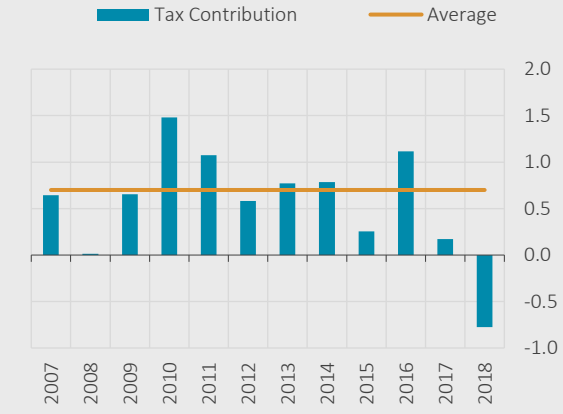
Box 7.2

The Interaction Between Monetary and Fiscal Policies in a Structural General Equilibrium Model

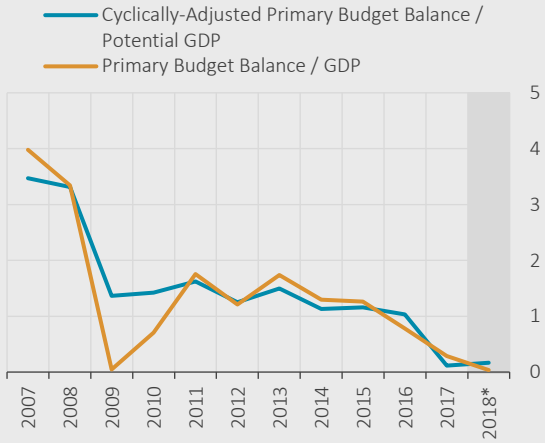
As the Turkish economy has faced many global and geopolitical shocks in recent years, the interaction and coordination between monetary and fiscal policies have gained greater importance in order to limit the effects of these shocks and to diminish policy trade-offs. While the monetary policy stance has been gradually tightened because of a rise in inflation mainly stemming from the exchange rate and import prices since the last quarter of 2016, many fiscal policy measures were taken by using the fiscal space generated by fiscal discipline in order to prevent the slowdown in the economy and to prevent the contraction in loans from causing a negative cycle. Thus, fiscal policy supported economic activity in 2017 while tax adjustments were set to limit the rise in inflation at the same time (Chart 1, Chart 2). The sliding scale tariff applied to fuel prices in 2018 is an important example of how recent fiscal policy has sought to reduce the volatility in inflation (Box 3.2). In this context, while the monetary policy framework is given in this box, it is emphasized how inflation and output gap volatility are affected in a situation where fiscal policy is established to ensure debt stability as well as to minimize the fluctuations in inflation and output gap.

Chart 1: Contribution of Tax Adjustments to Inflation (%)



Source: CBRT, TURKSTAT.

Chart 2: Cyclically-Adjusted Primary Budget Balance (As a share of potential GDP, %)



Source: Ministry of Treasury and Finance, CBRT calculations.
* Estimation.

In this box, the interaction between monetary and fiscal policies in Turkey is examined through a small-scale structural dynamic general equilibrium model. The model used consists of total supply, total demand, a monetary policy interest rate rule, fiscal policy spending and tax rules, and debt dynamics equations. A detailed explanation of the model can be found in Büyükbaşaran, Çebi, and Küçük (2018). For this analysis, fiscal policy spending and tax rules are important:

Spending Rule $$\hat{g}_t = \rho_g \hat{g}_{t-1} + (1-\rho_g)\left[g_y \hat{y}gap_{t-1} + g_b \hat{b}_t\right] + \epsilon_t^g \quad (1)$$

Tax Rule $$\hat{t}_t = \rho_t \hat{t}_{t-1} + (1-\rho_t)\left[t_y \hat{y}gap_{t-1} + t_b \hat{b}_t\right] + \varepsilon_t^t \quad (2)$$

The fiscal policy rules described in Equations (1) and (2) respond to debt stability and the output gap. $\widehat{y}gap$ represents the output gap, i.e. the percentage deviation from the potential value of the gross domestic product (GDP). $\hat{g}_t$, $\hat{t}_t$ and $\hat{b}_t$ denote the ratio of budget expenditures, tax revenues and public debt stock to GDP, respectively. The parameters g_y and g_b in equation (1) show the sensitivity of public expenditures to output gap and debt stock, respectively. The parameters t_y ve t_b in equation (2) display the sensitivity of tax revenues to output gap and debt stock, respectively. The fiscal smoothing parameters (ρ_g and ρ_t) play an important role in determining the sensitivity of fiscal policy instruments to debt stock and the output gap. It is assumed that the public sector can change parameters g_y, g_b, t_y and t_b with the changes made in expenditures and tax policies.

In short, different expenditure and tax policies correspond to different g_y, g_b, t_y and t_b parameter values. When constructing fiscal policies, important variables are taken into consideration in terms of macro economy such as budget balance, growth and inflation. If more than one variable is included in the policy objective function at the same time, different fiscal policies can be applied depending on the priority given to a variable in case of trade-offs between these variables. Differences in fiscal policy implementations cause changes in resource allocation and macro balances in the economy.

For example, in a period when the debt stock is relatively high, a fiscal policy framework that prioritizes debt stock stability may choose to make a relatively larger cut in public spending, given the low tax revenues due to low growth, while a fiscal policy that prioritizes the growth outlook may decide to increase spending, at the expense of increasing the debt stock. In this box, an analysis is made to show how the implications of budget discipline, growth and price stability in the objective function of the fiscal policy can have consequences for macro balances. Four different objective (loss) functions have been selected to represent different priorities of fiscal policy:

$$L1 = 0.01var(\pi) + 0.2var(ygap) + 1.0var(b) \quad (3)$$

$$L2 = 0.01var(\pi) + 1.0var(ygap) + 0.2var(b) \quad (4)$$

$$L3 = 1.0var(\pi) + 1.0var(ygap) + 0.2var(b) \quad (5)$$

$$L4 = 1.0var(\pi) + 1.0var(ygap) \quad (6)$$

Here, *var(x)* represents the variance (volatility) value from the structural general equilibrium model of variable *x*, inflation π, output gap *ygap* and debt stock *b*. Fiscal policy is assumed to select the parameters g_y, g_b, t_y and t_b to minimize L1, L2, L3 and L4 loss functions. Here, L1 prioritizes debt discipline, L2 prioritizes the output gap outlook, L3 gives priority to the inflation outlook and output gap without ignoring budget discipline and L4 is constructed to represent a fiscal policy that gives equal importance to inflation and growth. Table 1 shows the optimal parameter selections ($\mathrm{g_y}$, $\mathrm{g_b}$, $\mathrm{t_y}$ and $\mathrm{t_b}$) for each objective function as well as what these parameters imply in terms of inflation, output gap and debt stock volatility.

Table 1: Optimal Parameter Choices under Different Objective (Loss) Functions of Fiscal Policies

	Spending Rule		Tax Rule		Standard Deviation						
	g_y	g_b	t_y	t_b	Inflation	Output Gap	Debt Stock	L1	L2	L3	L4
Optimal L1	-1.0	-1.0	0.0	0.5	1.299	2.955	5.224	29.1	14.2	15.9	5.2
Optimal L2	-0.1	-0.3	0.5	0.9	1.298	2.288	5.483	31.1	11.3	12.9	3.5
Optimal L3	-0.2	-0.3	0.4	0.9	1.296	2.289	5.482	31.1	11.3	12.9	3.5
Optimal L4	-1.0	0.2	-0.6	0.3	1.242	2.042	16.245	264.8	57.0	58.5	2.9

According to this, fiscal policy implementations (such as L3), which give more importance to the volatility in inflation and output gap, are more successful in decreasing the volatility of inflation and output gap compared to the loss function that gives more importance to debt stability (L1)[1].

In order to understand what the alternative fiscal rule practices summarized in Table 1 imply for the interaction of monetary and fiscal policies, it would be useful to focus on the macroeconomic effects of the cost-push shock under different fiscal policy implementations. Within the framework of the structural general equilibrium model used, the inflation rate increases as the output decreases after the cost-push shock and this situation results in a trade-off in terms of monetary policy. The reason for the trade-off is that an increase in the interest rate against the rise in inflation following the shock will bring the output further down. On the other hand, following the cost-push shock in the model, fiscal policy responds, to varying degrees, by increasing public spending under all loss functions. In other words, a tight monetary policy and expansionary fiscal policy mix is preferred following the cost-push shock, and thus the decreasing effect of the inflation shock on the output is offset by expansionary fiscal policy implementations[2].

Interpreting the optimal parameter choices implied by the cost-push shock of alternative objective functions with different priorities described above, it is observed that the L1 loss function, which gives the most importance to debt stability, reflects a policy choice that reduces the volatility of debt stock at the expense of increasing the volatility in inflation and output. On the other hand, if a loss function, which gives more importance to reducing inflation and output volatility such as L4, is adopted, it is observed that the decrease in the output at the beginning is deeper than other specifications, but output recovery is realized faster due to the high increase in public spending. In such a case, it should be noted that such a fiscal policy preference would require relatively higher fiscal space, as the increase in public spending would increase the debt stock more than others, and the implementation of this kind of policy would be limited in periods when the country risk premium is sensitive to debt stock or budget developments.

The findings of the study indicate that fiscal policies which take into account inflation and output gap volatility without permanently giving up the fiscal discipline, are effective in reducing the volatility and limiting the effects of shocks.

References

Büyükbaşaran, T., Çebi, C. ve H. Küçük, 2018, "The Interaction between Monetary and Fiscal Policies in a Small Scale Structural Model", *CBRT Research Notes in Economics*.

[1] Although the L2 loss function gives less importance to inflation stabilization than the L3 loss function, optimal response parameters and volatility levels related to fiscal policy rules are calculated in similar values for two loss functions. This is due to the fact that the output gap stabilization is largely sufficient for inflation stabilization because the real exchange rate and risk premium are not modeled clearly in the structural model used here.

[2] A more detailed explanation of impulse-response functions can be found in Chart 3 of Büyükbaşaran, Çebi, and Küçük (2018).