Box 4.3

Nowcasting Turkish GDP Growth: MIDAS Approach

GDP data are announced by TURKSTAT at a quarterly frequency while many short-term business statistics, particularly on industrial production, are monitored at monthly, credit developments at weekly, and exchange rates at daily frequencies. In the classical approach, to be able to use different-frequency data in forecasts, high-frequency data are converted to low-frequency data (e.g., the quarterly average of monthly industrial production data is calculated and related to quarterly GDP). However, the Mixed Data Sampling (MIDAS) approach, which is popular in modern practice and is among the methods used in economic activity forecasts (particularly in nowcast models), allows data to be used at its own frequency and forecasts to be revised according to the data release calendar for the lowest-frequency data (Anesti et al., 2017). This box presents an analysis of GDP growth forecasts in Turkey from a MIDAS perspective along with a performance evaluation of various models.

The technical display of the MIDAS method is given in Equation 1. y_t can be taken as annual, monthly or weekly data. x_t^m is data at a frequency that is observed m times faster than y_t. For example, if y_t is quarterly data such as GDP and x_t^m is monthly data such as the industrial production, then m=3 as monthly data are announced three times a quarter. The number of independent variables rises when the lagged data of the high-frequency indicator, x_t^m, are also used. This may considerably increase the uncertainty in coefficient estimates. However, in the MIDAS method, coefficients can be calculated using polynomials. In this way, a limited number of parameters required by the relevant polynomial are estimated and a large number of coefficients are obtained as a function of these parameters. The "h" in y_{t+h} denotes the forecast horizon.

$$y_{t+h} = \beta_0 + \lambda y_t + \beta_1 B\left(L^{\frac{1}{m}}, \theta\right) x_{t+w}^m + \varepsilon_{t+h} \quad (1)$$

The fact that the MIDAS method allows for analyses where dependent and independent variables can be used at their own frequencies provides significant flexibility in updating forecasts based on data flow. The range of studies employing the method may give a better idea. Accordingly, some examples include:

i. Revision of quarterly growth forecasts by using daily financial data (Aprigliano et al., 2017),
ii. Revision of global growth forecasts based on monthly data flow for annual growth (Ferrara and Marsilli, 2014),
iii. Daily revision of inflation forecasts (Marsilli, 2017),
iv. Forecast of weekly volatility in stock markets via daily data (Alper et al., 2012).

This box includes two applications regarding the analysis of GDP forecasts. First, we analyze the performance of quarter-on-quarter GDP growth nowcasts obtained by using selected indicators derived from production, survey, credit, tax, and sales data (Table 1). While credit data are announced weekly, all explanatory variables are used in monthly frequency since real credit data are employed in nowcasting.

A total of 2,024 models, obtained from combinations of these 24 indicators taken three at a time, have been included in the analysis. For example, one model employs industrial production, PMI and housing loan data whereas another model uses data on industrial production, PMI and automobile sales. The nowcast performance of each indicator may be evaluated individually or a model may employ more than three variables. Pursuing a balance between the information set

used in the model and the complexity of the model, three-variable models have been included in the analysis.

Table 1: Information Set Used in Quarter-on-Quarter GDP Growth Nowcast*

IPI- Total industry	BTS- Export orders in the last three months	TAX- VAT on imports
IPI- Share of exports <20	BTS- Domestic market orders in the last three months	CREDIT- Total (FX-Adjusted)
IPI- Share of exports >20 ; <40	PMI- Overall	CREDIT- Total corporate (FX-Adjusted)
IPI- Share of exports <40	PMI- Production	CREDIT- Total consumer
BTS- Production in the last three months	PMI- New orders	CREDIT- Housing
BTS- Registered orders	PMI- New export orders	VEHICLE- Automobile sales
BTS- Production in the next three months	TAX- Total real tax revenues	VEHICLE- Light commercial vehicle sales
BTS- CUR	TAX- Real VAT on imports	ELEC- Electricity generation

* Capitalized expressions in front of variables show the data category to which the relevant variable belongs. IPI: Industrial Production Index, BTS: CBRT Business Tendency Survey, CUR: Manufacturing Industry Capacity Utilization Rate, PMI: Manufacturing Industry Purchasing Managers Index.

Three-variable nowcast models have been ranked according to their performance of nowcasting the GDP growth between 2014Q1 and 2018Q1, and the best 10 models have been identified. The information set at the time the nowcast was made has been taken into account when evaluating the nowcast performance. Accordingly, nowcasts have been generated by using data available as of the second and third months of the reference quarter and the middle of the first and second months of the next quarter. For example, in February 2018, survey indicators pertaining to January will be included in the information set while December 2017 data will be available for industrial production. Coefficient estimates have been revised at each stage of the nowcast.

The four-chart panel starting with Chart 1.a demonstrates the average of the nowcasts of the best 10 models obtained for four different periods based on data flow, and the interval between the highest and lowest nowcasts. Results indicate that nowcast errors diminish due to data flow, particularly for the 2014-2016 period. It is notable that nowcast errors increase starting from 2017.

Chart 1.a: GDP Growth and Nowcasts* (Quarter-on-Quarter Change, %)

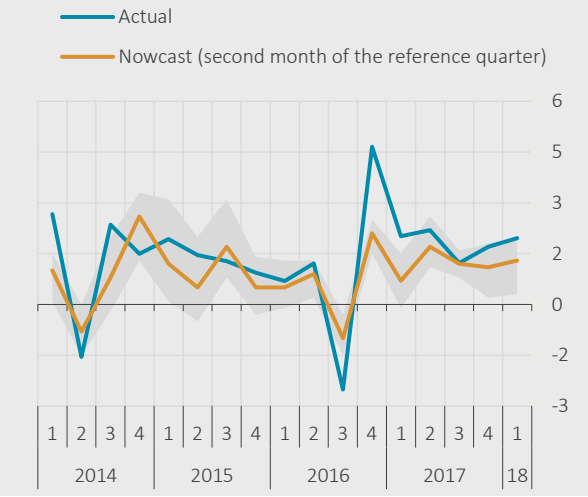


Chart 1.b: GDP Growth and Nowcasts* (Quarter-on-Quarter Change, %)

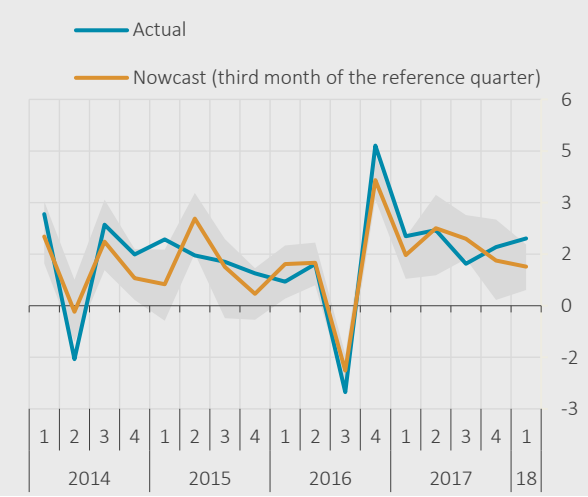


Chart 1.c: GDP Growth and Nowcasts* (Quarter-on-Quarter Change, %)

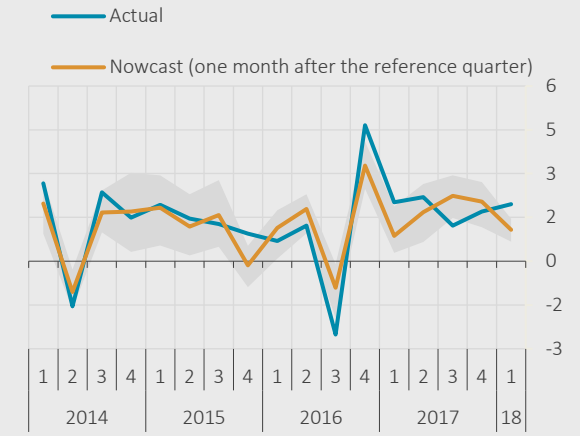
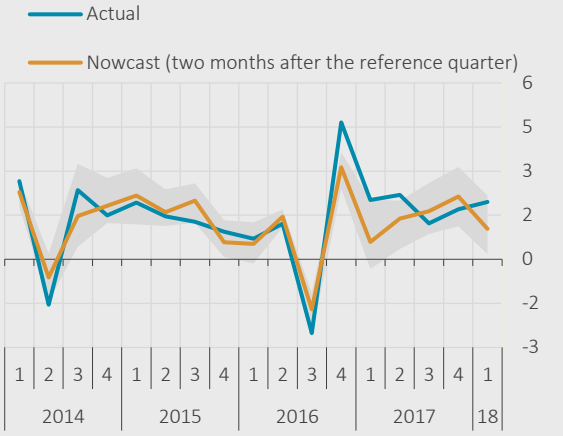


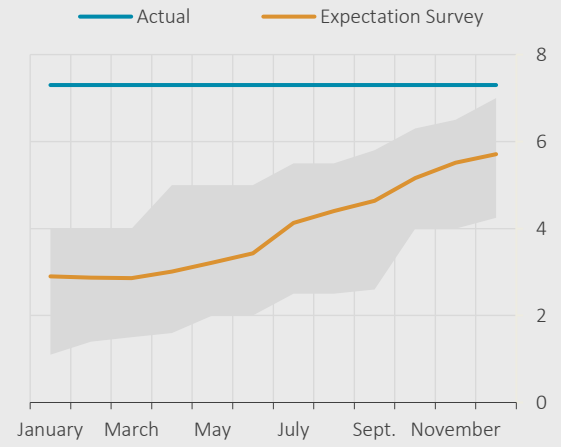
Chart 1.d: GDP Growth and Nowcasts* (Quarter-on-Quarter Change, %)



* Shaded areas in the charts show the interval between the highest and lowest forecasts of the best 10 models.

Since the MIDAS method allows data at different frequencies to be processed together, it enables generation of annual growth nowcasts that can be mechanically revised based on data flow (Günay, 2018). Accordingly, the second section in this box offers findings related to the annual growth nowcast. Considering the changes in growth expectations in 2017, the importance of this issue becomes more visible. For example, although growth forecasts for 2017 compiled by the CBRT Survey of Expectations increased throughout the year, the average expectation remained significantly below the actual growth in December (Chart 2). Forecasts released by international institutions throughout the year may also considerably diverge from one another as well as from the actual figures even at year-end (Chart 3). The high levels of forecast errors despite a substantial amount of data accumulation for forecasts towards the end of the year indicate that a judgmental approach may play a significant role in forecasts.

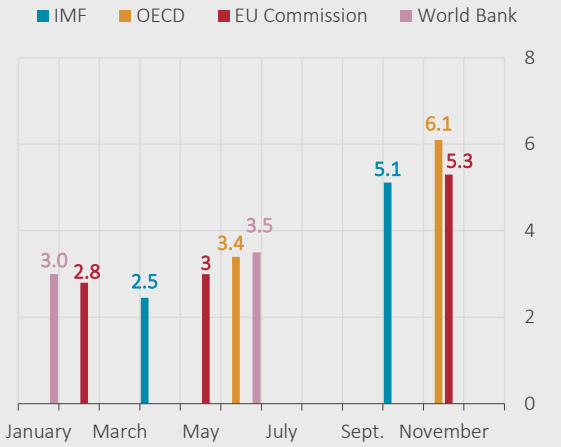
Chart 2: Survey of Expectations-Based Forecasts for GDP Growth in 2017*



Source: CBRT, TURKSTAT.

* Shaded area shows the interval between the highest and lowest forecasts.

Chart 3: GDP Growth Forecasts for 2017 by International Institutions



Source: European Commission, World Bank, IMF, OECD.

To observe the advantage of effectively integrating the data flow into nowcasts, the annual GDP growth has been estimated by using the month-on-month industrial production growth and quarter-on-quarter GDP growth. However limited the number of data may be, nowcast errors are expected to decrease when data announced throughout the year are effectively employed. For instance, data on growth in the first two quarters and on July industrial production are

included in the information set in September. Likewise, in December, the information set will include the GDP growth in the first three quarters and the industrial production in October. Consequently, nowcast errors will possibly decrease when actual figures recorded throughout the year are consistently reflected on nowcasts.

The four-chart panel starting with Chart 4.a shows the annual growth nowcasts and actual figures for the 2010-2017 period, as of April, June, September, and December. The reason for choosing these months is that the quarterly GDP is announced in these months (or in the preceding month). A comparison of nowcasts and actual figures reveals that nowcast errors substantially decrease in the second half of the year. In this framework, it may be useful to generate model-based nowcasts for annual growth in addition to the judgmental approach. Although annual growth nowcasts are not expected to be merely model-based, revising nowcasts so that they are consistent with data flow will enable a sounder assessment of the economic outlook.

Chart 4.a: GDP Growth and Nowcasts (Annual Change, %)

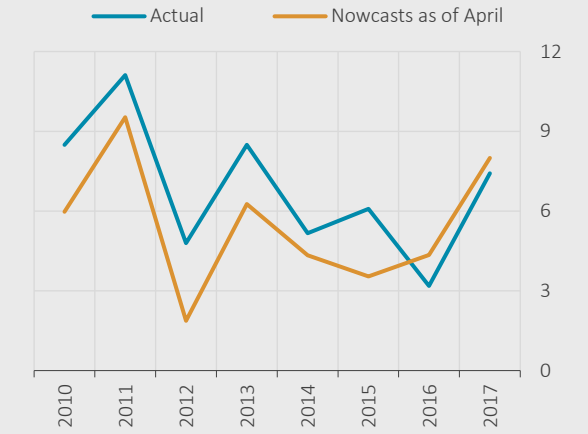


Chart 4.b: GDP Growth and Nowcasts (Annual Change, %)

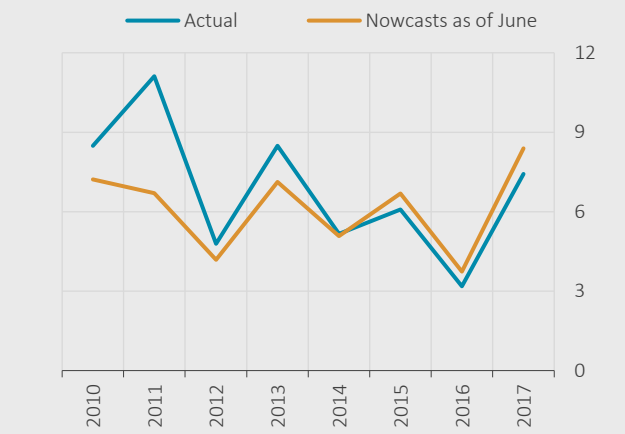


Chart 4.c: GDP Growth and Nowcasts (Annual Change, %)

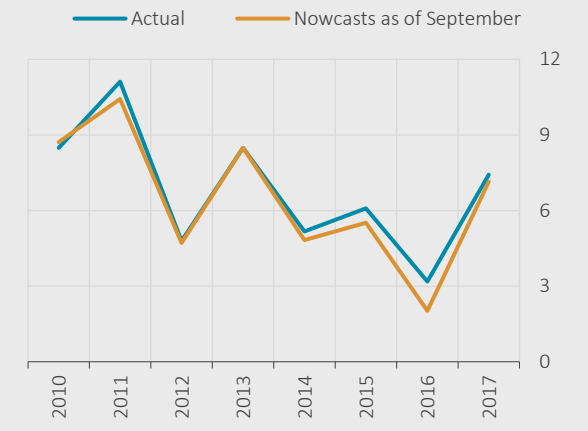
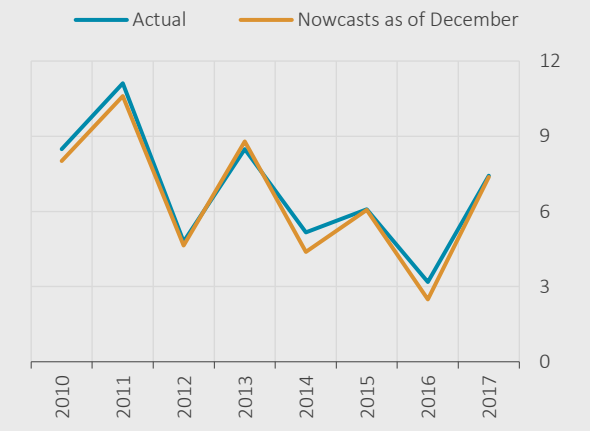


Chart 4.d: GDP Growth and Nowcasts (Annual Change, %)



This box has presented an analysis of the performance of quarter-on-quarter and annual growth nowcasts generated by employing the MIDAS method that allows for nowcasts based on data at different frequencies. The findings suggest that more accurate estimates can be produced for quarter-on-quarter growth nowcasts through data flow but they also point to the role of judgmental evaluations in the success of nowcasts even with full information set availability. As for annual growth nowcasts, the use of the MIDAS method reduces nowcast errors in the second half of the year, proving that more structural models are needed for long nowcast horizons.

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