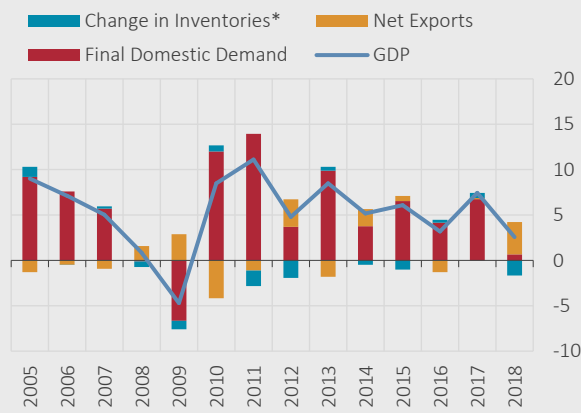


Box 4.2

Short-Term Forecasts of Domestic Demand

An analysis of the contribution of expenditure components to annual GDP growth shows that final domestic demand is generally the main driver of growth for the Turkish economy, while the relative contribution of net exports varies over time (Chart 1).¹ In addition to the level of growth itself, the domestic and external demand composition of growth is also important for main macroeconomic indicators such as inflation and current account that factors in the decision making process by policymakers (Chart 2). In this regard, it is important to determine the indicators that have information content about the recent trends of expenditure components.

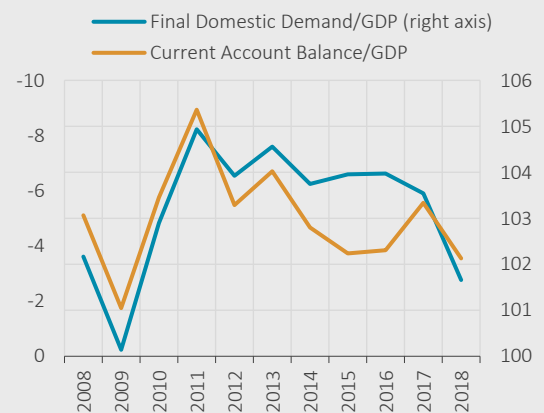
Chart 1: Contribution to Annual GDP Growth (% Points)



Source: CBRT, TURKSTAT.

* Includes statistical discrepancy.

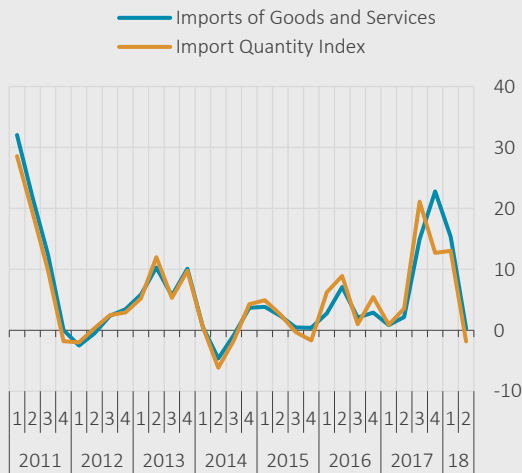
Chart 2: Share of Final Domestic Demand and Current Account Balance in GDP (%)



Source: CBRT, TURKSTAT.

In order to monitor developments in exports and imports of goods and services, which are published on a quarterly basis as part of the national accounts, there are monthly published indicators that are directly related to these components. For example, the monthly import quantity index that is published by TURKSTAT within 40-45 days following the relevant month displays similar movements to the imports of goods and services released within the scope of national accounts (Chart 3).

Chart 3: Imports of Goods and Services and Import Quantity Index (Annual % Change)



Source: TURKSTAT.

Chart 4: Exports of Goods and Services and Export Quantity Index (Annual % Change)²

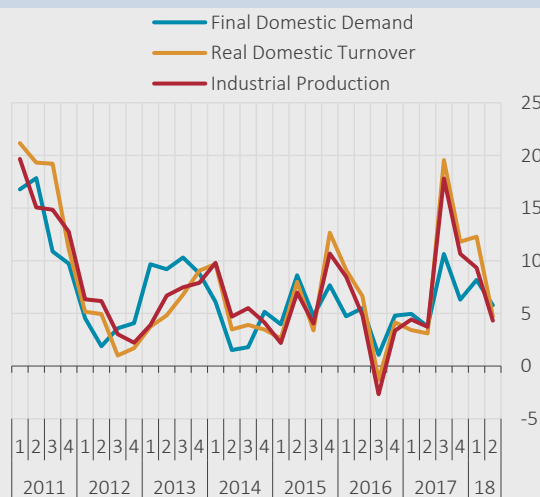


Source: CBRT, TURKSTAT.

The relationship between the export quantity index and the exports of goods and services under the national accounts is relatively weaker (Chart 4). The reason for this is that tourism and transportation revenues, which are evaluated within the scope of services exports, have a significant share in exports of goods and services. When goods exports and services revenues under the balance of payments data are used together, there is a relatively strong relationship with national accounts-defined exports of goods and services. Thus, timely information on net export developments can be obtained following the relevant monthly indicators.

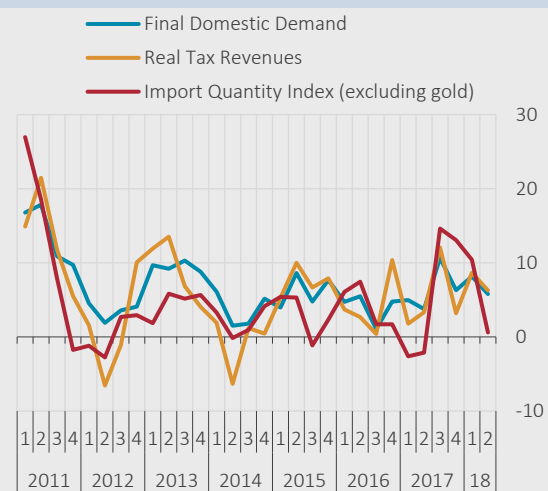
Indicators such as domestic real turnover in industry, industrial production, real tax revenues and import quantity index are expected to be related to domestic demand. The relationship between final domestic demand growth and these indicators is not as strong as the one observed between exports and imports of goods and services and related indicators of foreign trade (Charts 5 and 6). In this context, to monitor the developments in domestic demand, it is important to determine which indicators have more information content and develop forecast models accordingly. This box presents the results of an analysis based on the short-term forecast performance in the period of 2011-2018 conducted to determine the variables that may be useful for monitoring final domestic demand growth (Günay, 2019).

Chart 5: Final Domestic Demand, Real Domestic Turnover and Industrial Production (Annual % Change)



Source: CBRT, TURKSTAT.

Chart 6: Final Domestic Demand, Real Tax Revenues and Import Quantity Index (Annual % Change)



Source: CBRT, Ministry of Treasury and Finance, TURKSTAT.

Indicators from the following groups are selected for short-term forecasts of final domestic demand: industrial production index, real domestic turnover index, import quantity index, vehicle and white goods sales, real tax revenues, central government real budget expenditures and real credit stock. In order to be able to interpret the results economically, a total of 50 indicators that are expected to be directly related to final domestic demand components are selected from a large pool of indicators from these groups.

Similar to Günay and Yavuz (2017), the analysis uses the advantage of the timeliness of indicators relative to GDP data. Bridge equations are estimated with year-on-year growth of final domestic demand at the quarterly frequency using the information set that would be available after the

¹ Final domestic demand is defined as the sum of consumption and investment.

² Services revenues and goods exports published in USD terms as part of the balance of payments data are converted to Turkish lira. Then, services revenues and goods exports are deflated with the consumer price index and non-domestic producer price index, respectively. The balance of payments-defined real exports of goods and services are obtained by aggregating these two components.

completion of the monthly data on the reference quarter. To evaluate the short-term forecast performance of the candidate indicators, regressions are estimated as in Equation 1. Since the GDP data are published at quarterly frequency, annual percentage changes are calculated by taking the quarterly averages of monthly indicators.

$$FDD_t = \beta_0 + \beta_1 \text{Candidate Indicator}_{1,t} + \beta_2 \text{Candidate Indicator}_{2,t} + \dots + u_t \quad (1)$$

For the 50 indicators used in the analysis, forecast performances of all combinations with one, two, three and four-variable models are examined through the recursive out-of-sample forecast exercise. The out-of-sample forecast performance is evaluated separately for 2011Q1-2013Q4, 2014Q1-2018Q2 and 2011Q1-2018Q2. The aim of analyzing sub-periods is to see whether the forecast performance is stable over time. Findings show that the lowest forecast error is achieved by using the average of the best-performing 10 models rather than using individual models (Table 1). This finding is consistent with the results obtained in the literature, which suggest that forecast combination yields better forecasts than relying on individual models (Stock and Watson, 2004).

Table 1: Best-Performing Models for 2014Q1-2018Q2

Number of Variables	Model	RMSE for 2014Q1-2018Q2*
Three	Average – Best-Performing 10 Models for 2014Q1-2018Q2	0.85
Four	Average – Best-Performing 10 Models for 2014Q1-2018Q2	0.87
Two	Average – Best-Performing 10 Models for 2014Q1-2018Q2	0.89
Three	Best-Performing Three-Variable Model for 2014Q1-2018Q2	0.92
Three	Average – Best-Performing 10 Models for 2011Q1-2018Q2	0.94

*RMSE: Root Mean Squared Error.

In addition to the analysis presented in Table 1 regarding the period averages, a comparison of the realizations and the forecasts via charts can give information about whether forecast errors increase substantially at certain times. In this context, forecasts and realizations are evaluated through charts, producing the following results:

- When the sensitivity of the forecast performance to the number of variables used in the models is analyzed, it is seen that the averages of the forecasts of the models estimated using two or more variables are close to each other (Chart 7).
- In Günay and Yavuz (2017), it is found that the forecast performance of the best 10 models selected separately for 2011Q1-2013Q4 and 2014Q1-2017Q1 substantially differs from one period to another. For final domestic demand, while there are occasional differences in the forecast performance of the best models selected for different sub-periods such as 2013 and the first half of 2018, the performances of models are relatively stable (Chart 8).

Chart 7: Forecasts of the Best 10 Models Based on the Performance in 2014Q1-2018Q2 and Realization (Annual % Change)

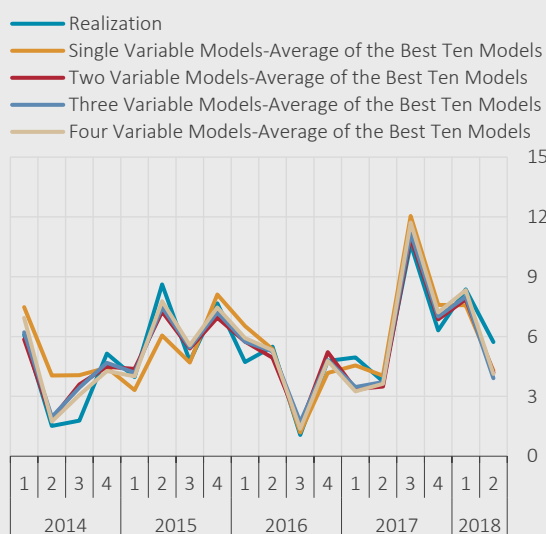
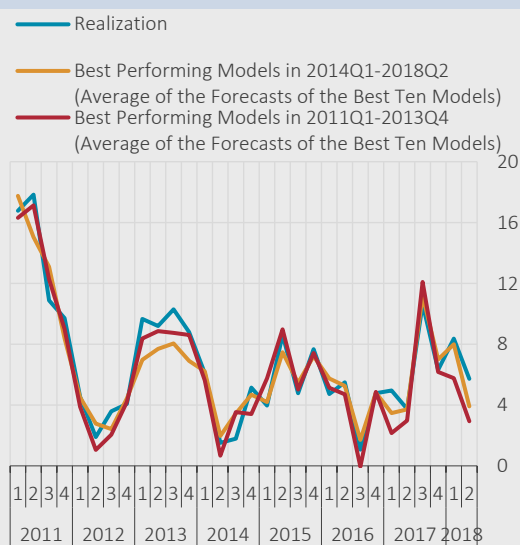


Chart 8: Performance of Three-Variable Models by Periods and Realization (Annual % Change)



Finally, for the 100 models that deliver the lowest forecast error for 2014Q1-2018Q2, indicators that most frequently appear in the one, two, three and four-variable models are examined (Table 2).

- Real domestic turnover indicators stand out in terms of contribution to the forecast performance. In addition to the total real domestic industrial turnover, the real domestic turnover in fabricated metal products, electrical equipment, capital goods and motor vehicles appear in the best-performing models relatively frequently. The fact that these are the indicators mostly related with investment and durable consumption goods expenditures implies that they are helpful in capturing the cyclical movements in the GDP.
- The industrial production index, indicators from real tax revenues, and housing credits also appear in the best-performing models.

Table 2: The Most Frequently Used 10 Indicators in the Best-Performing 100 Models*

Single-Variable Models	Two-Variable Models	Three-Variable Models	Four-Variable Models
IP-Total Industry	RDT- Electrical Equipment	RDT- Electrical Equipment	RDT- Electrical Equipment
IP- Electrical Equipment	RDT- Fabricated Metal Products	TAX- Total Tax Revenues	RDT- Fabricated Metal Products
IP-Machinery and Equipment	RDT-Capital Goods	RDT- Fabricated Metal Products	RDT-Total Industry
IP-Motor Vehicles	RDT-Total Industry	RDT-Capital Goods	TAX- Income Tax
RDT-Total Industry	IP-Total Industry	RDT-Total Industry	RDT-Capital Goods
RDT-Durable Consumption	TAX-Total Tax Revenues	RDT-Motor Vehicles	RDT-Motor Vehicles
RDT-Non-Durable Consumption	RDT-Machinery and Equipment	QM-Motor Vehicles	TAX- Total Tax Revenues
RDT-Capital Goods	IP-Machinery and Equipment	IP-Capital Goods	IP-Capital Goods
RDT-Other Non-Metallic Mineral Goods	IP-Capital Goods	IP-Total Industry	CR-Housing
RDT- Fabricated Metal Products	TAX- Stamp Tax	CR-Housing	IP-Total Industry

* For single-variable models, 50 models are used in the analysis. Indicators are listed in the order of their frequency. RDT: Real domestic turnover, IP: Industrial production index, TAX: Real tax revenues. QM: Import quantity index, CR: Real Credit Stock.

The composite indicator constructed using the indicators that stand out from the analysis presented above signals that in the first quarter of 2019, final domestic demand has declined relative to the same period of the previous year while it has increased relative to the last quarter of 2018 (Chart 4.2.11).

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