

A survey-based measure of slack¹

Measures of economic slack, such as the output gap, are an important element of economic policy analysis, as they represent the interaction between demand and supply. However, slack is unobserved and has to be estimated, therefore no single indicator is published that would express the exact magnitude (and in some cases, not even an indication) of slack. It follows that estimates of slack are uncertain, tend to be revised and therefore, need to be interpreted with caution². This note presents a tool that draws information on demand from the DG ECFIN survey “factors limiting production”, to estimate slack in the economy. The measure described has relatively favourable revisions properties, and can thus complement estimates using structural models.

Widely used methods to estimate slack

Several methods exist to assess the degree of slack in the economy. Estimates of slack based on a production function have the advantage that they are consistent with economic theory and are able to explain developments in potential output via its components (labour, capital and total factor productivity). Estimates of this type are produced by the European Commission³ and the OECD⁴, while the IMF uses different approaches depending on the country assessed. Chart 1 depicts recent estimates by these institutions for the euro area. The output gap in the euro area is estimated to stand between -2.1% and -2.7% in 2015, thus suggesting that there is still a considerable amount of slack.

One drawback of such estimates, however, is that they tend to be revised quite significantly, due to changes to data, parameters and the model setup⁵. For example, the Autumn 2007 forecast of the European Commission showed a negative euro area output gap in 2006 and 2007, at -0.6% and -0.2%, respectively. This assessment suggested that the euro area economy was near to its potential, and if anything, there was a slight excess supply in the economy, with no inflationary pressures. These negative output gaps were then gradually revised over time, and the Spring 2015 forecast

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² See, for example, the box entitled “Recent evidence on the uncertainty surrounding real-time estimates of the euro area output gap”, *Monthly Bulletin, ECB*, November 2011.

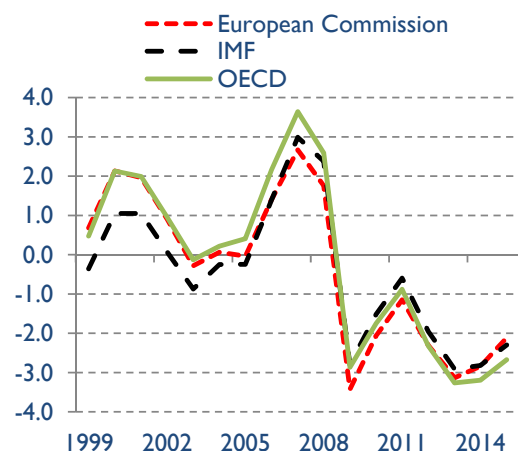
³ See Havik, K. et al., “The production function methodology for calculating potential growth rates and output gaps”, *European Economy – Economic Papers, No 535, European Commission*, November 2014.

⁴ See Beffy, P. O. et al., “New OECD methods for supply-side and medium-term assessment: a capital services approach”, *OECD Economics Department Working Papers, No 482, OECD*, July 2006.

⁵ On the revisions and uncertainty of estimates by international institutions, see Section 2.2 of Anderton, R. et al., “Potential output from a euro area perspective”, *Occasional Paper Series, No 156, ECB*, November 2014.

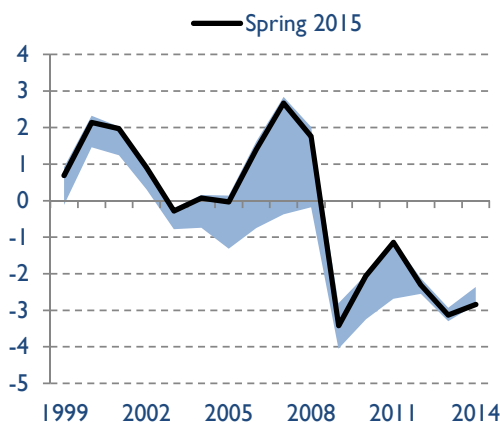
estimates the output gaps for these two years at +1.6% and +2.8%, respectively⁶. As Chart 2 demonstrates, revisions tend to be particularly large around turning points and can be of the magnitude of several percentage points.

Chart 1: Estimates of the euro area output gap (in percent of potential output)



Sources: European Commission, OECD, IMF

Chart 2: Revisions of the euro area output gap estimates of the European Commission (in percent of potential output)



Sources: European Commission
Note: the blue area covers vintages between Spring 2007 and Spring 2015

The main sources of uncertainty in structural models, such as the production function method, are related to i) data used in the models, ii) parameters of the model used to estimate output gaps, and iii) the structure of the model used for the estimation of the output gap.

The more structured a model is, the more understanding it might provide about developments in potential output and the output gap. A production function based methodology has the advantage that it offers a breakdown of potential growth to labour, capital and TFP components. The labour contribution is then broken down into developments in working hours, population, labour force participation and the structural unemployment rate. Being able to assess the developments in these contributing factors is valuable in understanding what is behind developments in potential growth and the output gap.

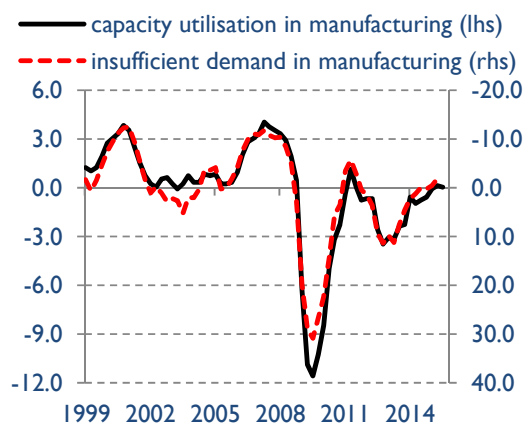
Simple statistical filters – such as the Hodrick-Prescott filter - are a widely used alternative to the production function approach. These filters are transparent, and are easy to implement and update when new data are published. However, they are not able to tell an economically consistent story and their assessment of the amount of slack largely depends on the statistical settings and assumptions. As with the production function estimates referred to earlier, these filters also tend to be revised over time.

To assess the amount of slack, analysts also turn to surveys such as capacity utilisation in the manufacturing sector, or the perceived degree of insufficient demand as constraint on businesses.

⁶ Admittedly, the composition of the euro area has also changed between 2007 and 2015, but this cannot account for such large revisions.

These surveys have the advantage of being revised less frequently, and thus perform better in real time, and are known for better identifying turns in the cycle. Survey indicators can also be released with a short lag period. However, survey measures may only capture a small share of the economy

Chart 3: Capacity utilisation and insufficient demand in manufacturing in the euro area
(deviation from historical mean)



Sources: European Commission

managers in the manufacturing, services and construction sectors are asked quarterly (monthly in the case of construction) for the main factors currently limiting their production (business in the case of services). Unless they consider that 'none' is the appropriate answer, managers can choose one or more of the following factors: insufficient demand; weather conditions (only in the construction survey); shortage of labour force, shortage of material (space in the services survey) and/or equipment; financial constraints; other factors. For the survey-based measure, the answer "insufficient demand limiting production" was selected. One alternative would have been if a principal component is calculated from all the above answers, and the principal component was used in the model. Principal component analysis is however an additional source of uncertainty, as factor loadings also tends to revise over time. Another alternative would be to use the questions related to capacity utilisation; however, the capacity utilisation data series for the services sector only contains data from 2011 onwards.

In the survey-based measure of slack, answers for the manufacturing, construction and services sectors are used, and these are aggregated by using the weights of these sectors' value added in the total economy. Series for manufacturing and construction are available from 1985Q1, while the series for services starts only in 2003Q3 (Chart 4). Therefore, only manufacturing and construction series are aggregated for the period 1985Q1-2003Q2, and all three sectors are taken into account from 2003Q3 onwards. Before calculating the weighted average, each sector's series is rescaled such that it matches the volatility of the correspondent value added series. This is necessary because the volatility of the sectoral indicators in the survey does not match the volatility of economic activity in these sectors. Hence, not rescaling would result an aggregate indicator that is biased towards the

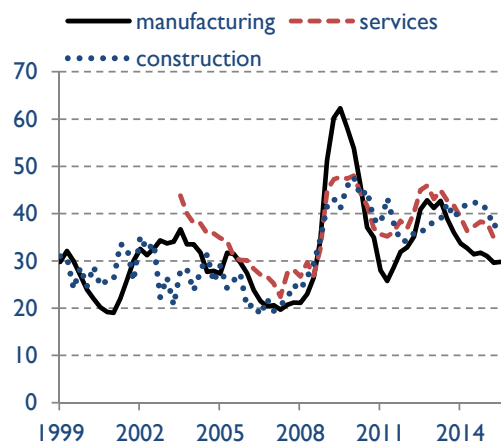
(manufacturing represents less than a fifth of the euro area economy) and are more volatile than GDP or value-added data series. In contrast to the estimates published by international institutions, surveys of capacity utilisation or insufficient demand in manufacturing indicate that there is no slack in the euro area economy in mid-2015 (see Chart 3).

The survey based measure of slack

A new survey-based measure of slack presented in this note maps the results of the "factors limiting production" survey conducted by DG-ECFIN to GDP dynamics. In this survey,

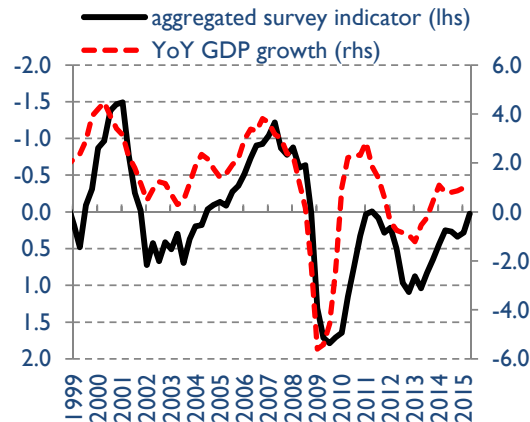
sector with the most volatile survey indicator. Chart 4 presents the aggregated survey indicator for the euro area, together with year-on-year GDP growth.

Chart 4: Insufficient demand limiting production, euro area
(percentage of total answers)



Source: European Commission

Chart 5: The aggregated survey indicator and GDP growth, euro area
(percentage point deviation from historical mean and percentage change)



Sources: European Commission, Eurostat, ECB staff calculations

The aggregate survey indicator is used in a bivariate unobserved components model to calculate slack. In the model, actual output is equal to the sum of potential output and the output gap. Potential output is modelled as random walk in first difference, and the output gap is a function of the survey indicator:

$$y_t = \bar{y}_t + \hat{y}_t$$

$$d\bar{y}_t = d\bar{y}_{t-1} + \varepsilon_t$$

$$\hat{y}_t = \beta DLP_t + \gamma break_t \times DLP_{t+1} + \mu_t$$

where \bar{y} is potential GDP, \hat{y} is the output gap, DLP is the indicator “demand limiting production”, and $break$ is a dummy variable to control for the possible break in the DLP series due to the availability of services sector data in 2003Q3. The model is estimated with maximum likelihood⁷.

Table 1 shows the estimation result for the sample 1996Q1-2015Q1. Both β and γ are significant at 1%.

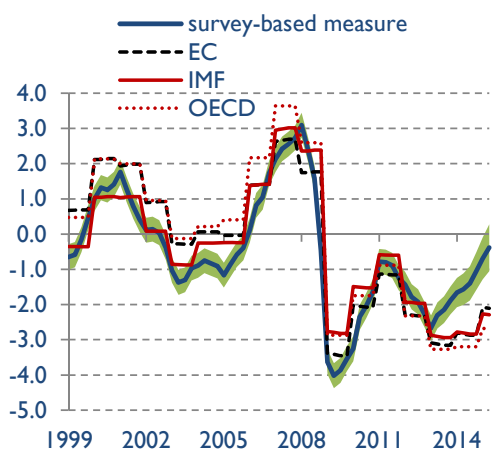
Table 1: Estimation results

	Coefficient	p-value
β	-0.008	0.009
γ	-0.014	0.000
	Final state	p-value
\bar{y}	14.713	0.000
\hat{y}	-0.003	0.6409

⁷ Bayesian estimation could also be considered, although only 3 parameters have to be estimated.

For most of the period 1999Q1-2015Q2, the survey-based measure shows an estimate of slack similar to the most recent estimates by the European Commission, OECD, and the IMF. However, according to the survey-based measure, the amount of slack in the period 2014-2015 is declining relatively fast. As a result, the amount of slack in 2015 is smaller than that estimated by international institutions (see Chart 6). Since the survey-based measure draws information from firm's assessment on demand limiting their production, the decline in slack suggests that growth in the euro area since 2014 reflects an improvement in demand, rather than in supply conditions.

Chart 6: Slack in the euro area
(percentage deviation form trend)

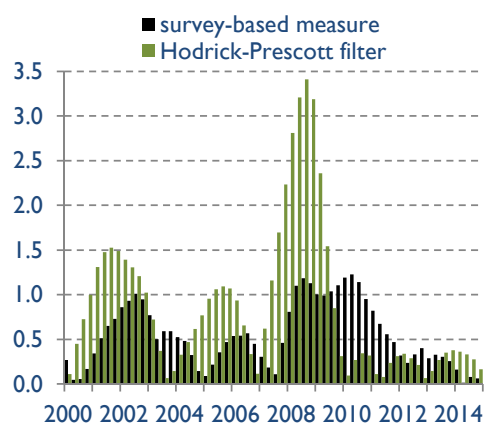


Sources: European Commission, IMF, OECD, ECB staff calculations

The survey question “insufficient demand limiting production” helps to pin down developments in slack in the survey-based model. This, together with the simple structure of the survey-based model, results in favourable revision properties. Recursive estimates show that, over most of the period of 2000-2014, the survey based measure produces smaller differences between quasi-real time and ex-post estimates than an HP-filter (Chart 7). Using GDP vintages to create comparable real-time estimates show that, for the most volatile period of 2007-2012, revisions are the smallest for the (annualised) survey-based measure of slack. Revisions of an HP-filter and the European

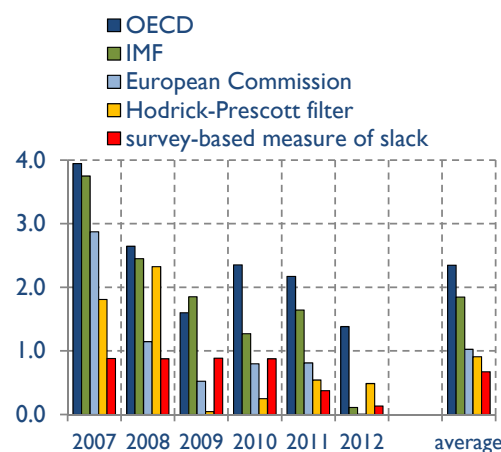
Commission’s output gap estimates are somewhat larger. The largest revisions are seen for the OECD and IMF estimates (Chart 8).

Chart 7: Revisions of slack, quarterly data
(percentage point)



Source: ECB staff calculations

Chart 8: Revisions of estimates of slack
(percentage points)



Source: European Commission, IMF, OECD, ECB staff calculations

Conclusions

Overall, the survey-based measure would point to a smaller amount of slack in the euro area in 2015 than the published estimates of international institutions. While the measure of slack based on the survey-based measure is also surrounded by uncertainty, and it lacks a decomposition into labour, capital and total factor productivity developments, the approach has relatively favourable revision properties. Thus using such measures to complement output gap estimates of production-function based models could be worthwhile.

The survey-based measure could be developed further. The survey data series are available for all EU countries (albeit with different length); therefore, slack can be estimated for individual countries as well. In addition, the data series “demand limiting production” is strongly correlated with the capacity utilisation series, at least in manufacturing and at the euro area level (see Chart 3). It can be examined whether an aggregate “demand limiting production” indicator could be used in the European Commission’s TFP gap model, in order to overcome the lack of capacity utilisation series for construction and services.