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THE NATURE OF IMPULSE MECHANISM: AN EMPIRICAL STUDY FOR TURKEY

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ABSTRACT

The fundamental purpose of this paper is to identify the nature of impulse mechanism, from which random shocks to general price and income levels are generated. In recent business cycle literature, it is generally accepted that business cycles are triggered by random productivity and technology shocks. However, this approach can not explain the current degree of volatility of business cycle fluctuations. Especially, New Keynesian economists emphasized the influence of demand shocks under the assumption of nominal and real rigidities and some other market imperfections. Therefore, it is convenient to identify whether the shocks to the general prices and national income are on demand or supply side. It is shown in the paper that between the first quarter of 1987 and the fourth quarter of 2003 in Turkey, shocks to national income are mostly composed of shocks to demand factors. On the other hand, the shocks to cost factors influence the shocks to general price level more frequently than shocks to demand factors.

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1. INTRODUCTION

Identification of the principle sources of fluctuations and growth is an important goal of macroeconomics and particularly business cycle literature. In traditional business cycle approach, the economy is characterized as growing along a smooth trend path from which it is disturbed by cyclical fluctuations. According to most economists, the trend is an underlying growth path along which the economy evolves. What causes the macroeconomic aggregates to fluctuate around this smooth growth trend is the basic question that the economists seek to answer. In this manner, there is a consensus of decomposing a cycle into two complementary processes: an *impulse* and a *propagation mechanism*. The former consists of random shocks, which cause the macroeconomic aggregates to deviate from their long-term equilibrium trends. The latter, on the other hand, includes the dynamic responses of those aggregate variables to random shocks that are generated by the impulse mechanism.

A useful way of approaching this topic is to suppose the economy as being affected by two types of shocks. Some shocks have permanent effects on output. The basic examples of this kind of shocks are improvements in productivity or increases in the labour force. These shocks are thought to determine the smooth growth trend. On the other hand, some shocks have transitory effects on output, which disappear over time. Shocks to autonomous expenditures, monetary aggregates and aggregate cost factors can be identified as temporary shocks. This kind of temporary shocks cause the business cycle fluctuations and they form the impulse mechanism.

An alternative view to the traditional approach is developed by Prescott (1986). Although the traditional approach proceeds on the assumption that the part of output, that is due to permanent shocks is smooth, Prescott argues that there is no reason to believe that productivity shocks lead to smooth growth in output. According to him, the process for productivity itself may not be smooth. This means that actual output and trend can not be separable, since all fluctuations are the results of permanent shocks. Thus, actual and trend outputs are the same. This view is later called as Real Business Cycle Approach**,** (RBC). The main thesis of the RBC economists is that business cycles are the product of exogenous productivity shocks and the propagation mechanism is generated by the optimizing behavior of economic agents operating in competitive environments. In this case, the rational expectations hypothesis provides that the temporary demand shocks have no influence on the business cycles.

There has been an enormous number of studies in RBC literature in the last two decades. However, the empirical studies show that RBC models can not explain the whole variation in actual output. Consequently, some economists try to solve this problem by taking into account the wage and price stickiness. Those implications of sticky prices and wages in general equilibrium business cycle models were explored in 1970's. The basic reference for those studies is that of Barro and Grossman (1976). Also, important contributions were made by Benassy (1982), Malinvaud (1977) and Negishi (1979). However, the wage and price stickiness hypothesis needed a sound

economic theory. In that manner, New Keynesian economists focused on the market imperfection as a source of business fluctuations caused by temporary demand shocks. Some Keynesian theories of the business cycles have relied upon inflexible wages and prices in Mankiw (1985) and in Taylor (1980), while others have used hysteresis effects, as in De Long and Summers (1988), or co-ordination failures, as in Cooper and John, (1988), to achieve real effects of demand shocks. The New Keynesian approach is developed by other important contributions: Hahn (1978), Negishi (1979), Drazen (1980), Blanchard and Kiyotaki (1987) and Benassy (1987), Erceg, Henderson and Levin (2000), Gali and Gertler (1999), Kim (2000), Ireland (2001). These studies in New Keynesian literature are much more successful than RBC models to explain the variation in actual output. The influence of demand shocks on actual output, therefore, should be taken into account.

Another way of explaining the effects of random shocks on output can be addressed to the study of Sims, (1980), which was Vector Autoregression Analysis, (VAR). VAR processes have been a popular tool for analyzing the dynamics of economic systems since Sims's (1980) influential work. Depending on this study, the Structural VAR (SVAR) models have been developed. One important application of this SVAR process is the study of the effects of aggregate demand and supply shocks on macroeconomic variables under several restrictions. In these studies, it is intented to decompose the short and long run effects of supply and demand shocks on output and price levels. A more general SVAR approach has emerged later; different kind of shocks from both the demand and supply side , are taken into account in explaining the variability of output (Blanchard and Quah (1989), King et. al. (1991), Shapiro and Watson (1998)).

Those works, generally, made a distiction between the demand and supply shocks. The movements in output depending on permanent shocks, under the assumption that these shocks are being caused by changes in technical knowledge, are considered as supply shocks. By contrast, the main effects of aggregate demand shocks on output are largely transitory. In recent years, a number of authors have used SVAR analyses by different restrictions to identify their dynamic models, (Keating (1992), Gali (1992), King et.al (1991), Claus (2000), Kim and Roubini (2000), Hoover and Jorda (2002), Krolzig (2003)).

The recent studies on Turkish economy reached different conclusions about the dynamic nature of inflation and economic fluctuations. For instance, by using a data set composed of WPI, monetary base and nominal exchange rate, Öniş and Özmucur (1990) finds that non monetary supply-side factors have significant effects on inflation in Turkey. In another study, Özatay (1992) using monthly manufacturing price index for public and private sectors, nominal exchange rates, domestic and imported input prices, concludes that imported input prices are influential on inflation. On the other hand, using annual data from 1960 to 1988 Ateşoğlu and Dutkowsky (1995) present supportive evidence that the Turkish economy behaves consistent with predictions

of a real business cycle model. Consequently, they find that there is no significant influence of demand side shocks on output and prices respond to monetary expansions at the same rate. A similar result has been derived by Metin (1995) who finds that fiscal expansion and devaluations have some inflationary effects. This result was confirmed by Erol and Van Wijnbergen (1997) and Leigh and Rossi (2002). As cost determinants of inflation, the effects of oil prices were analysed by Kibritçioğlu and Kibritçioğlu (1999) who find negligible role of oil prices on inflation. Besides, Kibritçioğlu (1999) points out that imported crude oil prices causes a cummulative increase in general price levels. An alternative view is presented by Yeldan (1993) by using a CGE analysis that the inflation process in Turkey has a strong source of demand pull inflation in Turkey. An enhancing result is presented by Diboğlu and Kibritçioğlu (2001) that real oil price, supply and balance of payments shocks have no significant effects on inflation, while the real aggregate demand shocks, which stemmed from changes in the money stock and autonomous aggregate-demand can be interpreted as a combined result of changes in high public sector budget deficits and devaluation of the TL. Depending on these results, in this study, we try to see the impacts of both demand side and cost factors on the growth rates of real GDP and WPI. For that reason we take 7 demand side and 5 supply side factors including the energy prices and the prices of imported inputs.

Our main purpose is to explain the nature of impulse mechanism, which consists of transtory shocks triggering the economic fluctuations in aggregate level. Therefore our main focus is neither on the long term growth trend nor on the short term fluctuations around this trend. Instead, we try to decompose the transitory shocks, which have effects on the national income and the general price levels, into their determinants. In aggregate level, the transitory shocks may be classified as in two categories: the demand and supply side factors. Demand side factors are the factors, which effectively alter the level of aggregate expenditures such as, consumption, investment or monetary shocks. Conversely, the supply oriented transitory shocks are determined by cost factors in aggregate level, such as; the prices of imported industrial products, the prices of raw materials or the prices of energy sources. Our terminology, in this manner, differs from that of RBC proponents. They intend to identify the supply shocks which influentially have permanent effects on long-term growth trends of aggregate level economic variables, such as shocks to productivity of labour force or general technology level. However, we propose to identify, in what degree the shocks to the cost factors determine the shocks to the national income and general price levels.

In order to achieve this purpose we apply a two step VAR analyses. Our data will consist of quarterly growth rates of general price, real GDP and various demand, cost factors. The first step will maintain the propogation mechanism, which leads the economic activity through business cycle. Second step will explain the nature of impulse mechanism which triggers the business cycle.

Section II explains the data set and the

methodology we use through out the paper. Section III represents the first and second step VAR results, which provides us the propagation and impulse mechanism. Section IV is a brief conclusion of the paper. The Appendix consists of three parts: Appendix A presents the tables which include the estimation results of two step VAR analyses. Appendix B includes the graphs of fitted and actual values of transitory shocks to general price and real GDP growth rates from the second step VAR. Finally, Appendix C includes definitions and abbrevations of variables used in VAR estimation processes.

2. DATA AND METHODOLOGY

The data set consists of 13 quarterly data series between 1987:Q1 and 2003:Q4. First two variables are the real GDP and WPI (1987=100). Seven of the variables are demand side determinants, namely, real consumption, real investment, real government expenditures, real exports, real imports, government tax revenues and nominal money supply (M2). There are five cost factors as WPI for electricity, raw oil and machinery, the nominal prices of imported oil products and industrial goods.[1] We take the logarithmic differences of each variable. This application enables us to eliminate the long term trend. Furthermore, the elimination of seasonalities is managed by using seasonal dummies (di for ith quarter).

[1] We use the sources of official website of the Central Bank of Turkey. There is an important problem in data management process. The prices of imported oil products and industrial products are real and denominated in T.L. In order to have nominal prices we deflate the relevant series by general WPI. This gives us the opportunity to provide the nominal prices of imported oil products and industrial products.

Our theoretical framework is a standard open economy aggregate demand and aggregate supply model. The aggregate expenditures are composed of consumption (c), investment (i), government expenditures (g), exports (x), imports (z) and tax revenues (v). Domestic real interest rate (r) is determined in the money (m) market and the money market equilibrium resembles a standard LM curve. The exchange rate (s) is determined through Interest Rate Parity theory, where world inflation (π^*) is assumed to be zero for convenience. Therefore, the nominal world interest rate (i^*) is equal to real world interest rate (r^*). The aggregate supply equation shows the relationship between general price level (p) and the national income level (y). In addition to that, the prices of domestic inputs (p^o) and their inflation rate (π^o) form an important cost factor. Finally, the prices of imported inputs are effective in the formation of aggregate supply relationship. All the variables except the interest rates are in logarithmic values. Each variable has also a stochastic component, which we identify as the exogenous shocks. The stochastic components of general price level (e^p) and the national income level (e^y) are the compositions of stochastic components of other variables. The baseline of the model is composed of 12 equations:

$$c_t = c_1 y^e_t + e^c_t;\ 0 < c_1 < 1;$$
"consumption expenditures" (1)

$$i_t = i_o + b_1 y^e_t - b_2 r^e_t + e^i_t;\ 0 < b_1 < 1;$$
"investment expenditures" (2)

$$g_t = g_o + e^g_t;$$
"government expenditures" (3)

$x_t = x_o + x_1 (s_t - p^e_t) + e^x_t; \; 0 < x_1;$
"exports" (4)

$v_t = v_o + \tau y^e_t + e^v_t; \; 0 < \tau < 1$
"tax revenues" (5)

$z_t = z_o + + z_1 y^e_t + z_2 (s_t - p^e_t) + e^z_t;$
"imports" (6)
$0 < z_1 < 1 \; ; \; 0 < z_2;$

$$y^e_t = \sum_{i=1}^{q} a_i y_{t-i}, \; \sum_{i=1}^{q} a_i = 1 \qquad (12)$$

Therefore the system can be identified as a "qth order" difference equations system, which is a VAR(q) process plus intercept terms as seen in equation (13):

$$\begin{bmatrix} y_t \\ p_t \\ c_t \\ i_t \\ g_t \\ x_t \\ v_t \\ z_t \\ m_t \\ s_t \\ p^o_t \end{bmatrix} = \begin{bmatrix} \lambda_0 \\ \lambda_1 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \\ \lambda_6 \\ \lambda_7 \\ \lambda_8 \\ \lambda_9 \\ \lambda_{10} \\ \lambda_{11} \end{bmatrix} + \begin{bmatrix} \beta_{1,1} & \beta_{12} & & \beta_{1,11} \\ \beta_{2,1} & \beta_{2,2} & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ \beta_{11,1} & & & \beta_{11,11} \end{bmatrix} * \begin{bmatrix} y_{t-1} \\ p_{t-1} \\ c_{t-1} \\ i_{t-1} \\ g_{t-1} \\ x_{t-1} \\ v_{t-1} \\ z_{t-1} \\ m_{t-1} \\ s_{t-1} \\ p^o_{t-1} \end{bmatrix} + \begin{bmatrix} \gamma_{1,1} & \gamma_{12} & & \gamma_{1,11} \\ \gamma_{2,1} & \gamma_{2,2} & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ \gamma_{11,1} & & & \gamma_{11,11} \end{bmatrix} * \begin{bmatrix} y_{t-q} \\ p_{t-q} \\ c_{t-q} \\ i_{t-q} \\ g_{t-q} \\ x_{t-q} \\ v_{t-q} \\ z_{t-q} \\ m_{t-q} \\ s_{t-q} \\ p^o_{t-q} \end{bmatrix} + \begin{bmatrix} e^y_t \\ e^p_t \\ e^c_t \\ e^i_t \\ e^g_t \\ e^x_t \\ e^v_t \\ e^z_t \\ e^m_t \\ e^s_t \\ e^o_t \end{bmatrix} \qquad (13)$$

$y_t = c_t + i_t + g_t + x_t - z_t - v_t$
"goods market equilibrium – IS" (7)

$r_t = \mu_o + \mu_1 y^e_t - \mu_2 (m_t - p^e_t) - e^m_t; \; 0 < \mu_1, \mu_2 < 1;$
"money market equilibrium - LM" (8)

$s_t = s^e_t + \delta(r^e_t + \pi_t - r^*) + e^s_t; \; 0 < \delta;$
"interest rate parity"
$(\pi^*) = 0$ and $i^* = r^*;$ (9)

$\pi_t = p_t - p^e_t$
$= \psi_1 (y_t - y^e_t) + \psi_2 \pi^o_t - \psi_3 (s_t - s^e_t + \pi^*);$
"aggregate supply" (10)

$\pi^o_t = \theta \pi_t + e^o_t; \; 0 < \theta < 1;$
"evolution of domestic input prices" (11)

"e" demonstrates weighted average of relevant variable for recent "q" periods. For instance;

where,

$e^y = f(e^c, e^i, e^g, e^x, e^z, e^v, e^s, e^m, e^o)$
$e^p = f(e^c, e^i, e^g, e^x, e^z, e^v, e^s, e^m, e^o)$ (14)

Equation (14) shows that the shocks to income and price levels are compositions of shocks to demand and cost factors. Depending upon this model, the construction of our methodology stands over a two-step VAR estimation process. This is quite similar to the approach in Rotemberg and Woodford (1992), who identify the reduced form residuals of a regression of defence purchases on a number of macro economic variables as policy shocks. These residuals are then used in a VAR to simulate the dynamic response of the economy to these shocks.Also Höppner (2002) uses residuals from a restricted VAR estimation in order to

captivate the impact of fiscal shocks and automatic stabilisers on business cycle. The distinguishing point in our approach is that we use the residuals of a VAR system, which represents the propogation mechanism. We, then, identify these residuals as shocks to price and income levels. The difference between our approach and the classical VAR and SVAR processes lies upon the definitions of impulse and propagation mechanisms in a standard business cycle. VAR processes determine the co-dependent patterns in relevant business cycle indicators without any economic constraints identified by a theoretical model. On the other hand, SVAR processes examine the effects of shocks on the business cycle indicators with some constraints that are identified by a specific economic model. These constrained or unconstrained co-dependent patterns resemble the propagation mechanism. Besides, it is intended to examine the dynamics of impulse mechanism in this paper. Thus, our main purpose is to define the impacts of shocks to aggregate demand and supply components on the shocks to the national income and general price levels. That will enlighten us about the dynamic nature of the impulse mechanism. Depending on these arguements, in the first-step-VAR estimation, we compute the quarterly growth rates of all the variables with individual drift terms and no trend and exogenous variables. This process, similar to the SVAR studies, will give us the propagation mechanism of underlying economic fluctuations. The procedure depends on the assumption that the cyclical movements in all the economic variables are interdependent. Thus, the co-dependent patterns in the determinants of both aggregate demand and supply compose the propagation mechanism of the business cycle.

In the second-step-VAR estimation, we use residuals from the first VAR estimation. The residuals can be approximately accepted as the shocks generated by impulse mechanism. The results of the second VAR estimation will show us the demand and cost factors which have significant effects on the shocks to general price and real GDP levels. Depending on the results, we intend to estimate a new VAR that has the same dependent variables but only those independent variables, which have significant coefficient estimates.

3. THE ESTIMATION RESULTS

Since a Business Cycle is mainly composed of an impulse and a propagation mechanism, the oscillatory behavior emerges from the responses of the propagation mechanism to the shocks generated by the impulse mechanism. There has to be such a dynamic system, where the shocks –whether they are demand or supply side shocks- generated by the impulse mechanism should cause an oscillatory behavior in all of the indicators. In order to understand the dynamic system, we will estimate VAR (1), VAR(2) and VAR(3) with all the variables endogenously responding the system. VAR(4) and the higher order systems can not be estimated since the determinants of their covariance matrices very close to zero. Comparing the three systems by using Akaike Information Criteria, Log Likelihood Ratios and Schwartz Criteria we obtain better results and higher explanatory power in VAR(3) estimation process**.** The equation of

the VAR (3) system, by definition, yields us the propagation mechanism of the general business cycle. On the other hand, this estimation will also provide us the random shocks to each variable. The residuals of the system can be approximately accepted as the shocks generated by the impulse mechanism.

In Table 1. in Appendix A the results of the first step VAR(3) estimation process can be seen. The propagation mechanism is the product of this set of interdependent economic relationships. The residuals from this estimation are used as dependent and independent variables in the second step VAR estimation.

The results from first step VAR(3) estimation show that income is strongly procyclical with past prices. Consequently, the most influential demand determinant on national income level is the consumption expenditures. The effect of consumption on national income is statistically significant for two quarters. Moreover, investment affects the national income level strongly; however the parameter coefficient is not statistically significant. It is indicated that national income is strongly countercyclical with exchange rates and gives significant responds after 3 quarters. This presents that exchange rates have higher impacts on aggregate supply than on exports demand. The results confirm that national income is strongly countercyclical with prices for domestic machinery equipment and imported industrial products as cost factors. National income fluctuations respond these indicators after 3 quarters. The seasonal effects on national income are significant in the 1st and 3rd quarters. The mean growth rate of national income is quarterly 1% and annually 4% approximately.

The general price level is countercyclical with past income levels. On the other hand, it is strongly procyclical with money supply and exchange rates. While money supply coefficient estimate in the 1st quarter is significant, the coefficient estimates of nominal exchange rates is insignificant. It is indicated that there is no long run effect of cost factors on inflation. The seasonal behaviour of general prices has significant impacts only in the fist quarter. Within the sample period, quarterly mean inflation rate is 12% and it is annually 50%.

Table 2 in Appendix A shows the results of the second step VAR estimation in which the residuals from the first estimation are used as dependent and independent variables. The relevant variables are identified in Appendix C.

The results in Table 2 in Appendix A indicate that shocks to national income are mainly composed of shocks to aggregate demand components. Among them shocks to consumption, investment and exports are more influential than others. Cost factors are relatively less influential in explaining the nature of shocks to national income. Nevertheless, shocks to exchange rates and prices for imported oil products have significant impacts.

In explaining the nature of shocks to general price level; shocks to government expenditures, imports, exchange rates and prices for electricity, domestic machinery equipment and imported industrial products have the most influential impacts. As the coefficient estimate of the past price level in the equation for national income is negative and as the estimate is very close to zero, it can be inferred that there is a negatively

sloped aggregate demand curve and it is quite steep. On the other hand, the coefficient estimate of national income in the equation for general price level is positive and very close to zero, it can be inferred that, within the sample period, there is a positively sloped but highly flat aggregate supply curve.

After these results, we intend to estimate a third VAR process, which includes shocks to national income and general price levels as dependent variables and shocks to consumption, investment, exports, money supply, exchange rate and prices for electricity and imported oil products which have significant estimation results in the second VAR. Table 3 in Appendix A presents the estimation results of the third VAR. It is seen that shocks to income are composed of shocks to consumption, investment and exports among demand side factors**.** Moreover all the cost factors have negative impacts on shocks to national income and, among them, the coefficient estimate of the shocks to prices of electricity is the most significant and influential one.

Shocks to general price level are mainly composed of cost factors. Among them, shocks to exchange rates are the most influential and the most significant ones. Also, shocks to prices of imported industrial products are also significant and influential. Among shocks to demand determinants, shocks to exports are more influential than others. While export shocks have significant impacts, consumption shocks have insignificant coefficient estimate.

Looking at the cross coefficient estimates of national income and general price levels, it can be inferred that the aggregate demand curve is downward sloping and highly steep and aggregate supply is upward sloping and flat. Nevertheless, the aggregate supply curve is less flat than the one estimated in the second VAR.

As a consequence of the estimation results from the third VAR, we present the fitted and actual values of ry and rp as fry and frp. In Appendix B the fitted and actual values are seen in Figures 1 and 2. In Figure 1, fry and ry are shown. In Figure 2 frp and rp are presented.

4. CONCLUSION

In this paper, the dynamic nature of impulse mechanism of business cycles in Turkish economy is analysed. In order to achieve this purpose, we apply a two step VAR estimation approach depending on the structural relationships identified by a standard aggregate supply – aggregate demand model. This enables us to decompose the shocks to national income and general price level into demand and cost factors. The theoretical model assures us that the shocks to national income and general price levels are the compositions of shocks to aggregate expenditure components, money supply, exchange rates and domestic and imported input prices. The decomposition of income and price shocks into these components gives us the dynamic structure of impulse mechanism in the sample period.

The impulse mechanism for national income is mostly composed of shocks to aggregate expenditures. Among them; shocks to consumption, investment and exports have relatively stronger impacts. Shocks to prices of electricity and imported oil products have significant impacts on

shocks to national income. Positive shocks to these cost factors produce negative shocks to national income. On the other hand, shocks to exchange rates behave like cost factors. This means that, the impact of exchange rates on aggregate supply is greater than their impacts on exports. Shocks to general price level are mostly composed of cost factors. Among them, shocks to exchange rates and shocks to prices of imported oil products are relatively more influential than others. Shocks to consumption and exports are the dominant demand side shocks affecting the shocks to general price level. Within the sample period, it may be inferred that aggregate demand is downward sloping and aggregate supply is upward sloping. Furthermore aggregate demand can be steeper than aggregate supply.

APPENDIX A:

TABLE 1: THE FIRST STEP VAR (3) ESTIMATION RESULTS

	y	p	c	i	G	V	x	z	m2	s	pelk	pmak	ppet	pzp	pip
y(-1)	-0,37	0,15	-0,05	-0,64	-0,55	-2,08*	-0,64	-1,42	0,54	0,41	-0,33	0,10	-3,85	-1,57	0,94
y(-2)	0,48	-1,27	0,22	1,01	0,50	1,59	0,31	0,32	-0,87	-2,25	-0,86	-1,16	-5,09*	-3,71*	-0,69
y(-3)	0,60	-1,25*	0,64*	0,86*	-0,58*	1,50*	0,24	2,08*	-1,15	-2,33*	0,03	-1,32*	-2,01	-2,77*	-1,00
p(-1)	1,09*	-1,09	1,01*	2,94	1,31	3,63*	2,02*	3,05*	-0,49	-2,81*	-0,86	-1,09	-1,04	1,37	-0,50
p(-2)	1,28*	-1,31	1,28*	1,57	0,89	1,86	-0,29	2,37	-1,35	-2,82*	-1,66	-1,47	-3,17	-2,97	-1,43
p(-3)	1,03*	0,09	0,53*	-0,73	0,13	0,83	0,49	1,56	0,70	-0,40	0,82	-0,34	-0,57	-1,34	-0,32
c(-1)	-0,87*	0,65	-0,96*	0,55	-0,04	-0,21	-0,56	-0,64	0,28	1,41	-0,20	0,68	0,69	1,91	-0,01
c(-2)	-0,80*	1,04	-0,89**	-0,45	-0,56	-1,88*	-1,61*	-0,87	1,26	1,21	-0,29	0,90	2,03	3,42*	0,70
c(-3)	-0,37	0,29	-1,18	-0,78	0,30	-1,24	-1,36*	-1,48	1,11	0,47	-0,68	0,25	-2,44	-1,13	0,42
i(-1)	0,02	0,21	0,16	-0,17	-0,16	-0,12	0,19	0,50	0,13	0,57	0,09	0,12	0,73	0,39	0,19
i(-2)	0,20	0,25	0,33**	0,34	-0,28*	-0,12	0,11	0,85*	0,03	0,01	0,05	0,04	1,03	0,75	0,31
i(-3)	0,20	-0,07	0,19	-0,08	0,34*	-0,11	0,06	-0,13	-0,11	-0,26	0,22	-0,10	-0,30	-0,66	-0,11
g(-1)	-0,05	-0,11	0,11	-0,05	-0,30*	0,20	-0,42*	-0,58	0,31	0,02	0,33	-0,14	-0,64	-0,92	-0,30
g(-2)	0,06	-0,05	0,07	0,09	-0,10	0,30	-0,09	-0,04	0,00	-0,08	0,35	0,07	2,38*	1,25*	-0,17
g(-3)	-0,35*	0,17	-0,28	-0,19	-0,16	0,34	0,29	-0,53	0,24	0,60	-0,19	0,42	1,26	1,17	0,20
v(-1)	-0,01	-0,12	-0,08	0,11	0,21*	-0,58**	0,14	-0,13	-0,09	-0,01	-0,12	-0,09	-0,80*	-0,42	-0,15
v(-2)	0,02	0,00	0,02	0,17	-0,19	-0,80**	-0,16	-0,16	-0,07	0,13	-0,05	-0,02	-0,07	0,36	-0,02
v(-3)	0,05	-0,22	0,07	0,20	-0,04	-0,11	0,23	0,35	0,01	-0,23	-0,13	-0,20	-0,19	-0,03	-0,31
x(-1)	0,10	-0,25	0,00	0,18	0,43*	0,84*	0,13	0,19	0,09	-0,31	-0,05	-0,14	1,48*	0,57	-0,19
x(-2)	-0,17	0,19	-0,20	-0,17	0,04	0,10	0,00	-0,64	-0,21	0,42	-0,49*	0,36*	0,28	0,57	0,21
x(-3)	-0,01	-0,06	-0,14	-0,50	0,00	0,15	-0,07	-0,39	-0,15	-0,08	-0,03	0,04	-1,14*	-0,68	-0,04
z(-1)	0,03	-0,07	0,04	0,01	-0,14	0,31	0,09	-0,28	-0,09	-0,15	0,00	0,02	-0,18	-0,22	-0,16
z(-2)	-0,01	0,08	-0,05	-0,43	0,17	0,09	0,22	-0,40	-0,22	0,28	0,48	0,14	0,33	-0,14	0,01
z(-3)	-0,29	0,15	-0,13	0,11	-0,10	0,39	0,37	-0,38	0,27	0,65	0,00	0,33	0,89	1,05	0,12
m2(-1)	-0,49*	0,71*	-0,17	-0,29	-0,41	0,38	0,36	-0,64	0,84*	1,46**	0,62	0,71*	1,66	1,47*	0,71
m2(-2)	0,21	-0,06	0,27	0,46	0,31	0,18	-0,51	0,52	-0,35	-0,70	-0,42	-0,18	-0,43	-0,20	-0,23
m2(-3)	0,05	-0,09	-0,09	-0,47	0,39	0,08	-0,04	0,42	0,30	0,03	0,43	-0,12	-0,13	-0,87	0,00
s(-1)	-0,01	0,22	-0,36	-0,48	0,38	-0,61	-0,42	-1,02	-0,11	0,70	1,07*	0,23	-1,26	-2,19*	0,21
s(-2)	-0,50	0,29	-0,32	-0,23 -	0,13	0,45	0,45	-0,88	0,01	0,11	0,32	0,38	2,74	2,62*	0,53
s(-3)	-0,47*	0,15	-0,29	-0,49	-0,32	-0,19	-0,05	-0,70	0,24	0,63	0,05	0,26	-1,29	-0,55	0,32
pelk(-1)	0,14	-0,07	0,01	-0,35	-0,36*	-0,63*	-0,65**	0,02	-0,02	0,09	-0,19	-0,25	-1,15	-1,02*	-0,20

	y	p	c	i	G	V	x	z	m2	s	pelk	pmak	ppet	pzp	pip
pelk(-2)	-0,07	0,07	-0,03	-0,33	-0,21*	-0,86*	0,26	-0,37	0,45	0,55	0,33	0,12	0,89	0,42	0,03
pelk(-3)	-0,03	0,13	0,05	0,37	0,01	-0,08	0,13	-0,14	-0,39	0,10	-0,10	0,23	0,79	1,05*	0,00
pmak(-1)	-0,81	0,58	0,06	-0,70	-1,88	-2,23	0,19	-0,88	1,37	1,83	1,01	0,98	-0,18	1,33	-0,02
pmak(-2)	0,79	0,23	-0,13	0,30	0,54	-0,68	-0,47	0,68	-0,76	0,17	0,76	-0,07	-2,01	-2,54	-0,15
pmak(-3)	-0,89*	-0,09	-0,72	0,40	-0,26	-0,74	-0,47	-1,52	0,46	0,23	-0,23	0,16	2,57	2,01	0,25
ppet(-1)	0,03	-0,06	0,00	0,02	0,02	0,11	-0,05	0,16	-0,02	-0,18	-0,16	-0,07	0,06	0,45*	-0,02
ppet(-2)	0,06	-0,11	0,03	0,09	-0,09	0,31	0,00	0,44	0,09	-0,21	-0,25	-0,12	-0,64	-0,31	-0,22
ppet(-3)	0,20*	0,08	0,08	0,12	0,04	0,06	-0,06	0,47*	-0,07	-0,11	-0,06	-0,03	0,45	-0,01	0,08
pzp(-1)	0,09	0,03	0,05	0,07	0,09	-0,11	0,00	-0,17	-0,19	-0,08	0,24	-0,05	0,24	-0,22	0,17
pzp(-2)	-0,26	0,01	-0,11	-0,18	-0,05	-0,29	0,14	-0,81*	0,08	0,40	0,09	0,11	0,05	0,05	0,03
pzp(-3)	-0,05	-0,07	0,03	-0,04	-0,15	-0,09	-0,03	-0,05	0,01	0,03	0,00	0,00	-0,21	0,22	-0,17
pip(-1)	-0,48*	0,46	-0,57*	-1,19*	-0,28	-1,25*	-0,88*	-0,91	0,06	0,95	0,15	0,46	0,04	0, 23	0,30
pip(-2)	-0,44*	0,65	-0,37	-0,67	-0,77**	-1,00*	-0,15	-0,65	0,69	1,10	0,79*	0,74*	1,06	1,26	1,00
pip(-3)	0,17	-0,54	0,23	0,87	0,97**	0,84	0,32	0,22	-0,75	-1,10	-0,52	-0,40	-0,36	-0,26	-0,28
d1	-0,43**	0,59**	-0,21	-0,80	-0,55**	-1,49**	-0,15	-0,35	0,15	0,97*	0,38	0,51*	0,65	0,62	0,62
d2	-0,27	0,36	-0,14	0,13	0,32	-0,28	-0,09	-0,95	0,42	0,88*	0,02	0,31	-1,32	-0,23	0,31
d3	0,50**	-0,13	0,27	0,45	-0,28	0,17	-0,48	0,24	-0,35	-0,71	0,02	-0,19	0,65	0,59	-0,03
d4	-0,06	-0,39	-0,11	-0,28	0,38	1,49**	0,68*	0,68	-0,05	-0,64	0,02	-0,26	0,49	-0,42	-0,43
R-squarsd	0,99	0,78	0,99	0,96	1,00	1,00	0,96	0,82	0,79	0,79	0,87	0,79	0,77	0,83	0,69
Adj. R-squarsd	0,97	0,07	0,96	0,84	0,99	0,99	0,85	0,23	0,12	0,13	0,46	0,13	0,03	0,28	-0,29
Sum sq. rssids	0,02	0,06	0,02	0,10	0,02	0,09	0,05	0,16	0,06	0,13	0,06	0,04	0,50	0,23	0,11
S.s. squation	0,03	0,06	0,03	0,08	0,04	0,08	0,05	0,10	0,06	0,09	0,06	0,05	0,18	0,12	0,08
F-statistic	50,35	1,10	32,77	8,11	98,41	121,69	8,30	1,40	1,19	1,20	2,12	1,19	1,04	1,52	0,70
Log likslihood	173,33	134,75	171,16	115,58	162,23	120,51	141,36	100,00	134,01	106,61	130,97	141,79	64,31	88,96	113,81
Akaiks AiC	3,89	-2,68	-3,82	-2,08	-3,54	-2,23	-2,89	-1,59	-2,66	-1,80	-2,56	-2,90	-0,48	-1,25	-2,03
Schwarz SC	-2,23	-1,03	-1,16	-0,43	-1,89	-0,58	-1,23	0,06	-1,00	-0,15	-0,91	-1,25	1,17	0,40	-0,37
Msan dspsndsnt	0,01	0,12	0,00	0,00	0,01	0,02	0,02	0,02	0,14	0,11	0,12	0,11	0,12	0,13	0,12
S.D. dspsndsnt	0,21	0,06	0,17	0,21	0,34	0,73	0,14	0,12	0,07	0,10	0,09	0,06	0,19	0,15	0,07

*indicates 95% level of significance.

** indicates 99% level of significance.

TABLE 2: SECOND VAR (1) ESTIMATION RESULTS

	ry	rp
ry(-1)	-0,01	0,03
rp(-1)	-0,02*	0,03
const	0,00	0,00
rc	0,73**	0,16
ri	0,09	-0,08*
rg	-0,15**	0,20**
rx	0,05*	0,01
rz	0,02	0,16**
rv	0,05*	0,00
rm2	0,01	0,03
rs	-0,19**	0,22**
rpelk	0,03	0,09*
rpmak	0,28**	0,53**
rppet	0,05**	-0,03
rpzp	-0,17**	0,01
rpip	0,23**	0,25**
R-squared	0,98	0,98
Adj. R-squared	0,98	0,97
Sum sq. resids	0,00	0,00
S.E. equation	0,00	0,01
F-statistic	175,74	127,81
Log likelihood	298,65	249,79
Akaike AIC -	8,97	-7,42
Schwarz SC	-8,43	-6,88
Mean dependent	0,00	0,00
S.D. dependent	0,02	0,03

*indicates 95% level of significance.
**indicates 99% level of significance.

TABLE 3: THIRD VAR (1) ESTIMATION RESULTS

	ry	rp
ry(-1)	0,10*	0,20*
rp(-1)	-0,01	0,05
const	0,00	0,00
rc	0,66**	0,12
rm2	0,04	-0,11*
ri	0,09**	-0,09
rx	0,11**	0,18**
rs	-0,01	0,52**
rpelk	-0,07**	0,03
rpzp	0,00	0,09*
R-squared	0,93	0,89
Adj. R-squared	0,92	0,88
Sum sq. resids	0,00	0,01
S.E. equation	0,00	0,01
F-statistic	76,71	49,97
Log likelihood	254,43	203,08
Akaike AIC	-7,76	-6,13
Schwarz SC	-7,42	-5,79
Mean dependent	0,00	0,00
S.D. dependent	0,02	0,03

*indicates 95% level of significance.
**indicates 99% level of significance.

APPENDIX B:

FIGURE 1: THE FITTED AND ACTUAL VALUES OF DEMAND SHOCKS

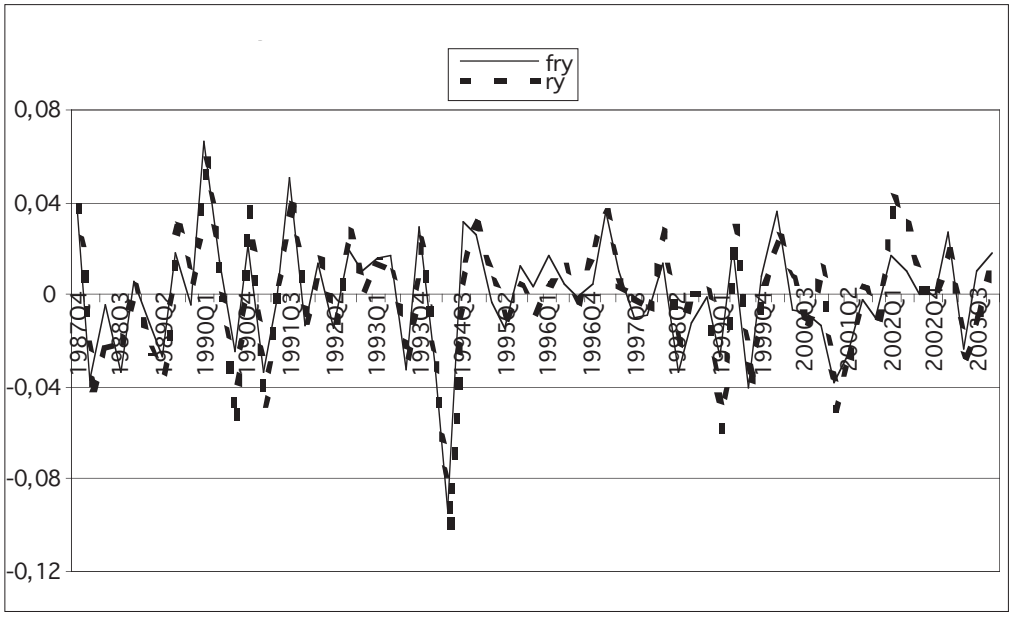
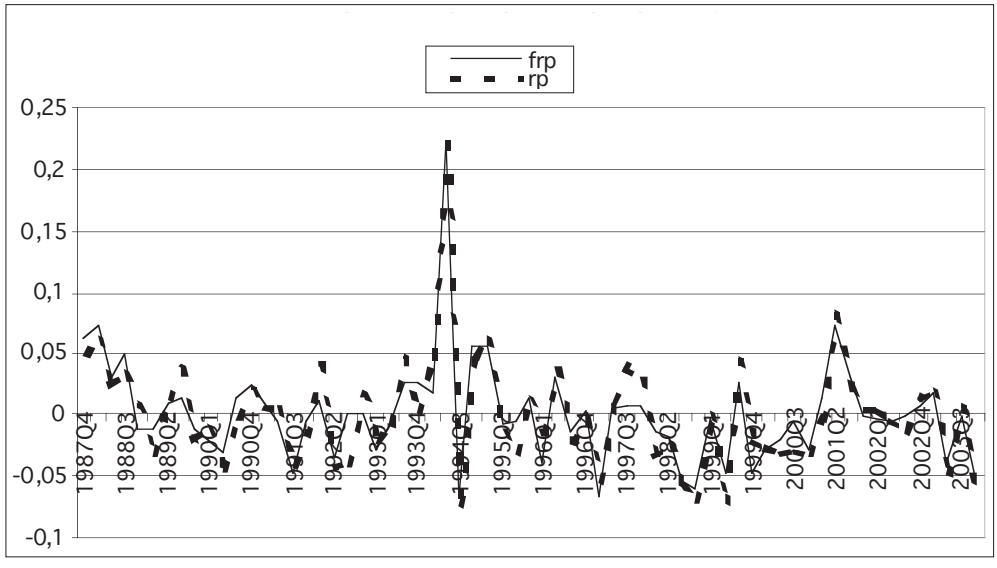


FIGURE 2: THE FITTED AND ACTUAL VALUES OF SUPPLY SHOCKS



APPENDIX C: THE DEFINITIONS AND ABBREVIATIONS OF VARIABLES

y: The natural logarithmic difference (the growth rate) of quarterly real GDP.
p: The natural logarithmic difference (the growth rate) of quarterly WPI.
c: The natural logarithmic difference (the growth rate) of quarterly real consumption.
i : The natural logarithmic difference (the growth rate) of quarterly real investment
g : The natural logarithmic difference (the growth rate) of quarterly real government expenditures.
v: The natural logarithmic difference (the growth rate) of quarterly real tax revanues.
s: : The natural logarithmic difference (the growth rate) of quarterly exchange rate.
x : The natural logarithmic difference (the growth rate) of quarterly real exports.
z : The natural logarithmic difference (the growth rate) of quarterly real imports.
m2: The natural logarithmic difference (the growth rate) of quarterly nominal money supply.
pelk : The natural logarithmic difference (the growth rate) of quarterly WPI for electricity.
ppet : The natural logarithmic difference (the growth rate) of quarterly WPI for raw oil.
pmak : The natural logarithmic difference (the growth rate) of quarterly WPI for machinery.
pzp: The natural logarithmic difference (the growth rate) of quarterly nominal prices for imported oil products.
pip: The natural logarithmic difference (the growth rate) of quarterly nominal prices for imported industrial products.
ry: The residuals of the y from the first VAR estimation.
rp: The residuals of the p from the first VAR estimation.
rc: The residuals of the c from the first VAR estimation.
ri: The residuals of the i from the first VAR estimation.
rg: The residuals of the g from the first VAR estimation.
rv: The residuals of the v from the first VAR estimation.
rs: The residuals of the s from the first VAR estimation
rm2: The residuals of the m2 from the first VAR estimation.
rx: The residuals of the x from the first VAR estimation.
rz: The residuals of the z from the first VAR estimation.
rpelk: The residuals of the pelk from the first VAR estimation.
rppet: The residuals of the ppet from the first VAR estimation.
rpmak: The residuals of the pmak from the first VAR estimation.
rpzp: The residuals of the pzp from the first VAR estimation.
rpip: The residuals of the pip from the first VAR estimation.

REFERENCES

Ateşoğlu H.S and D.H. Dutkowsky, (1995) " Money, Output and Prices in Turkey", *Applied Economic Letters*, Vol.2, pp.38-41

Barro, R., and H.Grossman,(1976), *Money, Employment and Inflation*, Cambridge University Press.

Benassy J.P., (1987), "Imperfect Competition, Unemployment and Policy", *European Economic Review*, Vol.31, pp. 417-426

Benassy, J.P., (1982), *The Economics of Market Disequlibrium*, New York: Academic Press

Blanchard O. J., and D. Quah. (1989), "The Dynamic Effects of Aggregate Demand and Supply Disturbances", *American Economic Review*, Vol.79, pp. 655-673

Blanchard O., and N. Kiyotaki, (1987), "Monopolistic Competition and the Effects of Aggregate Demand", *American Economic Review*, Vol.77, pp. 647-666

Claus I., (2000) "Estimating Potential Output for New Zealand : A Structural VAR Approach", *Reserve Bank of Zealand Discussion Papers*,DP 2000/03

Diboğlu S and A. Kibritçioğlu, (2001), "Inflation Output and Stabilization in a High Inflation Economy: Turkey, 1980-2000", University of Illinois at Urbane-Champaign, *Collage of Commerce and Business Administration, Office of Research Working Paper*, No.01-0112

Erceg C.J., W.Henderson and A.T.Levin, (2000) "Optimal Monetary Policy with Staggered Wage and Price Contracts", *Journal of Monetary Economics*, Vol.46, pp.281-313

Erol T. and S.Van Wijnbergen, (1997) "Real Exchange Rate Targeting and Inflation in Turkey :An Emprical Analysis with Policy Credibility", *World Development*, Vol.25, pp.1717-1730

Gali J. and M. Gertler, (1999), "Inflation Dynamics: A Structural Econometric Analysis", *Journal of Monetary Economics*, Vol.44, pp.195-222

Gali J., (1992), "How well does the IS-LM model fit Postwar U.S data?" *Quarterly Journal of Economics*, Vol.107, pp.709-738

Hahn F., (1978), "On Non-Walrasian Equilibria", *Review of Economic Studies*, Vol.45, pp.1-17

Hoover K.D. and Jorda O., (2002) " Measuring Systematic Monetary Policy", University of California Davis, *Department of Economics of Working Papers*, No.00/05

Höppner F.,(2002) "Fiscal Policy and Automatic Stabilisers: A SVAR Perspective, *University of Bonn Institute for International Economics*

Ireland P., (2001) " Sticky Price Models of the Business Cycle: Specification and Stability", *Journal of Monetary Economics*, Vol.47, pp.3-18

Keating J.W., (1992)"Structural Approaches to Vector Autoregression", Federal Reserve Bank of St. Louis Review, Vol.74, p. 37-57

Kibritçioğlu A and B. Kibritçioğlu, (1999) *The Inflationary Effects of Increases in Price of Crude-oil and Oil-products in Turkey*, (In Turkish) Ankara: Hazine Müsteşarlığı, EAGM. AID, No.21

Kibritçioğlu A.,(2001), "Recent Increases in Prices of Oil Products and Their Possible Effects on the 2001-2002", *İktisat, İşletme ve Finans Dergisi*, 16(No.184), p:31-41

Kim J., (2000) "Constracting and Estimating a Realistic Optimazing Model of Monetary Policy", *Journal of Monetary Economics,* Vol.45, pp.329-359

Kim S. and N.Roubini, (2000) "Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach", *Journal of Monetary Economics*, Vol. 45, p.561-586

King R.G., C.I. Plosser, J.H. Stock and M.W. Watson, (1991) " Stochastic Trends and Economic Fluctuations", *American Economic Review*, Vol.81, p.819-840

Krolzig H.M., (2003) "General to Spesific Model Selection Procedures for Structural Vector Autoregressions", *Nuffield College Economics Working Papers*,W15

Leigh D. And M.Rossi, (2002) "Exchange Rate Pass Through in Turkey", *IMF Working Paper*,WP/02/204

Lucas R.E., (1977) " Understanding Business Cycles", In Karl Brunner and Allan Meltzer (eds), *Stabilization of the Domestic and International Economy*, Amsterdam: North- Holland, p.7-29

Malinvaud E.,(1977) *The Theory of Unemployment Reconsidered*, Oxford, Basil Balckwill.

Metin K., (1995) " An Integrated Analysis of Turkish Inflation", *Oxford Bulletin of Economics and Statistics*, Vol.57, pp.513-531

Öniş Z. and S. Özmucur.,(1990), "Exchange Rates, Inflation and Money Supply in Turkey: Testing the Vicious Circle Hypothesis ", *Journal of Development Economics*, 32(1), 133-154

Özatay F.,(1992), "The Role of Public Sector Prices in Price Dynamics in Turkey"In (eds.), *Price Dynamics*: Papers presented at workshop held in Antalya, Turkey on May 7-10, 1990, Ankara, Central Bank of Republic of Turkey, p.33-69

Rotemberg J.J. and M. Woodford, (1992) "Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity", *Journal of Political Economy*, Vol.100, pp.1153-1207

Shapiro M. and M.Watson., (1998) "*Sources of Business Cycle Fluctuation*" , In Stanley Fisher, (eds)., *NBER Macroeconomics Annual*, Cambridge MIT Press, p. 111-148

Sims C.A., (1980) "Macroeconomics and Reality", *Econometrica* , Vol.48, p.1-48