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# How large is the output gap in the euro area

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*The estimates of the output gap depend on the features of the models used to derive them. We discriminate among different estimates on the basis of their ability to forecast inflation. Our analysis suggests that output in the euro area was 6% lower than potential in 2014 and 2015, which is substantially below institutional estimates.*

## Output gap in the euro area

To stabilise the economy, policymakers must assess the output gap, which is the deviation of real economic activity from its potential. In periods of low economic growth, a large output gap may be one aspect which could increase the need for a demand stimulus, while slow potential output growth calls for supply-side policies. Several economists currently believe in a version of the "secular stagnation" hypothesis (see e.g. Gordon, 2014) according to which developed economies, including the euro area, are experiencing a decrease in the growth rate of potential output. Recent analysis carried out by international institutions, suggesting that the Great Recession and its aftermath resulted in a decline in potential output growth in the euro area, seems to support this idea. However, the assessment that the slowdown in growth in the euro area reflects a decrease in potential output growth rather than a widening of the output gap is far from straightforward, primarily because potential output and, consequently, the output gap, are unobservable.

This article (based on Jarocinski and Lenza, 2016) describes a recent assessment of the euro area output gap. The latter is estimated as the common factor underlying the business cycle fluctuations in a set of real activity indicators and core inflation. The distinctive feature of this work is that it discriminates among different estimates of the output gap, resulting from the combinations of the modelling features commonly used in the economic literature. The criterion used to rank the different output gap estimates is their ability to forecast inflation in an evaluation which takes into account the data releases available in *real-time*.

The best model according to this evaluation criterion provides accurate inflation forecasts and implies that the output gap in the euro area was about -6% in 2014 and 2015, on average. This estimate implies a much wider gap between actual and potential output than alternative institutional assessments (which estimate that the output gap in the euro area was between -2% and -3% around that time), suggesting that the latter may underestimate the extent of economic slack in the euro area. A possible implication of this finding is that policies aimed at stimulating aggregate demand (including fiscal and monetary policies) should play an even more important role in the economic policy mix.

## Estimation of the euro area output gap

The model employed in the paper separates the trend from cyclical fluctuations in real activity and core inflation. A single factor captures the common cycle in the variables and is defined as the deviation of output from its trend, which is the output gap. Different modelling assumptions lead to different estimates of the output gap. In particular, the model variants considered here differ along three dimensions: the specification of the set of real activity variables (GDP only or a larger set of variables that includes six variables in addition to GDP[2] ), the specification of the trend of inflation (tied to Consensus long-term inflation forecasts or simply driven by a univariate random walk process), and the form of the trends for the real activity variables (more or less sensitive to current economic conditions). The various combinations of the modelling assumptions just described lead to the estimation of seven different models. Chart 1 shows the estimates of the output gap obtained by the different models.

*Chart 1: Alternative estimates of the output gap in the euro area (percentage points)*

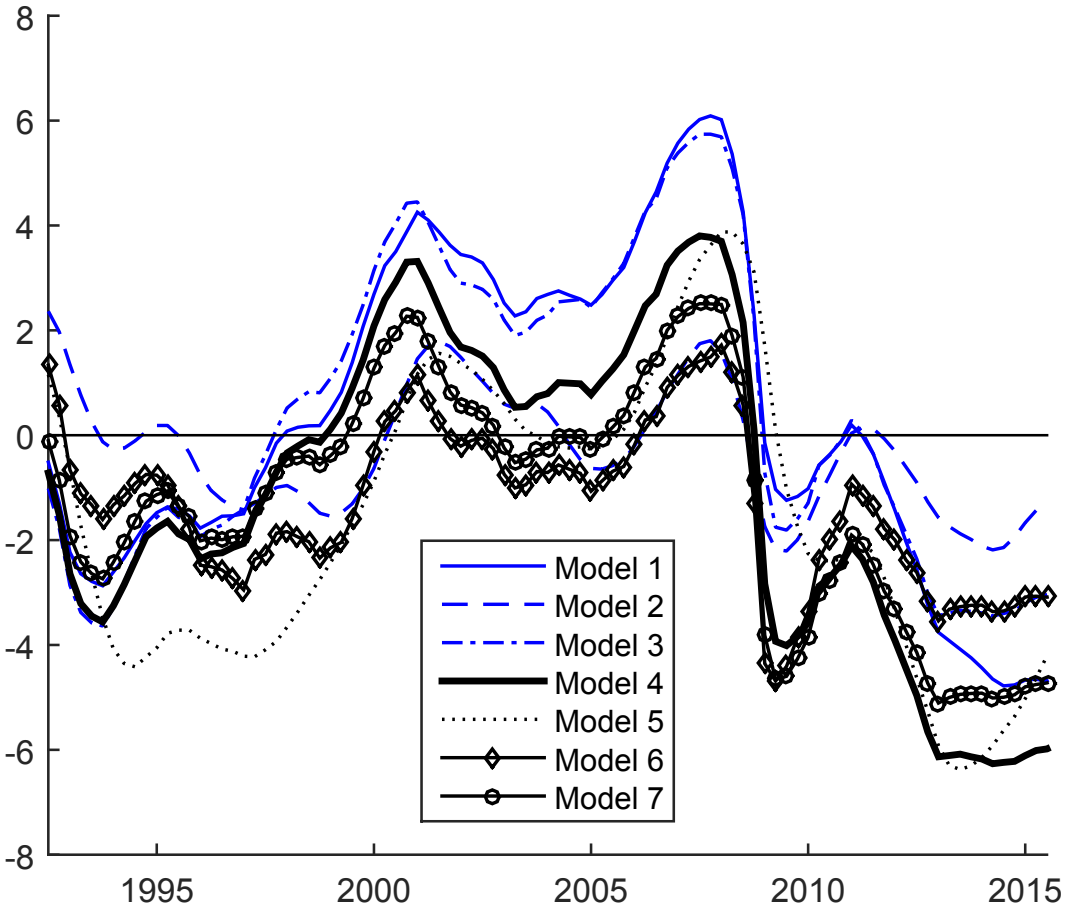
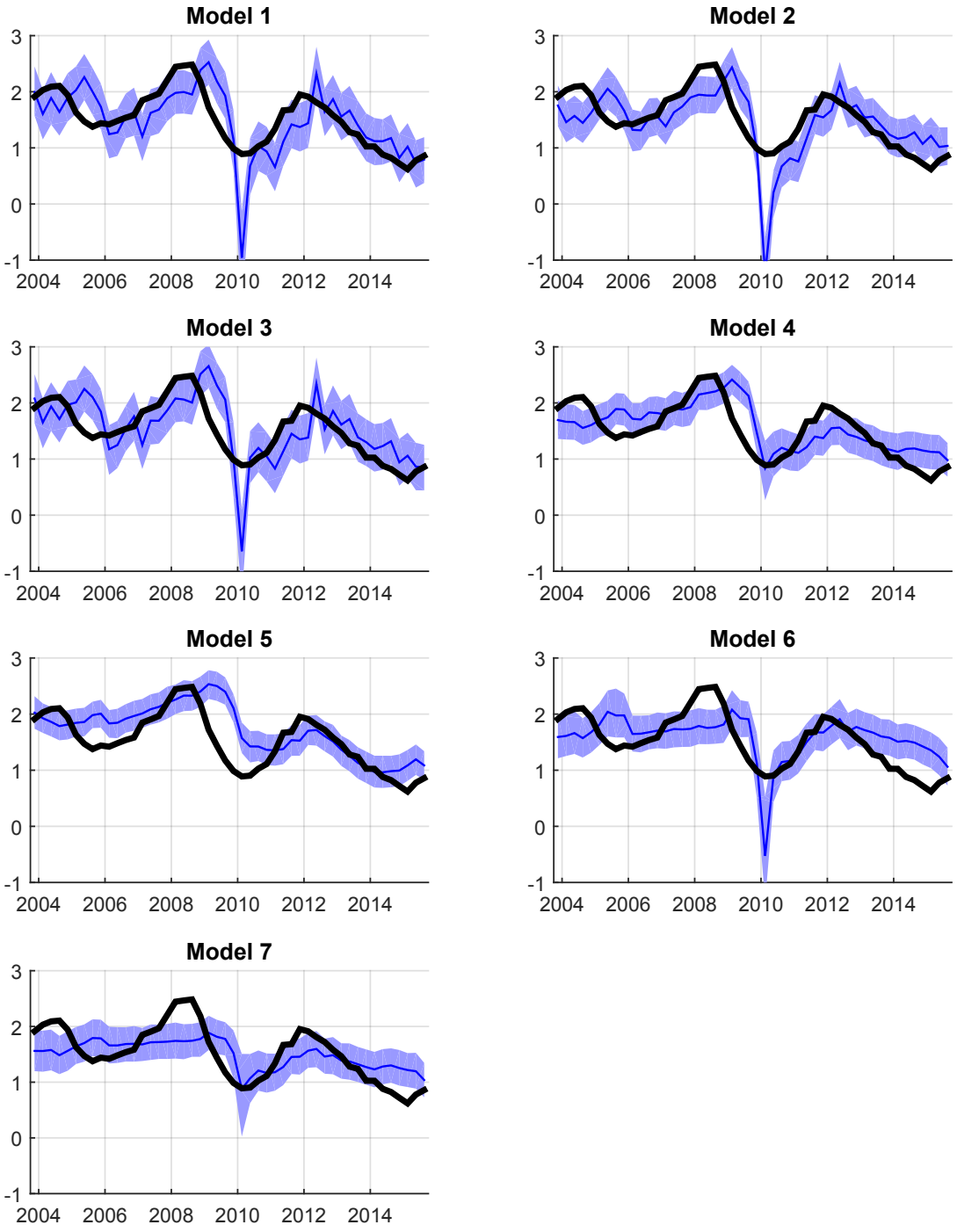



Chart 1 shows that it is important to discriminate among modelling assumptions. In fact, while the alternative estimates agree about the timing of peaks and troughs, they disagree about the level of the output gap. Such differences are economically relevant: the output gap in 2014 and 2015 was, on average, close to -2% according to some estimates, and -6% according to others.

## Validation of output gap estimates: core inflation forecasts

In assessing the alternative measures of the output gap produced by the seven different models, it is not possible to evaluate the forecasting accuracy of the output gap estimates themselves, because the output gap is unobservable. In order to address this issue, we exploit the relationship between the output gap and inflation, also known as the Phillips curve, which is a building block of modern macroeconomic theory. In practice, we rank the different estimates of the output gap on the basis of their ability to forecast inflation. Chart 2 reports the distribution of one-year-ahead inflation forecasts, produced by employing the seven model variants.

*Chart 2: One-year-ahead inflation forecasts (percentage points, year-on-year, real time data)*




The best model (model 4) provides accurate inflation forecasts, capturing very well the recent drop in inflation and implies that the output gap in the euro area was about -6% in 2014 and 2015, on average. These estimates are also quite robust in real time. In particular, models with a relatively large number of real activity indicators, such as model 4, generate estimates of the output gap that do not need to be revised too much when data are revised or subsequent data are made available. However, it is important to notice that such estimates are still characterised by a certain degree of uncertainty and they should therefore be interpreted with caution. Chart 3.a and 3.b allow us to dig deeper into the insights provided by the forecasting comparison. The charts compare, respectively, the level of potential GDP (i.e. the GDP trend) and the output gap estimates of model 4, the best model specification according to the metric of forecasting accuracy, and model 6.

*Chart 3.a: Alternative views of trend real GDP in the euro area (log scale)*

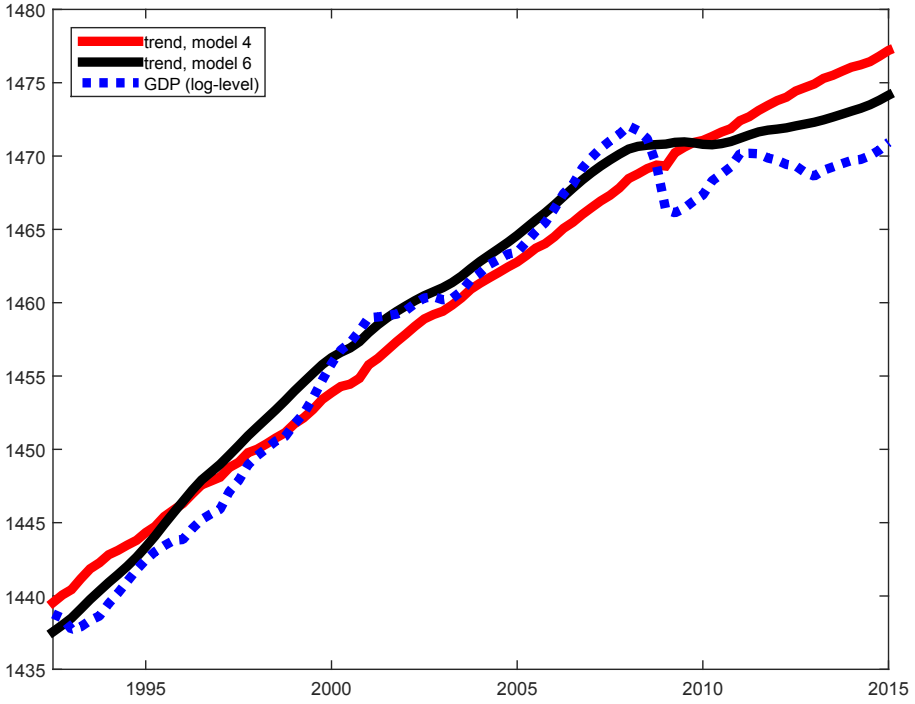
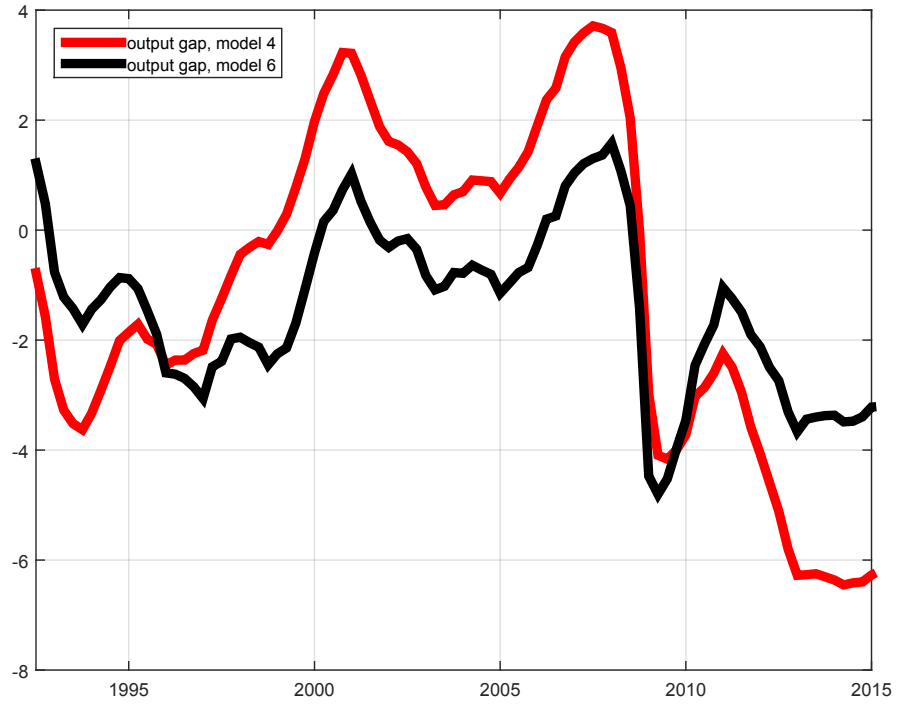



*Chart 3.b: Alternative views of the output gap in the euro area (percentage points)*




The comparison is instructive because the only difference between potential output in model 6 and that in model 4 is that the former is allowed to be more sensitive to current economic conditions. Hence, the two models capture two polar views on the post-financial crisis sluggishness of economic activity in the euro area. Model 4 implies that potential output growth (i.e. the slope of trend growth in Chart 3.a) has not changed much over time and the recent sluggishness in real GDP in the euro area reflects a large output gap. However, some economists believe in a version of the “secular stagnation” hypothesis according to which developed economies, including the euro area, are facing a persistent slow-down of trend growth.

Model 6 captures this view, and its implication is that the euro area output gap is small, in absolute terms. However, model 6, as well as other specifications that produce slow trend growth and, consequently, small output gaps, forecast core inflation poorly in general and worse than model 4, in relative terms. In conclusion, the results suggest that reconciling the secular stagnation hypothesis with the core inflation data is a challenge and may imply that policies aimed at stimulating demand should complement supply side policies in the economic policy mix.

## References

R. Gordon (2014): "**The Demise of U. S. Economic Growth: Restatement, Rebuttal, and Reflections**", *NBER Working Paper 19895*.

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[1]Disclaimer: This article has been written by Marek Jarocinski (Senior Economist, Directorate General Research, Monetary Policy Research Division) and Michele Lenza (Principal Economist, Directorate General Research, Monetary Policy Research Division). The views expressed here are those of the authors and do not necessarily represent the views of the European Central Bank and the Eurosystem.
[2]The full set of variables considered in the paper includes real GDP, real private investment, real imports, real exports, the unemployment rate, consumer confidence and capacity utilisation.

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