

Box 3

The baseline forecast compared to a forecast from the Bank's DSGE model

Monetary policy decisions must be grounded in an assessment of the economic situation and outlook, and such an assessment must rely on economic models. As a result, Central Bank staff devote considerable work to the development of models. The Bank's main modelling tool has been QMM (Quarterly Macroeconomic Model; see Daniélsson *et al.*, 2015), but in recent years a model called DYNIMO (Dynamic Model of the Icelandic Economy; Seneca, 2010) has also been under development. This Box gives a brief description of DYNIMO and compares the forecasts it generates with the Bank's baseline forecast.

DYNIMO and its background

DYNIMO is a dynamic stochastic general equilibrium (DSGE) model. The main characteristics of DSGE models are as follows:

1. They are dynamic, in that economic variables and the decisions made by individuals, firms, and economic policy-makers at any given time have an impact over time;
2. Deviations from equilibrium relationships between individual economic variables are determined by stochastic processes that are assumed to be known to individual agents in the model;
3. They are general equilibrium models where economic relationships are derived from profit and utilisation maximisation and where equilibrium is determined in all markets simultaneously.

The origins of DSGE models can be found in real business cycle models, which date from the 1970s and 1980s (see, for example, Kydland and Prescott, 1982). Models of this type assume that all prices are perfectly flexible and will therefore adjust immediately following an economic shock. As a result, nominal variables and monetary policy have no impact on real variables, which appears at odds with data and findings from a number of studies. DSGE models are based on the same basic methodology but differ from real business cycle models in that they assume that nominal variables (such as prices and wages) are sticky. Because of this, models like these are often referred to as New Keynesian models. In addition, they assume that key markets are monopolistic, that agents can face adjustment costs, and that risk aversion will give rise to risk premia that have a marked impact on interest rates and exchange rates.¹

DYNIMO and a comparison with QMM

DSGE models have gained in popularity among central banks in recent years. The Central Bank of Iceland began developing one in 2008 and published the first version of it in Seneca (2010). The model has been under continuous development since then and is expected to play an increasing role in the Bank's analysis and forecasting, not least as a cross-check for the baseline forecast.

DYNIMO differs in important ways from the Bank's main forecasting model, QMM, although both models assume that agents are forward-looking; i.e., that they make decisions based on their expectations of future economic developments. QMM is essentially an empirically estimated macroeconomic model that does not account for various constraints that the underlying general equilibrium imposes on economic relations. Furthermore, unlike in QMM, all of the model's relations are estimated simultaneously in DYNIMO. Its parameters are based either directly on the findings from research into underlying behavioural relationships or indirectly,

1. An overview of DSGE models, including their characteristics and their use among central banks can be found in Sbordone *et al.* (2010).

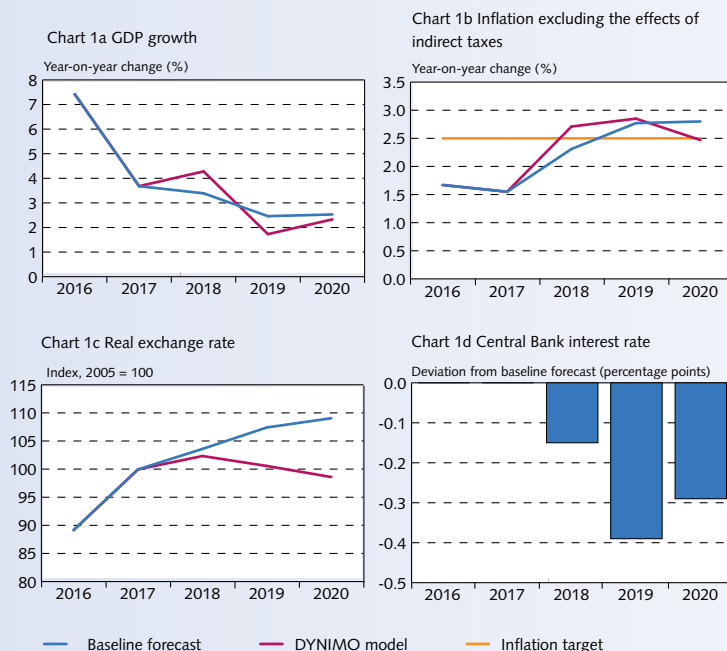
by using such findings to select a prior distribution when estimating the model using Bayesian methods.

The Central Bank's baseline forecast is based on staff assessments and on the forecast generated by QMM. DYNIMO and QMM differ in that in DYNIMO, convergence is ensured by the underlying structure of the model, which is not the case with QMM. However, QMM allows the forecaster to use detailed information on the Icelandic economy and to design the equations in the model according to Icelandic conditions more easily and to a greater degree than with DYNIMO. In particular, it is possible to use information and assumptions concerning future developments in exogenous variables in order to guide forecasts: for instance, changes in the tax system, committed public development projects, or known large-scale business investment plans such as purchases of ships and aircraft or development in the energy-intensive sector. Estimating DYNIMO is also sensitive to changes in the structure of production sectors and in the equilibrium behaviour of the model, which generally assumes that equilibrium values are fixed over the estimation period. QMM, however, is estimated over historical periods that may not always be well suited to current conditions. It can therefore be sensitive to changes in underlying relationships and to the so-called Lucas critique (Lucas, 1976), as are other models of its type. Each model therefore has its strengths and weaknesses.

Comparison of DYNIMO forecast with the Bank's baseline forecast

Before *Monetary Bulletin* is published, both DYNIMO and QMM are simulated and the resulting forecasts compared. In the forecast published here, DYNIMO is conditioned upon the same information from Bank staff concerning the near-term outlook for individual sectors of the domestic economy and developments in the global economy as was used to prepare the baseline forecast in *Monetary Bulletin* 2017/4 using QMM. Chart 1 compares the baseline forecast and the forecast obtained with DYNIMO.

Chart 1
Comparison between baseline forecast and DYNIMO forecast



Sources: Statistics Iceland, Central Bank of Iceland.

As can be seen, DYNIMO forecasts stronger GDP growth in 2018 than is assumed in the baseline forecast (Chart 1a), mainly because the baseline forecast is more pessimistic as regards external trade and terms of trade. This situation reverses in 2019, however, when the baseline forecast assumes stronger GDP growth than DYNIMO does. The outlook for 2020 is broadly similar for both models, and over the forecast period as a whole the forecasts are virtually identical. As Chart 1b indicates, the inflation outlook according to both models is also very similar. However, DYNIMO does not assume as steep a rise in the real exchange rate as the baseline forecast does (Chart 1c), and it entails a slightly lower policy rate (Chart 1d). The reason why the inflation outlook according to DYNIMO is so similar to the one in the baseline forecast despite a smaller rise in the exchange rate is that wages rise less in 2019-2020 in the forecast from DYNIMO than in the baseline forecast, offsetting the lower exchange rate in the latter.² This also explains why inflation is not as persistent at the end of the forecast horizon and interest rates somewhat lower according to DYNIMO. Overall, however, the two forecasts are very similar.

References

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2. One of the key uncertainties in the baseline forecast pertains to medium-term wage developments and their potential impact on inflation. DYNIMO forecasts higher inflation than is assumed in the baseline forecast if both models are conditioned upon the same wage inflation path, suggesting that the baseline forecast could be underestimating the inflationary effects of the wage increases expected over the next few years. Interest rates would then have to be higher so as to raise the exchange rate of the króna and generate more slack in the economy so as to offset the increased inflationary pressures.