

## Box 4.1

### Decomposition of Output Gap into its Demand Components

The output gap reveals the state of economic activity relative to its potential, non-inflationary level. In other words, it serves as an indicator of business cycle phases in the economy (overheating, cooling, etc.). The output gap is also one of the most important variables taken into account when making monetary policy decisions, whereas another one being the deviation of inflation from the target level. Figuring out the source of any output gap, i.e. to what extent it is domestic demand-driven and foreign demand-driven, is key in terms of policy design. For example, rebalancing-oriented policy tools will work through the relative prices (real exchange rate) channel when there is a foreign demand-driven pressure on economic activity while domestic demand-driven pressures will require spending control in addition to relative prices.

In this box, we estimate a New Keynesian general equilibrium model via the Bayesian method. The estimated total output gap is then decomposed into domestic and foreign demand components. In this respect, this box differs from the previous studies by Öğünç and Sarıkaya (2011) and by Alp, Öğünç and Sarıkaya (2012) at certain points. First of all, this study<sup>1</sup> includes a monetary policy reaction function, and accordingly employs a standard Taylor rule. In addition, the inflation target is not taken as exogenous but instead estimated in a time-varying structure consistent with the model. Data set includes eight observable variables from the model, namely, the growth rates of GDP, exports and imports, as well as inflation, real exchange rate, import prices, real interest rates, and global growth. Besides, as distinct from the studies cited above, this study employs the latest 2009-based national income data. The C index that excludes energy, food, alcoholic and non-alcoholic beverages, tobacco, and gold, which is deemed to be more consistent with a Phillips Curve model, is used as the inflation rate. On the other hand, foreign trade series are based on national income definitions.

**Table 1: Basic Equations**

<b>Domestic Demand Gap</b>
$\hat{d}_t = d_1 * \hat{d}_{t-1} + (1 - d_1) * E_t \hat{d}_{t+1} + d_2 * (r_t - E_t \pi_{t+1} - r_t^*) + \epsilon_t$
<b>Export Gap</b>
$\hat{x}_t = x_1 * \hat{x}_{t-1} + x_2 * y_t^{*,c} + x_3 * \hat{q}_{t-2} + \epsilon_t$
<b>Import Gap</b>
$\hat{m}_t = m_1 * \hat{d}_t + m_2 * \hat{x}_t + m_3 * \hat{q}_t + \xi_t$
<b>Phillips Equation</b>
$\pi_t = \lambda_b * \pi_{t-1} + \lambda_f * E_t \pi_{t+1} + e_2 * \hat{y}_t + e_3 * (pm_t - \pi_t) + \zeta_t ;$
$\lambda_b + \lambda_f = 0.99$
<b>Accounting Identity</b>
$\hat{y}_t = y_1 * \hat{d}_t + y_2 * \hat{x}_t - y_3 * \hat{m}_t$
<b>Monetary Policy Reaction Function</b>
$r_t = r_{t-1}^* + \rho_r * (r_{t-1} - r_{t-1}^*) + (1 - \rho_r) * (\theta_\pi (E_t \pi_{t+1} - \bar{\pi}_t) + \theta_y \hat{y}_t) + \eta_t$

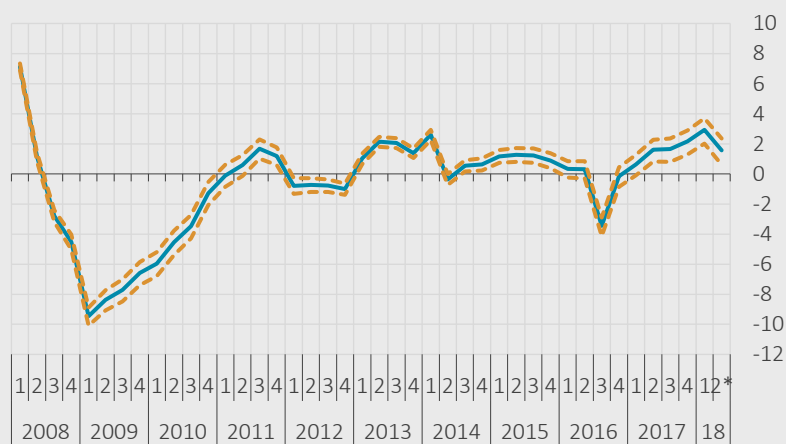
<sup>1</sup> This box involves the initial findings of the study by Koca and Kalafatçılar (2018) in progress.

Basic equations of the model are presented in Table 1.  $\hat{d}_t, \hat{x}_t, \hat{m}_t, \hat{y}_t$ , denote domestic demand, export, import, and total output gaps, respectively. These variables, defined as “gaps”, are expressed as percent deviations of their current levels from their long-term trends. Accordingly, a positive (negative) output gap value refers to overheating (cooling) of the economy. Domestic demand covers public and private sector consumption and total investments.  $\pi_t$  shows the inflation rate, defined as a deviation from the term average.  $\hat{q}_t$  refers to the deviation of producer prices-based real effective exchange rate from the equilibrium value. While  $r_t$  is the interest rate adjusted for average inflation,  $r_t^*$  stands for the natural real interest rate.  $pm_t$  demonstrates the difference of nominal import unit value index in domestic currency from the term average of inflation, whereas  $y_t^{*c}$  shows the cyclical component of the export-weighted global growth index. Finally,  $\bar{\pi}_t$  denotes the model-consistent inflation target.  $\epsilon_t, \varepsilon_t, \xi_t$  and  $\zeta_t$  refer to stochastic shocks, and  $\eta_t$  shows the monetary policy shock.

The model, which is composed of 21 equations including main equations and exogenous processes, is estimated for the post-2005 period from a Bayesian perspective. Chart 1 demonstrates the total output gap within the highest and lowest 10-percent posterior density while Chart 2 shows the subcomponents of the output gap.

In the aftermath of the global crisis in 2008, the total output gap remained in the positive area except for short intervals. It moved into the negative area following the sharp decline in economic activity in the third quarter of 2016 triggered by successive shocks. However, it rapidly recovered in the following period and moved back to the positive area where it remained until the second quarter of 2018. Indicator suggests that the economy entered an overheating phase starting from the second quarter of 2017 and the inflationary pressure of aggregate demand conditions consistently increased. It is estimated that economic activity started converging to its potential level as of the second quarter of 2018 in line with the recent rebalancing process in the economy.

Chart 1: Output Gap (%)



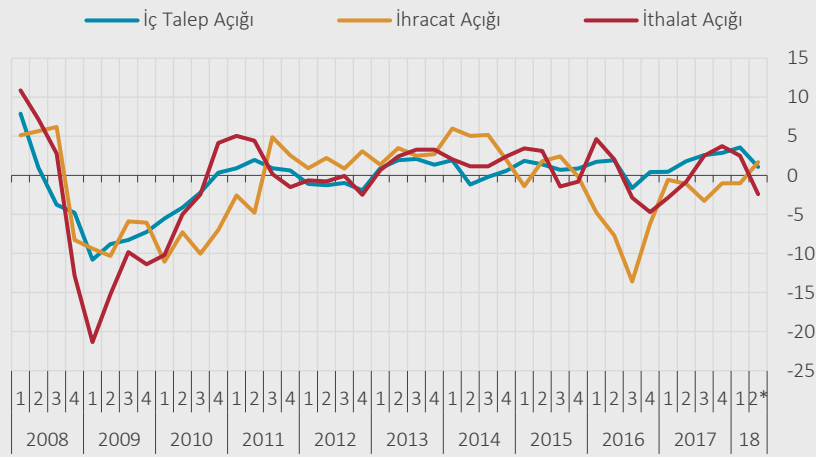
\* Forecast.

Chart 2 shows the components affecting the course of the total output gap and the magnitude of their effects. The export gap shifted to the negative area following the global crisis at end-2008 and remained there until the end of 2011 due to the deepening stagnation particularly in the euro area. Recovering and moving to the positive area with the emergence of new markets, the export gap exerted an upward pressure on the total output gap until 2016. With the sharp decline in tourism revenues due to geopolitical developments, the export gap remained below its long-term trend throughout 2016 and curbed aggregate demand pressures.

As a result of the strengthening global demand, the depreciation of the Turkish lira in real terms, and the recovery in the tourism sector in 2017, exports of goods and services rapidly converged to their long-term trend.

The domestic demand gap hovered around the positive area after the global crisis, except for the deceleration periods observed throughout 2012 and in the first half of 2014, and the transitional contraction period in the third quarter of 2016. The import gap largely followed this variable. As of the final quarter of 2016, the economy started to pick up quickly due to policies supporting domestic demand. As a result, domestic demand became the main factor triggering the overheating of the economy in 2017. Accordingly, imports also climbed above their long-term trend.

Chart 2: Subcomponents of Output Gap (%)



\* Forecast.

Model estimations indicate that domestic demand is still at an inflationary level despite the slowdown in the second quarter of 2018. During the same period, the import gap shifted to the negative area, which implies a rebalancing in both the rate and composition of growth. Meanwhile, the export gap moved to the positive area following its course just below the neutral level and thus increased the aggregate demand pressures.

To sum up, it is estimated that economy activity started converging to its potential level as of the second quarter of the year. It is projected that this largely domestic demand-driven trend will continue in the second half of the year and aggregate demand-driven inflationary pressures will be subdued. Maintaining the rebalancing process in the economy is crucial to eliminate internal and external imbalances in terms of inflation and current account deficit, and to achieve a stable and sustainable growth path.

## References

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