rather than using theoretical considerations and/or assumptions. If time series have stochastic trend, stochastic trend should be taken in consideration when investigating the dynamic interactions among the series. If there is common stochastic trend in data generation process of set of variables, they are

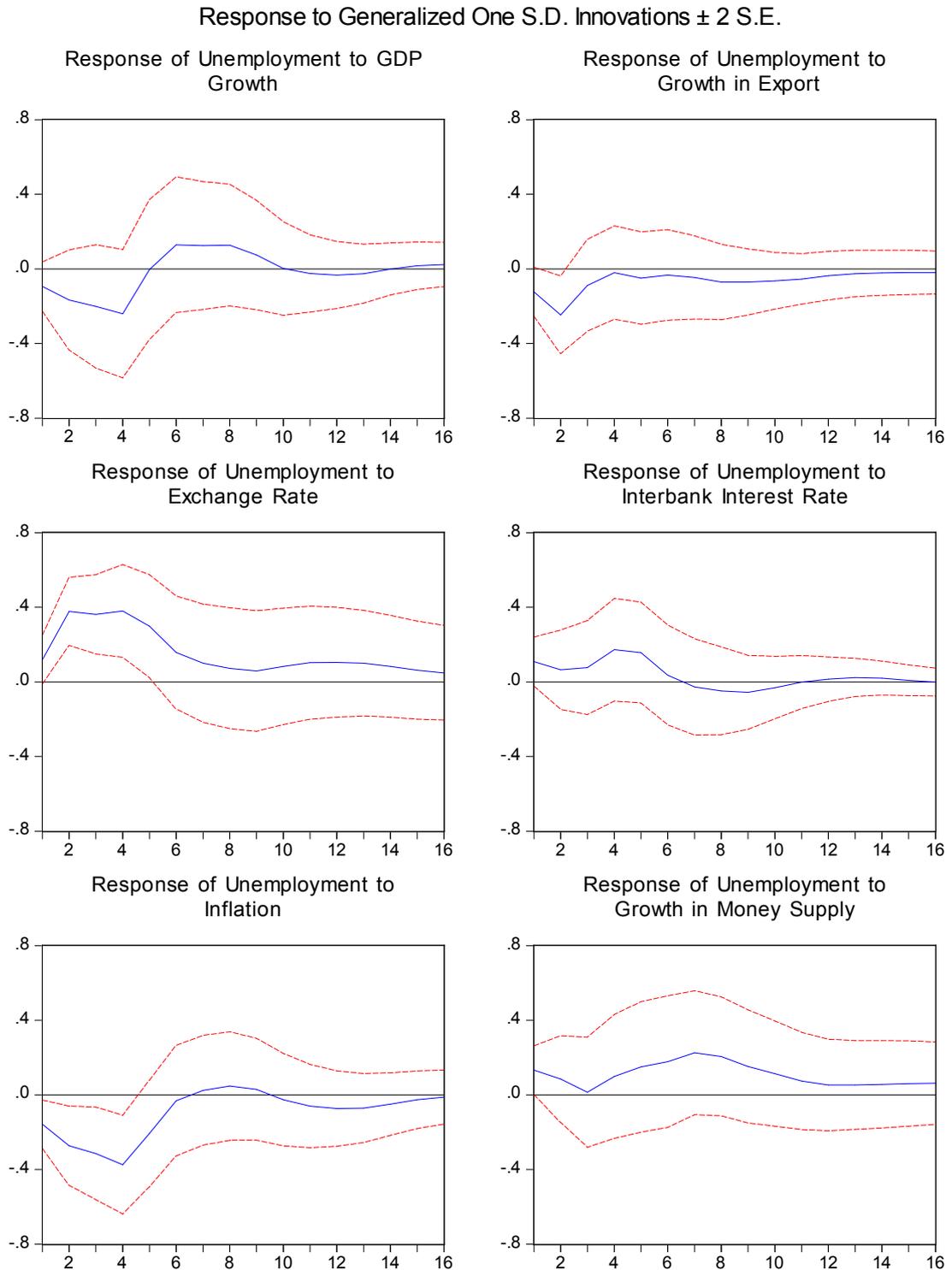
cointegrated variables according to Granger (1981) and Engle and Granger (1987). If it is so, VAR model is not good to handle the series. It is better to use Vector Error Correction Models (VECM) that capture cointegration structure within such set of series (Johansen, 1991). As mentioned above, the time series used in this study are found as stationary processes with structural breaks. Therefore, we use VAR model in order to investigate the dynamic linkages among the series considered. Before examining the dynamic effects of the economic growth, export growth, exchange rate, interest rate, inflation and growth in money supply on unemployment series, the study considers the endogenously founded two structural breaks by LS test for unemployment series. For them, it uses dummy variables to control the structural breaks for the unemployment series in the VAR model. In allowing for two breaks in the intercept, the dummy variable are defined as following: A period, at which the change in the parameters of the trend function occurs, will be referred to as the time of break, or TB_i for $i = 1, 2$. $DU_i(TB_1)$ and $DU_i(TB_2)$ that are the break dummy variables for the mean shift occurring at times $TB_1=2002:Q4$ and $TB_2=2008:Q2$, respectively. The break dummy variables have the following values: for $i = 1$ and 2 , $DU_i(TB_i) = 1$ and $DT_i(TB_i) = 0$ if $t > TB_i$; 0 otherwise.

To examine the effects of the economic growth, export growth, exchange rate, interest rate, inflation and growth in money supply series on unemployment series when one standard deviation shock is given to these series in the VAR model, first, the optimal lag length of VAR model is determined. For determining the length of lag in the VAR model, this study uses the Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Likelihood ratio (LR). Starting with $p=1$ in an ascending order, the uncorrelatedness of residuals until the residuals become uncorrelated by using these information criteria are checked out. If the LR for the VAR model proves to be uncorrelated for a given p , it is the one chosen as p for the model. As suggested by LR, the longest lag order of the identified VAR model is 2 for 8 specifications, while AIC and SIC indicating the longest lag order of the identified VAR model is 5. Moreover, due to sample size, the study also uses 2 for the longest lag order of the identified VAR model.

Figure 2 reports the generalized impulse response functions by Pesaran and Shin (1998) for the unemployment when one generalized standard deviation shock is given to the economic growth, export growth, exchange rate, interbank interest rate, inflation and growth in money supply series.

Here, effects of a unit standard deviation shock are examined for sixteen periods or four years. Response of unemployment to the shocks to the economic growth, seen on the left-hand side the first row in Figure 2, has significant influence for the first four periods. The influence of growth rate innovation on unemployment for the first four periods is negative. The innovation reaches its maximum impact at the fourth quarter. The result on the right-hand side of the first row given in Figure 2 indicates that the response of unemployment is reported when one generalized standard deviation shock is given to the growth in export. Innovation in the export extracts positive and statistically significant influence on unemployment for the first two periods. The graph given on the left hand-side of the second row in the Figure 2 shows that in the case of exchange rate shocks, unemployment response is positive and statistically significant for the first five periods and it loses its influence later on. The following variable in Figure 2, which is given on the right-hand side of the second row, is interbank interest rate. The unemployment response to interbank interest rate is always positive. It follows different behaviour than the other variables. It has significant influence for the first four periods and it reaches its maximum effect on the fourth quarter. On the other hand, the first two quarters have positive and significant impact and it hits its minimum impact at the third quarter, but it attains its maximum impact by jumping from its deep. After that, it loses its influence on unemployment. Inflation influence on unemployment can be seen on the left-hand side of the last row of the Figure 2. Here, the results on response of unemployment to inflation confirm Phillips Curve implication. Namely, there is inflation-unemployment trade-off. Here, the response of unemployment to inflation is negative and significant for the first four quarters. Its influence increases over time. That is, it reaches its maximum at the fourth quarter. The last variable studied is growth in money supply, given on the right-hand side of bottom row in Figure 2. The response of unemployment to innovation in money supply growth is statistically significant for the first four periods and its influence on unemployment is negative. It has similar movement like interbank interest rate, the response of money supply goes down a deep at third quarter and from this deep it jumps to its maximum at fourth quarter.

Figure 2. The effect of the economic growth, export, exchange rate, interest rate, inflation and money supply series on the unemployment series



4. Conclusion

In this study, macroeconomic variables influence on unemployment by including structural breaks which the literature previously has not taken in consideration when unemployment was studied in Turkey. As well as there have not been much macro empirical studies that worked this issue for Turkey. All the variables used in this study have statistically significant influence on unemployment

and they do not extract statistically significant impact more than five periods. GDP growth, export growth and inflation create negative impacts on unemployment but exchange rate, interbank interest rate and money growth extracts negative influences on unemployment. Further, the findings are consistent with previous literature. Lastly, the findings are also consistent with Phillips Curve relationship that foresees negative relationship between unemployment and inflation and Okun's Law relationship that expresses a negative relationship between output and unemployment.

References

- Aktar, I., Ozturk, L. (2009), *Can Unemployment be Cured by Economic Growth and Foreign Direct Investment in Turkey*. International Research Journal of Finance and Economics. 27, 203-211.
- Berument, M.H. (2008), *Macroeconomic Policy and Unemployment by Economic Activity: Evidence from Turkey*. IZA Discussion Paper: 3461.
- Berument, M.H., Dogan, N., Tansel, A. (2006), *Economic Performance and Unemployment: Evidence from and Emerging Economy*. International Journal of Manpower, 27(7), 604-623.
- Berument, M.H., N. Dogan, A. Tansel, (2009), *Macroeconomic Policy and Unemployment by Economic Activity: Evidence from Turkey*. Emerging Markets Finance and Trade, 45(3), 21-34.
- Butkiewicz, J.L., Ozdogan, Z. (2009), *Financial Crisis, Monetary Policy Reform and The Monetary Transmission Mechanism in Turkey*. Working Paper Series, no 2009-04, Department of Economics, Alfred Lerner College of Business & Economics, University of Delaware.
- Cascio, I.L. (2001), *Do Labour Markets Really Matter? Monetary Shocks and Asymmetric Effects across Europe*. Unpublished, Department of Economics, University of Essex, Colchester.
- Daly, M., Hobijn, B. (2010), *Okun's Law and Unemployment Surprise of 2009*. Economic Letter, Federal Reserve Bank of San Francisco.
- Doğrul, H.G., Soytaş, U. (2010), *Relationship between Oil Prices, Interest Rate, and Unemployment: Evidence from an Emerging Market*. Energy Economics, 32, 1523-1528.
- Engle, R., Granger, C. (1987), *Co-integration and Error correction: Representation, Estimation, and Testing*. Econometrica, 55, 251-276.
- Johansen, S. (1991), *Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models*. Econometrica, 59, 1551-1580.
- Lee, J., Strazicich, M.C. (2003), *Minimum LM Unit Root Test with Two Structural Breaks*. Review of Economics and Statistics, 85 (4), 1082-1089.
- Lumsdaine, R.L., Papell, D.H. (1997), *Multiple Trend Breaks and Unit-Root Hypothesis*. The Review of Economics and Statistics, 79(2), 212-218.
- Pesaran, M.H., Shin, Y. (1998), *Generalised Impulse Response Analysis in Linear Multivariate Model*. Economic Letters, 58, 17-29.
- Perron, P. (1989), *The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis*. Econometrica, 57, 1361-1401.
- Ravn, M.O., Simonelli, S. (2007), *Labor Market Dynamics and the Business Cycle: Structural Evidence for the United States*. Working Paper Series, no 182, Centre for Studies in Economics and Finance.
- Said, S.E., Dickey, D.A. (1984), *Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order*. Biometrika, 71(3), 599-607.
- Sims, C. A. (1982), *Policy Analysis with Econometric Models*. Brookings Papers on Economic Activity, 1, 107-152.
- Valletta, R., Kuang, K. (2010), *Is the Structural Unemployment on the Rise?* The Economic Report, 86(273), 185-209.
- Yeldan, E. (2002), *Behind the 2000/2001 Turkish Crisis: Stability, Credibility, and Governance, for Whom?* IDEAs Conference on International Money and Developing Countries: Theoretical and Policy Issue in the Current Context, 16-19 December, Chennai, India
- Zivot, E., Andrews, D.W.K. (1992), *Further Evidence on the Great Crash, Oil-Price Shock and the Unit-Root Hypothesis*. Journal of Business and Economic Statistics, 10(3), 251-270.