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Investigation of Interaction Between Monetary and Fiscal Policy in Turkey: SVAR Approach

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Abstract

Interaction between monetary and fiscal policies plays an important role in ensuring macroeconomic stability. This study aims to examine the interaction between monetary and fiscal policy with key data on macroeconomic variables in Turkey. The interaction between the policies has been analyzed by Structural VAR (SVAR) technique, which is also widely used in the literature. The analysis is based on the impact-response functions obtained by the SVAR technique. In this way, dynamic interactions of policy variables used for monetary and fiscal policies can be identified. In the study, the contemporaneous effects of macroeconomic key variables such as output and inflation were examined. The existence of a strategic interaction between monetary and fiscal policies has been discussed as a result of the findings.

Keywords: monetary policy, fiscal policy, policy ınteraction, svar

1. INTRODUCTION

The role of the interdependence between fiscal and monetary policy is crucial in analyzing the core areas of macroeconomics, such as inflation, growth and unemployment. It has become important to analyze the interaction of these two policy makers when two policy makers have different objectives in the theoretical investigations, following consensus on the necessity of separation of powers between the financial authority (government) and independent monetary authorities. Theoretically, the target of the monetary authority is the inflation and interest rate, while the target of the fiscal authority is usually the budget deficit or output. The implementation of monetary and fiscal policies on the basis of these targets creates a problem of reliability in the policies that policy makers will implement in the future. The problem of reliability created by tacit policy results in the economy, away from the commitment committed by policy makers, and with lower levels of prosperity (Kydland and Prescot, 1977). Rule-based policies generally lead to better outcomes than monetary policies based on macroeconomic stability (Barro and Gordon, 1983a, 1983b).

Price level determination The price stability, which is the monetary authority's target, can not be obtained unless the financial authority can guarantee the financial authority's ability to pay according to the fiscal theory. This is because rising debt payments and interest rate will increase inflationary pressures. Therefore, it can be said that both the rule-based politics of money and financial authorities and the cooperation they will carry out in the implementation of these policies open the way to reach their targets. The form of interdependence between finance and monetary policy, ie the possibility of strategic substitution or complementarity of these policy objectives, should not necessarily be construed in the sense of a conflict or cooperation, which may be due to economic shocks of supply and demand. For example, a supply shock in the economy leads to a policy conflict, while a demand shock may lead to a cooperative policy (Buti et al., 2001).

There are studies in the literature that generally support the view that two policy makers tend to act in the opposite direction, that is, a policy conflict. While monetary policies act in concert with expanding fiscal policy, a looser fiscal stance causes tight monetary policies (Von Hagen et al., 2001). A strong stance of the monetary authority in the direction of price stability may cause the financial authority to care less about output (Hughes et al., 2000)

2. METHOD: STRUCTURAL VAR

Structural VAR models were first proposed by Sims (1986), Bernanke (1986), Shapiro and Watson (1988). At the same time, the Structural VAR technique is often used in monetary policy studies. This technique allows us to identify the dynamic interactions between co-operating internal variables in a simple and powerful way. The VAR technique is also suitable for analyzing the macroeconomic effects of the fiscal policy process, ie expenditure and tax decisions, in the case of changes not only in analyzing the dynamic effects of monetary policy but also in monetary policy. Structural VAR is a technique that stands out in the context of economic policy analysis, in particular because it allows macroeconomic impacts of policy decisions to be determined. In practice, the estimated policy responses in the VAR model are interpreted as reduced forms of forward-looking policy response functions and structural parameters of the economy. Impulse response functions are interpreted as reactions to unexpected shocks in the economy.

To estimate the structural response functions, it is necessary to make some restrictive assumptions about the definition of the policy rules. However, these modeling assumptions should discuss fiscal policy rules in particular. Moreover, in VAR models, we can not deal with a single structural parameter of policy reaction functions. However, especially if econometric evidence is supported by information about a well-known political event, this model gives us a general impression of policy reactions (Muscatelli et al., 2002). This study has been based on an estimation of the structural model of the reaction functions of policy makers in order to analyze the interaction between monetary and fiscal policies in Turkey. The SVAR method will be used to estimate the structural model of the response functions of monetary and fiscal policy makers.

SVAR models are expressed as a set of variables that can be observed by their own latency and other factors (such as trend and constant terms). At the same time, these models are very flexible because they require very little restriction. These models also provide extremely useful tools in terms of the magnitude of the impact of macroeconomic policies, such as impact response functions, forecasting error variance decomposition, Granger causality, and the effects of supply and demand shocks.

3. ESTIMATION

The aim of this study is to estimate an SVAR model with four variables. The data frequency selection has been worked out to cover the period 2006m01-2016m09. The monetary policy to be used in the framework of the structural VAR model is the monthly average of the central bank's weekly lending interest rate (ir). Budgetary policy (bd) was used as a variable in fiscal policy. The Consumer Price Index (cPI) was used as the inflation rate. There was a need for a monthly scale to represent Gross Domestic Product (GDP) data with a frequency of one quarter. Due to the very high correlation between Quarterly GDP and Industrial Production Index (IPI) series, the industrial production index representing GDP is included in the model.

To analyze the interaction between monetary and fiscal policy in Turkey, the structural VAR (SVAR) model, which allows both possible synergy and delayed interaction among variables, is as follows;

$$AY_t = B + CY_{t-p} + \varepsilon_t \quad (1)$$

Here Y_t is the vector of 4x1 depended variables in the form [ipi, cpi, ir, bd] respectively. A, B and C are matrices of structural coefficients while $\varepsilon_{t,}$ [ε_{1t}, ε_{2t}, ε_{3t}, ε_{4t}, $\varepsilon_{5t,}$ ε_{6t}] is a vector of structural shocks. The structural shocks are assumed to have zero means and are uncorrelated with each other. A is a 4 x 4 matrix. Its main diagonal elements are one and off-diagonal elements are the contemporaneous structural coefficient that allows for the presence of contemporaneous feedback among the variables

3.1. Preliminary

VAR estimates after the model variables are tested for stationarity, optimal latency length, and Granger causality analysis. Otherwise, the significance of the results of VAR models becomes controversial. In order to use VAR models, it is necessary that all variables in the model are stationary. The non-stationary variables in the model cause the estimation results of the model to be insignificant. It can be seen that the series in the model are non-stable at the level of [ipi, cpi, ir, bd] respectively.

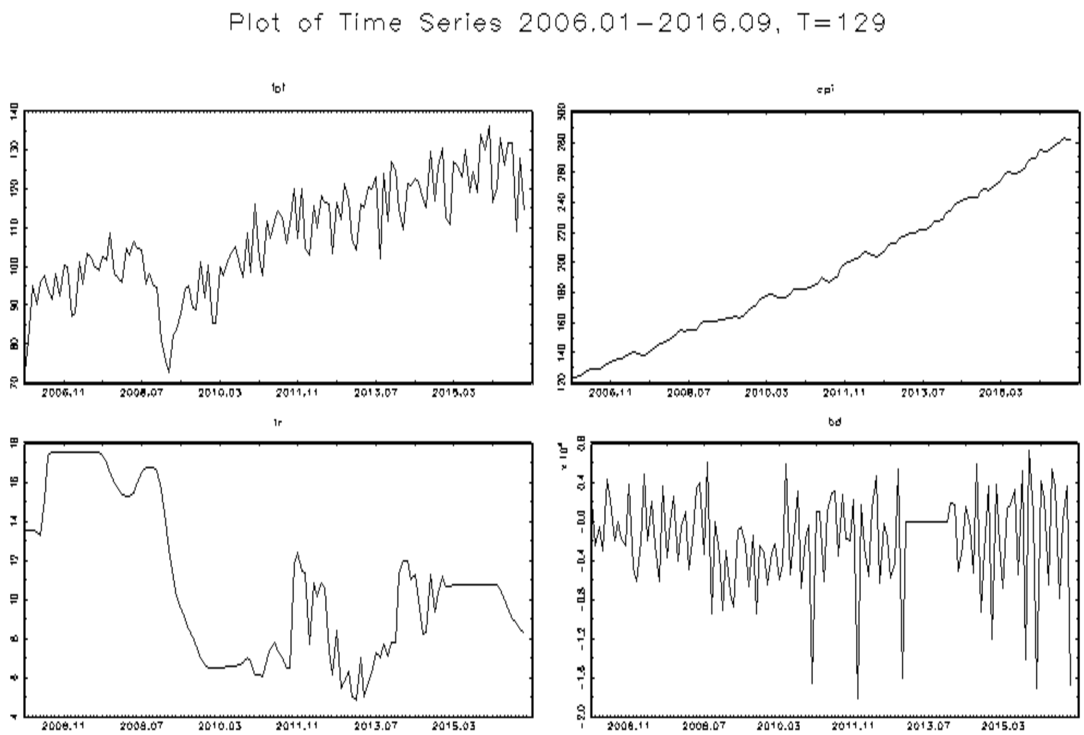

Figure 1: Series in Level

It may not be sufficient to look at the econometric stability of the series only graphically. For this reason, the extended Dickey-Fuller stationarity test commonly used in the literature is needed. Unit root test results for the series are given in Table 2 for the first differences.

Table 1: ADF Unit Root Test Results

All Period	Test Format	ADF Values	Davidson and Mackinnon Values		
			%1	%5	%10
ipi_d1	Level + Constant Term	-9.09	-3.43	-2.86	-2.57
cpi_d1	Level + Constant Term	-3.45	-3.43	-2.86	-2.57
ir_d1	Level + Constant Term	-6.02	-3.43	-2.86	-2.57
Bd_d1	Level + Constant Term	-11.76	-3.43	-2.86	-2.57

According to the ADF test results, the first differences of all variables were found to be stationary, as shown in table 1, when there was no variable level of stability at the 1% significance level. In this case, the analysis continues with the first differences of all variables. In this case, the order of the model variables is [ipi_d1, cpi_d1, ir_d1, bd_d1].

In the VAR models, the delay length of the variables in the model affects the analysis results to a great extent. If the delay length of the model increases, this leads to a rapid decline in the degree of freedom. For this reason, the optimal delay length for the model should be sufficiently short to cause autocorrelation between error terms, so short that the series do not cause loss of information about the interaction with each other. Akaike Information Criteria, Schwarz Information Criteria, Hannan-Quinn Knowledge Criteria (HQ), and Last Prediction Error (FPE) are the most commonly used latency length tests. In these tests, the optimal delay length is determined by the smallest value.

Hacker and Hatemi (2008) found that the Schwarz Information Criteria (SIC) performed better than the other criteria in selecting the optimal delay lenght in their study of the performance of different criteria to select the optimal lag length in stable and unstable VAR models. For the model, the result of the tests for determining the delay length is given in table 2. (Tetik and Ceylan, 2015).

Table 2: Lag Length Test

Test Criterion	optimal number of lags
Akaike Info Criterion	5
Final Prediction Error	5
Hannan-Quinn Criterion:	3
Schwarz Criterion	1

It has been decided that the delay length of the model should be taken as 1 in the study according to the better performing SIC criterion as stated in Hacker and Hatemi (2008).

3.2. Structural VAR (SVAR) Estimation

It is necessary to examine the causality between these variables before estimating the model in order for the SVAR model to yield meaningful results (Lutkepohl, 2005). The Granger causality test was used to avoid causal relationship between the variables in the SVAR model for theoretical reasons. Table 3 shows the results of causality between these variables.

Table 3: Granger Causality Test Results between Variables[1]

Granger Causality Test -1 H0: "ipi_d1" do not Granger-cause "cpi_d1, ir_d1, bd"	Test statistic l = 0.6517	pval-F= 0.5822
Granger Causality Test -2 H0: "cpi_d1" do not Granger-cause "ipi_d1, ir_d1, bd"	**Test statistic l = 3.5313**	**pval-F= 0.0148**
Granger Causality Test -3 H0: "ir_d1" do not Granger-cause "ipi_d1, cpi_d1, bd"	**Test statistic l = 2.7252**	**pval-F= 0.0437**
Granger Causality Test -4 H0: "bd" do not Granger-cause "ipi_d1, cpi_d1, ir_d1"	**Test statistic l = 12.4070**	**pval-F0.0000**

The results in Table 3 are sufficient for this analysis. When we look at the causality relationship between variables, it is seen that only the ip variable is not a cause of other variables. As a result of these tests it is now possible to run the SVAR model. Contemporaneous coefficient estimation results of the SVAR model are given in Table 4.

Table 4: Contemporaneous Structural Coefficient Estimation Results[2]

a_{11} **Estimated:0.1305** **Std. err.: { 0.0082}**	0.00	0.00	0.00
a_{21} Estimated: -0.0042 Std. err.: {0.0116}	a_{22} **Estimated: 0.7275** **Std. err. { 0.0456}**	0.00	0.00

[1] The figures in bold are statistically significant coefficients in our SVAR model.

[2] The figures in bold are statistically significant coefficients in our SVAR model.

a_{31} **Estimated:-0.0252** **Std. err.: { 0.0117}**	a_{32} **Estimated:-0.1599** **Std. err. { 0.0653}**	a_{33} **Tahmin 0.9697** **Std. err.: { 0.0608}**	0.00
a_{41} **Estimated: 0.0126** **Std. err.: { 0.0118}**	a_{42} Estimated 0.0424 Std. err.: { 0.0661}	a_{43} **Estimated: -0.1417** **Std. err.: { 0.0865 }**	a_{43} **Estimated:0.0002** **Std. err.: { 0.0000 }**

The coefficients in Table 4 are the inverse coefficients in the SVAR equation. According to the results in Table 4, all parameters except two out of 10 parameters are statistically significant and simultaneously affect other variables in the model. In general, most of the contemporaneous coefficients of the SVAR model are consistent with the theoretical expectations of the contemporaneous interaction between variables. In addition, the statistical significance of all the coefficients on the main diagonal in table 4 indicates that the dependent variables in the SVAR equations can be explained to a large extent by the delays of their own delays and other variables (Tetik and İvrendi, 2013).

3.3 Impulse-Response Analysis

Interpretation of the estimation results of SVAR models is made by looking at the effect-response function graphs. Impulse-response analysis is a graphical representation of the responses of variables to shocks. The vertical axis of the effect-response functions obtained from the estimation of the SVAR model shows the magnitude and direction of the response given by the other variables to a standard deviation increase shock given to the corresponding variable. The horizontal axis shows the time elapsed after the chest was given on the day scale. The dashed lines represent the 95% confidence interval for the response of the variables and play an important role in determining the statistical significance of the results.

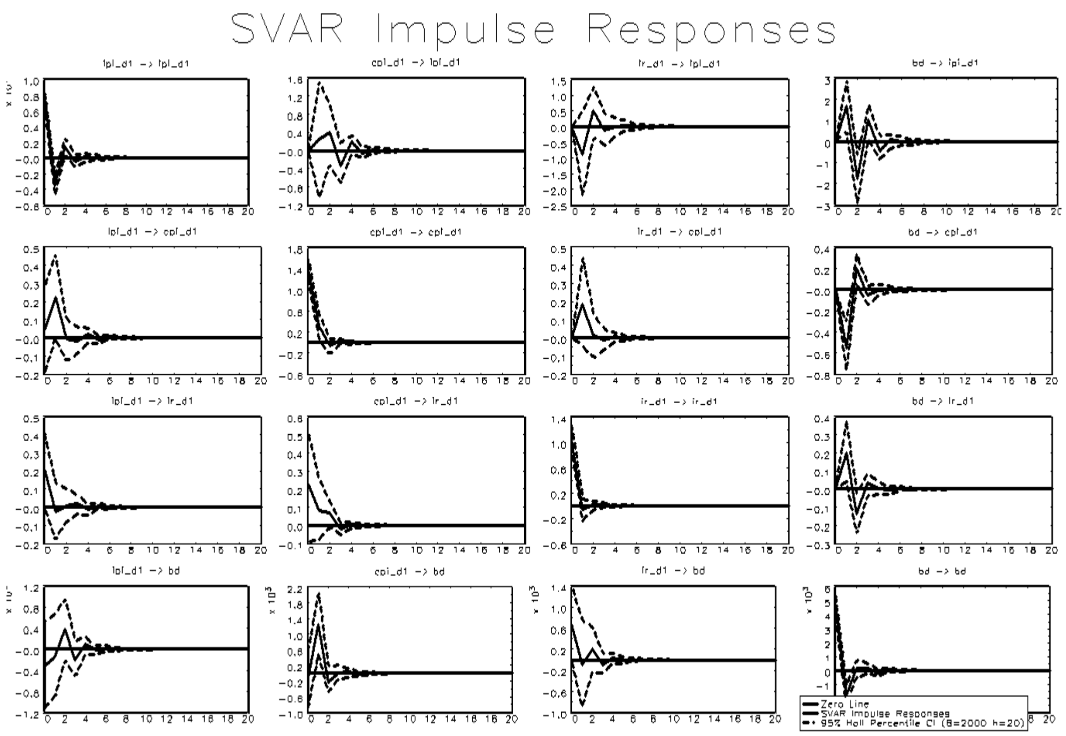

Figure 2: System Impulse Responses to one Standard Deviation Shock

Considering the impact-response functions, the important consequences are striking. Based on this model, impulse response functions show us the effects of shocks in the system and their path in time. First of all, the impact of shocks on the other variables whether statistically significant or insignificant, has four months or quarterly effects.

In the first column, a shock to aggregate demand (AD) is analyzed: Positive shock (ipi_d1) on output caused an increase in price level (cpi_d1). For this reason, the aggregate demand can be interpreted as a result of more increase in aggregate supply, resulting in post-inflation. The positive shoka policy rate in the output has also responded positively (ir_d1), ie a restrictive monetary policy has been applied. This can be interpreted as the Central Bank reacting to inflationary pressures by increasing interest rates. The first reaction of the positive coke budget deficit in output is negative (BD_d1). That is, a restrictive fiscal policy may be applied. Therefore, this result is thought to have overlapped with the conclusion that the demand for the study's odor may lead to a cooperative policy which can be seen in Buti et al. (2001).

The second column reflects a state of shock (cpi_d1) in aggeregate supply (AS). Inflation is increasing when a supply shock occurs in the economy. On the third line of the second column, it is seen that the positive shock center of the central bank responds by increasing the interest rate (ir_d1). As a result of the contractionary monetary policy, the inflation rate (cpi_d1) returns to its previous level at the end of the second month. An important finding in this section is that the budget deficit positively reacted in the case of supply-side shocks. That is, an expansionary fiscal policy has been implemented. Therefore, this result can be seen in Buti et al. (2001) is thought to have overlapped with the result that a shock of the economy seen in the economy leads to a policy conflict.

In the third column, the macroeconomic and fiscal policy variables seem to show a shock in monetary policy. As expected, a positive shock in monetary policy gives a negative response, even if the output is not simultaneous. This situation is perceived as a decrease in aggregate demand due to the consumption and investments channel. This shock effect is rising in 3 months. While a positive shock at interest rates did not have a significant effect on inflation, the budget deficit had a positive response. It can be interpreted as an expansionary fiscal policy implemented as a result of a contractionary monetary policy. This situation supports the view that two policy makers in the literature tend to act in the opposite direction, that is, a policy conflict.

In the last column, the effects of fiscal policy shock are seen, but no meaningful contemporaneous action has been found.

4. CONCLUSION

In this study, the analysis of the interaction between monetary and fiscal policies in Turkey was based on the estimation of the structural model of the reaction functions of these policy makers. The SVAR method was used to estimate the structural model of the response functions of monetary and fiscal policy makers. Significant findings were obtained about the interaction of the SVAR model monetary and fiscal policy, which was estimated for the Turkish economy in the period 2006m01-2016m09.

One of the important consequences of impact-response functions is the impact of shocks on the other variables, three months or quarterly. Another finding; In the first column, a shock to aggregate demand (AD) is analyzed: A positive shocking bank of merge in the output has reacted by applying a restrictive monetary policy. This situation was interpreted as the Central Bank reacting to inflationary pressures by increasing the interest rate. The positive shock in output has also reacted to the fiscal authority by implementing a restrictive fiscal policy. Therefore, this result can be seen in Buti et al. (2001) coincides with the conclusion that demand for the study's work may lead to a cooperative policy.

An important finding in the study is that in the case of a supply-side shock, the fiscal authority reacted with monetarist monetary policy while the fiscal authority was implementing an expansionary fiscal policy. Therefore, this result coincides with the conclusion that a supply shock in the economy leads to a policy conflict which can be seen in Buti et al. (2001).

A positive shock to interest rates has been interpreted as an expansionary fiscal policy as a result of a tightening monetary policy with a positive response to the budget deficit. This supports the view that two policy makers in the literature tend to act in the opposite direction, that is, a policy conflict.

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