Box I.1: Main drivers of growth in 2017 - shock decomposition from an estimated model

This box uses an estimated multi-region structural macro model [1] in order to provide a model-based quantification of the main drivers of euro area (EA) GDP growth in 2017. The model has been estimated on historical quarterly data for the period since 1999-Q1 and extended with forecast data from the European Commission's forecast for the set of available variables. The methodology allows decomposing deviations of real GDP growth from the long-run trend into the underlying shocks that drive the short- and medium-term dynamics. Hence, the decomposition provided in this box takes the European Commission's forecast as an input to recover the factors that explain the forecast in a model-consistent way. In other words, the analysis presents the exogenous factors ("shocks") that provide a model-consistent interpretation of the GDP growth forecast.

The advantage of using an estimated structural macroeconomic model to decompose economic dynamics is that the former uses all information in the dataset. Notably, the size of shocks to the model economy (e.g., financial, savings, and productivity shocks) is determined in such a way that these shocks fit not only the movement of GDP, but also the dynamics of other variables (including investment, consumption, the exchange rate, and employment) and the correlations between them (e.g., the correlation between GDP and inflation, or the correlation between employment and wages).

It should be noted, however, that the model-based decompositions are not necessarily identical with the impact that the same factors have in the European Commission's forecast. The driving factors recovered in the model-based analysis are conditioned on the structure of the model and the estimated parameter values, which have been obtained by fitting the model on seventeen years of quarterly data.

Not all estimated shocks can be interpreted directly in the sense of recovering the fundamental "causes" of fluctuations (behavioural, policy, etc.) within a model of tractable size. For instance, changes in financial risk premia and financing costs that affect interest-sensitive domestic demand, notably investment, and the exchange rate in the model can emanate from various sources that are not further analysed in the model, including regulatory policies

and non-standard monetary policy measures (QE). The simplified structure of the multi-region macro model and most other dynamic stochastic general equilibrium models alone does not identify the specific "events" behind the shock in such cases.

The estimated persistence of variables in the model, which is related, e.g., to price and wage stickiness, habit persistence, inertia in adjusting the capital stock and labour demand, and gradual adjustment of monetary and fiscal policies, implies that past events affect future economic outcomes together with current news and expectations about future developments.

Table 1 presents a decomposition of EA real GDP growth for 2017 as projected by the European Commission's forecast (1.5%) into its principal drivers based on the estimated multi-region model. The table summarises the large number of shocks in main groups of supply- and demand-side drivers and separates the contribution of past and future shocks. The first column ("historical") shows the contribution of shocks that occurred up to 2015-Q4 to the outlook for EA GDP growth in 2017, a contribution that is based on the persistence in the transmission channels in the model. The second column ("forecast") shows the contribution of shocks over the 2016-18 horizon. Shocks over the 2016-18 horizon are additional innovations in exogenous variables that the model requires to fit the forecast given the historical data and estimated shocks. The contribution of historical and forecast-horizon shocks adds up to the total impact of the various supply and demand forces, shown in the third column ("total"). Other factors, i.e. exogenous determinants outside the listed groups of supply- and demand-side drivers, are summarised in the "others" group.

The trend component (1.4%) in Table 1 is the attainable long-run growth rate if the euro area economy were to grow with the average growth rates of total factor productivity (TFP) and the population of working age as observed over the period since 1999. Real GDP growth is forecast to exceed trend growth by 0.2 percentage points (pps.) in 2017 due to positive shocks that outweigh negative factors.

The decomposition in Table 1 shows that there are positive and negative contributions from supply- and demand-side factors alike. The overall impact of past supply-side developments ("historical") on the deviation of GDP growth from trend is neutral,

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[1] These results are based on the Global Multi Country (GM) model developed by DG ECFIN and the Joint Research Centre of the European Commission.

whereas the impact of new shocks over the forecast horizon ("forecast") is slightly negative.

Table 1:

Shock decomposition for real GDP growth in 2017

	Historical	Forecast	Total
Supply:			
Long-run trend			1.4
TFP	-0.2	-0.2	-0.4
Labour & goods market adjustment	0.2	0.0	0.2
Oil	0.0	0.0	0.0
Demand:			
Domestic:			
Consumption	0.1	0.0	0.1
Investment	-0.1	0.0	-0.2
Fiscal spending	-0.1	0.0	0.0
Monetary policy	0.5	0.0	0.5
Foreign:			
World demand and int. trade	0.5	-0.5	0.0
Exchange rate	-0.1	0.0	-0.1
Others			-0.1
Real GDP growth (from forecast)			1.5

Note: The contributions of historical shocks and shocks over the forecast horizon do not at up to total in some cases due to rounding to the first digit.

The decomposition finds negative contributions of TFP in previous years and over the forecast horizon (-0.2 pps. each) to the forecast for EA real GDP growth, which suggests that TFP growth remains subdued and below the long-run trend over the forecast horizon. Deducting the negative impact of the slowdown in TFP on 2017 GDP growth (-0.4 pps.) from long-term trend growth (1.4%) gives a growth rate of 1.0%, which coincides with the current-vintage estimate of EA potential growth in 2017.

Labour and goods market adjustment in the past (0.2 pps.) has made a positive contribution on the supply side. The positive contribution is driven by wage developments. In particular, the model interprets moderate real wage growth compared to labour productivity growth, accompanied by declining unemployment, as structural adjustment of wages in the EA labour market, i.e. as positive labour supply shock that strengthens employment and economic activity. The contribution of product market factors is slightly negative. In particular, the GDP deflator increases more strongly than unit labour costs on average over the 2016-18 period, which the model interprets as increase in the price mark-up.

Falling oil prices, which reduce firms' production costs and boost household real disposable income, have been an important stimulus to EA GDP growth in previous years. For 2017, the positive contribution disappears in light of the recent recovery of oil prices and the further recovery that is embodied in the forecast's external assumptions.

On the demand side, one can distinguish between domestic and foreign factors. Among the domestic-demand factors, the model-based decomposition points to a small positive contribution (0.1 pps.) of the evolution of household savings in past years, namely a saving rate below the sample average, to private consumption and real GDP growth. The contribution of shocks to consumption behaviour over the forecast horizon is zero in light of the stabilising of the savings rate.

Investment growth in 2017 is strong compared to consumption growth, but it is still held back by estimated investment risk premia (financing costs, access to finance) in the model. The decomposition attributes -0.1 pps. of GDP growth to the delayed impact of elevated risk premia (financing costs) in the recent past, without significant contribution of new investment shocks over the forecast horizon.

While a -0.1 pps. negative contribution to 2017 EA real GDP growth is recorded for historical shocks to fiscal spending (government consumption and investment), the discretionary fiscal expansion that is embedded in the fiscal forecast does not make a significant positive contribution to GDP growth. It should be stressed, however, that the fiscal shock in Table 1 measures the impact of deviations of fiscal policy from estimated patterns of fiscal behaviour over the sample period. These deviations are not identical to the fiscal impulse as measured by the primary government balance.

A strong positive impact (0.5 pps.) is assigned by the model to monetary policy shocks that occurred before 2016. Monetary policy has been tighter than prescribed by the model's estimated Taylor rule and this partly reflects the fact that the zero bound has prevented a further reduction of short-term policy rate. The constraint on interest rates has negatively affected EA output in recent years, leading to a lower level of economic activity and a more negative output gap. Together with the assumption of a closing of the output gap this negative past impact on activity, however, implies a positive effect on GDP growth during the forecast horizon.

Robust growth of foreign demand and trade until 2014 has contributed to EA GDP growth and remains a positive factor (0.5 pps.) for GDP growth in 2017 due to the estimated persistence in demand and price adjustment. World demand and trade growth have slowed down in 2015-16, however. The forecast includes a pick-up of external demand and trade in 2017, but the dynamics remains weaker than over the sample average and the recent

Box (continued)

past. The weaker external demand over the forecast horizon, in particular in 2016, has the consequence that external demand no longer contributes positively to the gap between EA GDP growth and trend growth in 2017. Exchange rate assumptions for the forecast horizon, which imply limited real effective euro appreciation, do not imply competitiveness gains that could mitigate the impact of external demand.

Summarising the picture of growth drivers in Table 1, the overall GDP growth contribution of new shocks on the listed supply and demand factors over the forecast horizon is clearly negative (-0.7 pps.), with a strong downside contribution from external factors. The downside impact of developments within the forecast horizon can be interpreted as a slowdown of the recovery in 2017.