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# European Business Cycle Indicators

1<sup>st</sup> Quarter 2017

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EUROPEAN ECONOMY

A photograph of a financial chart with a pen and a tablet. The chart shows a line graph with a peak and a trough, and a bar chart below it. A silver pen lies across the chart, and a silver tablet is visible in the upper right corner.

Economic and  
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# European Business Cycle Indicators

## 1<sup>st</sup> Quarter 2017

### Special topic

- Nowcasting the direction of euro-area GDP growth

This document is written by the staff of the Directorate-General for Economic and Financial Affairs, Directorate A for Policy, Strategy and Communication, Unit A3 – Economic Situation, Forecasts, Business and Consumer Surveys.

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## OVERVIEW

### Recent developments in survey indicators

- After having booked marked increases over the last quarter of 2016, the euro-area and EU Economic Sentiment Indicators (ESI) remained broadly stable over the first quarter of 2017. At 107.9 (euro-area) and 109.1 (EU) points, both indicators remain comfortably above their long-term averages of 100, at levels which were last witnessed more than five (euro-area) or nine (EU) years ago.
- Also at the sectoral level, developments were quite contained: euro-area confidence brightened in the construction and industry sectors, and clouded over somewhat in the retail trade sector. The same holds for the EU, whereby the improvement in construction confidence was more forceful and the deterioration in retail trade confidence much more contained.
- From a country perspective, developments compared to December were rather limited, too. Sentiment improved in the UK (+1.7), Poland (+1.6), Italy (+1.4), the Netherlands (+1.1) and Spain (+0.9), while it cooled slightly in France (-0.6) and Germany (-0.2).
- Capacity utilisation in manufacturing increased by 0.2 percentage points in the euro area and 0.3 percentage points in the EU. Currently, both indicators are about 1 ½ percentage points above their respective long-term averages. Capacity utilisation in services remained unchanged in both the euro area and the EU, also about 1 ½ percentage points above their respective long-term averages.

### Special topic: Nowcasting the direction of euro-area GDP growth

While a vast amount of econometric models have been developed to forecast Gross Domestic Product (GDP) prior to its release, the commonality of virtually all models is their focus on predicting the growth rate of GDP. Although obviously a highly relevant estimation target, we argue that correctly predicting the profile of GDP growth (i.e. whether growth rates in- or decrease compared to the preceding quarter) can, at times, be even more important from an economic or policy point of view. In principle, the expected growth profile can simply be derived from a model's forecasts of GDP growth. However, experience shows that models producing high-quality point forecasts do not necessarily provide particularly reliable information on the growth profile.

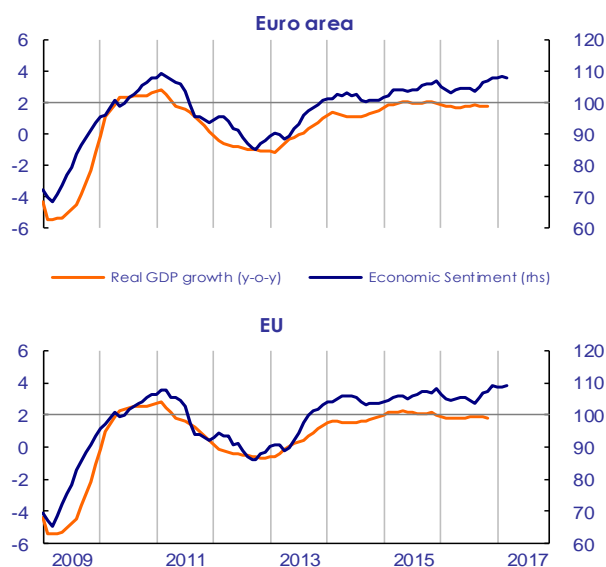
Against that backdrop, this special topic presents a number of new models explicitly tailored to forecast the profile of GDP growth. The models have in common that they rely to a large extent on interaction terms, i.e. variables measuring the effect of two developments happening at the same time. In a pseudo out-of-sample exercise the new models are shown to provide rather reliable forecasts of the GDP profile, resulting in 'hit ratios' of 97% to 86%, superior to the performance of the alternative approach of deriving the GDP profile from the point forecasts of conventional bridge models predicting GDP growth.

# 1. RECENT DEVELOPMENTS IN SURVEY INDICATORS

## 1.1. EU and euro area

Following sharp increases in the final quarter of 2016, the euro-area and EU Economic Sentiment Indicators (ESI) stabilised at a high level during the first quarter of 2017. Currently standing at 107.9 (euro-area) and 109.1 (EU) points respectively, both indicators are not only comfortably above their long-term averages of 100, but also at levels which were last witnessed more than five (euro-area) or nine (EU) years ago (see Graph 1.1.1).

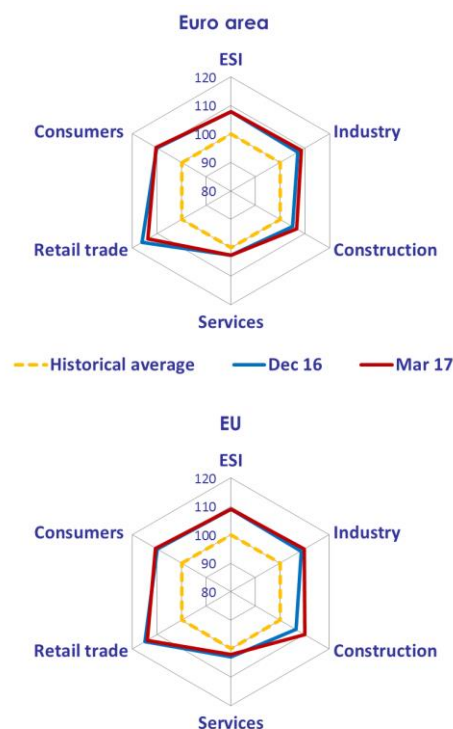
Graph 1.1.1: Economic Sentiment Indicator



Note: The horizontal line (rhs) marks the long-term average of the survey indicators. Confidence indicators are expressed in balances of opinion and hard data in y-o-y changes. If necessary, monthly frequency is obtained by linear interpolation of quarterly data.

While the ESI remained broadly unchanged in the first quarter, Markit Economics' Composite PMI for the euro area booked the strongest increase in the course of a quarter since the beginning of 2015. At 56.4 points, the March-reading is the highest in more than 5 ½ years. Also the Ifo Business Climate Index (for Germany) rose in the course of Q1. The indicator currently stands at 112.3 points, its highest level in more than 5 ½ years.

Graph 1.1.2: Radar Charts



Note: A development away from the centre reflects an improvement of a given indicator. The ESI is computed with the following sector weights: industry 40%, services 30%, consumers 20%, construction 5%, retail trade 5%. Series are normalised to a mean of 100 and a standard deviation of 10. Historical averages are generally calculated from 1990q1. For more information on the radar charts see the Special Topic in the 2016q1 EBCI ([https://ec.europa.eu/info/publications/economy-finance/european-business-cycle-indicators-1st-quarter-2016\\_en](https://ec.europa.eu/info/publications/economy-finance/european-business-cycle-indicators-1st-quarter-2016_en)).

From a sectoral perspective, confidence in the first quarter of the year increased slightly among euro-area managers in industry and construction (see Graph 1.1.2). On the other hand, confidence in the retail trade sector cooled down somewhat while consumer and services confidence stayed broadly unchanged. In the EU, confidence improved markedly in the construction sector, and, to a much lesser degree, in industry and among consumers, while it deteriorated slightly in the services and retail trade sectors.

In terms of levels, almost all sectoral euro-area and EU confidence indicators continue to be significantly above their historical means; only

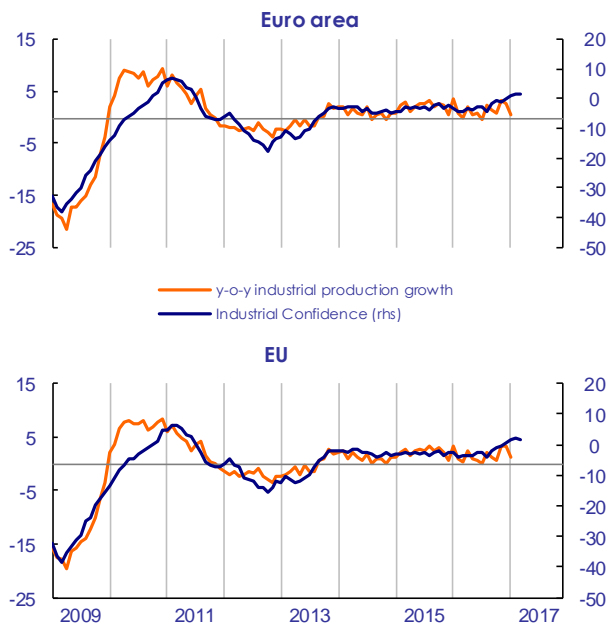
services confidence in both regions has still not lifted significantly above its long-term average.

From a country perspective, economic sentiment improved mildly in five of the seven largest EU economies, namely in the UK (+1.7), Poland (+1.6), Italy (+1.4), the Netherlands (+1.1) and Spain (+0.9), while it cooled slightly in France (-0.6) and Germany (-0.2).

## Sector developments

Industrial confidence in both the euro area and the EU brightened slightly, completing the first quarter 1.2 points (euro area) and 1.1 points (EU) higher than the preceding one. As illustrated by Graph 1.1.3, industry confidence is rather high by historic standards, at levels last seen in mid-2011.

Graph 1.1.3: Industry Confidence indicator



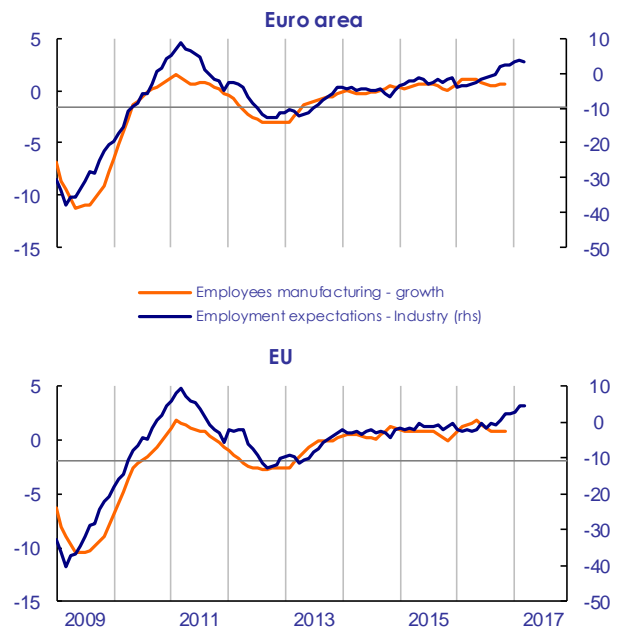
In both European aggregates, the slight upward trend of the confidence indicator resulted from improvements in managers' assessments of order books, while their assessments of the stocks of finished products remained broadly unchanged. Regarding production expectations, managers were slightly more optimistic in the euro area, while in the EU production expectations remained virtually stable.

Of the components not included in the confidence indicator, past production in the euro area deviated from the common trend,

settling below its December level, while export order books appraisals were significantly more upbeat than in December in both the euro area and the EU.

Euro-area and EU selling price expectations continued the forceful recovery they had embarked upon at the beginning of 2016, settling at their highest since mid-2011. The same goes for employment expectations which in March were as positive as last time in summer 2011 (see Graph 1.1.4).

Graph 1.1.4: Employment - Industry Confidence indicator



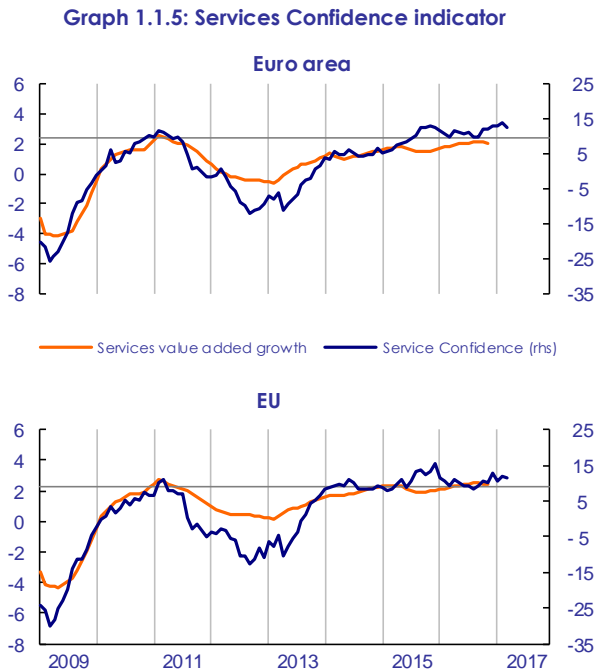
Focussing on the seven largest EU economies, a comparison of December and March readings shows sharply improved industry confidence in the UK (+5.6) and, to a lesser extent, Italy (+2.9), Spain (+1.7) Germany (+1.4) and the Netherlands (+1.3). Confidence in Poland (+0.6) and France (-0.5) showed little change on the quarter.

The latest results of the quarterly manufacturing survey (January) showed **capacity utilisation in manufacturing** having increased by 0.2 percentage points in the euro area and 0.3 percentage points in the EU. Currently, both indicators are about 1 ½ percentage point above their respective long-term averages (at 82.5% in the euro area and 82.1% in the EU).

In line with the ESI trend, euro-area **services confidence** remained broadly unchanged (-0.2),



while it slightly deteriorated (-1.1) in the EU. Still, both indicators score above their long-term averages (see Graph 1.1.5).



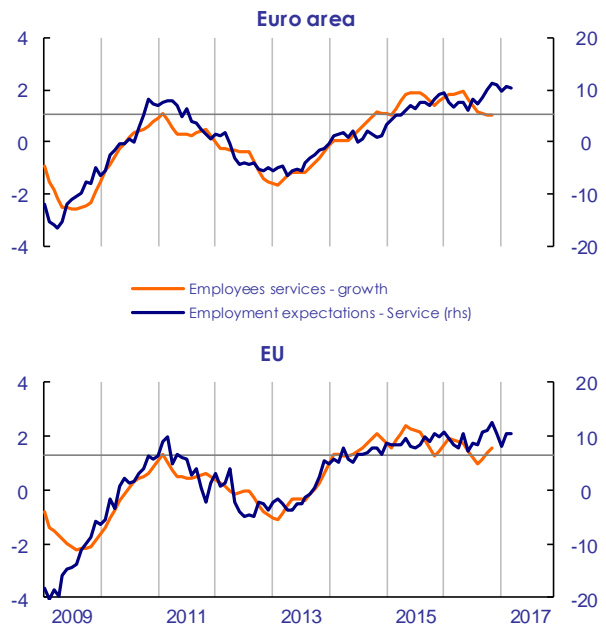
Looking at the components of services confidence, assessments of the past business situation and demand expectations worsened, while assessments of the past demand remained broadly unchanged (EU) or improved (euro area).

Compared to the end of Q4, employment expectations in March remained virtually unchanged both in the euro area and the EU (see Graph 1.1.6). Selling price expectations firmed in the euro area, while they stayed broadly unchanged in the EU.

The flat signals from the services sector were echoed in France (+0.3). Confidence brightened in the Netherlands (+3.3), Italy (+1.8) and Poland (+1.5), while it clouded over in the UK (-5.1), Germany (-2.4) and Spain (-1.6).

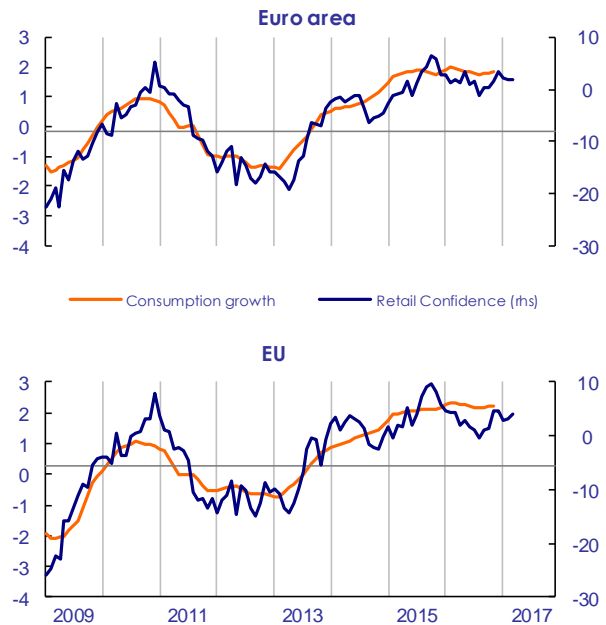
**Capacity utilisation in services**, as measured by the January wave of the dedicated quarterly survey, remained unchanged in the euro area and the EU. The current rates of 89.4% (euro area) and 89.3% (EU) correspond to levels above the respective long-term averages (calculated from 2011 onwards) of 87.8% and 88.1%.

**Graph 1.1.6: Employment - Services Confidence indicator**



Compared to the end of Q4, **retail trade confidence** in March decreased somewhat in the euro area (-1.7), and to a lesser extent in the EU (-0.7). Both indicators stand comfortably above their long-term averages (see Graph 1.1.7).

**Graph 1.1.7: Retail Trade Confidence indicator**



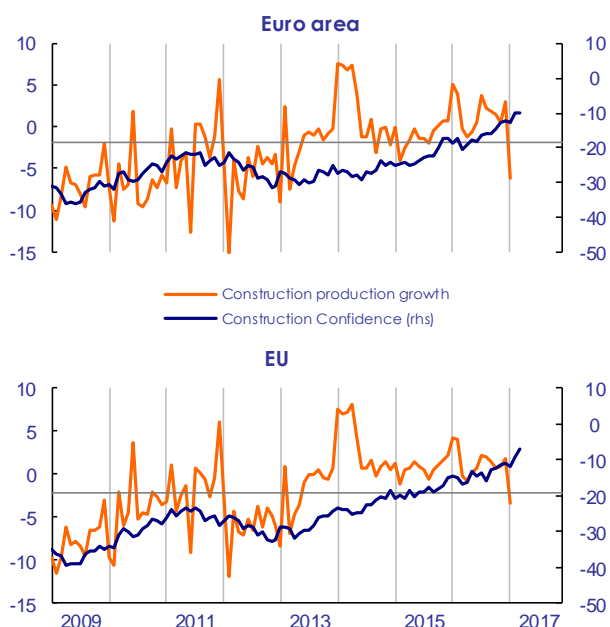
A look at the individual components making up the confidence indicator reveals that they followed opposing trajectories: while views on the past business activity clouded over, assessments of the volume of stocks marginally brightened. Finally, business expectations

slightly deteriorated in the euro area, while they mildly improved in the EU.

Turning to a country perspective, the months since December saw retail trade confidence improving in the UK (+3.7), Italy (+2.9) and Poland (+1.7), while worsening in Germany (-3.8), Spain (-2.0), France (-1.5) and, more mildly so, in the Netherlands (-0.8).

**Construction** confidence continued the recovery it had embarked upon in 2013. While EU managers were much more upbeat (+4.2 points on the quarter), the improvements in the euro area were somewhat more cautious (+2.2).

Graph 1.1.8: Construction Confidence indicator



In terms of the components making up the indicator, both EU and euro-area managers reported much more positive appraisals of their current order books, while employment expectations slightly improved in the EU and remained virtually unchanged in the euro area.

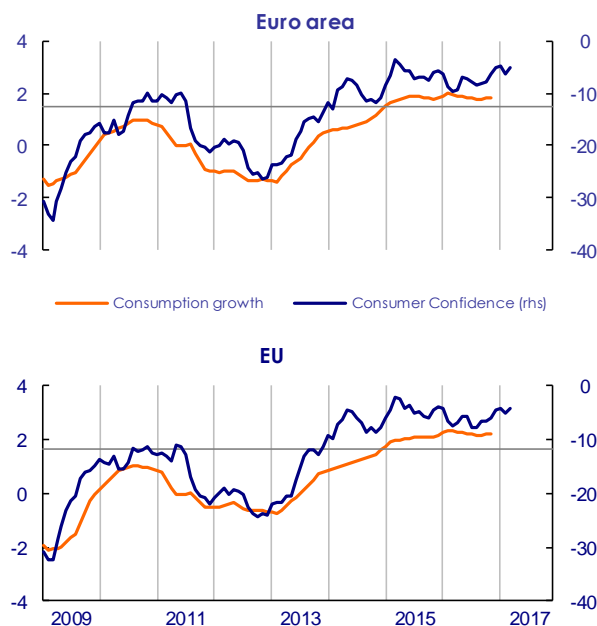
Focussing on the seven largest EU economies, construction confidence increased strongly in the UK (+15.5), but also in the Netherlands (+6.4), France (+3.1), Spain (+2.4) and Poland (+1.5). Increases were more contained in Germany (+0.9) and Italy (+0.4).

**Consumer confidence** remained broadly stable during the first quarter. Indicators increased by 0.1 points in the euro area and 0.4 points in the

EU, scoring comfortably above their long-term averages (see Graph 1.1.9).

While consumers' expectations were much more benign concerning unemployment and slightly more optimistic concerning their savings, they were more pessimistic about their personal financial situation and the general economic situation.

Graph 1.1.9: Consumer Confidence indicator

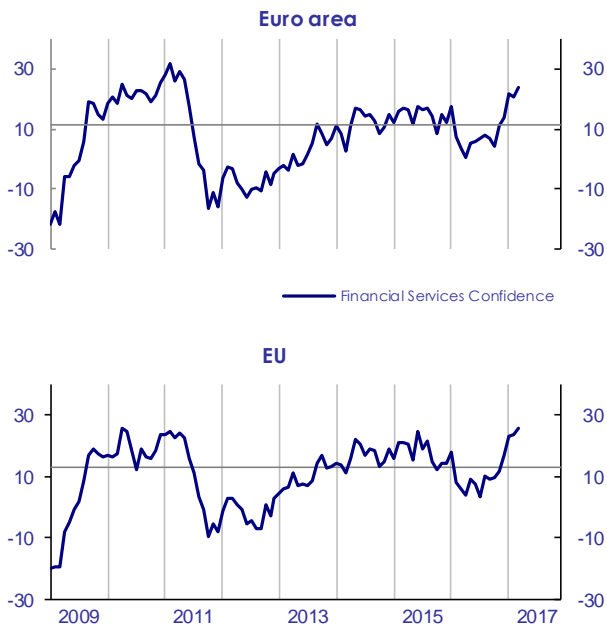


In terms of developments in the seven largest EU economies, the broadly flat developments were echoed in Spain (+0.5), France (+0.4) and the UK (+0.3). Confidence powered ahead in the Netherlands (+3.4) and, to some extent, Poland (+1.8) and Germany (+0.9), while it deteriorated in Italy (-3.4).

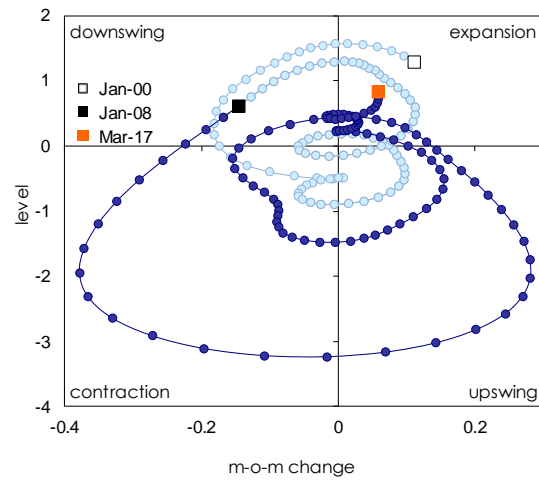
EU and euro-area confidence in **financial services** (not included in the ESI) booked solid increases at the beginning of the year, completing the first quarter 9.8 (EU) to 11.7 (euro area) points higher than the previous one. The indicators are currently scoring at their highest levels since 2011 (see Graph 1.1.10).

In both regions, appraisals of the past (demand and business situation) contributed mostly to the gains, while the improvements in expectations were somewhat more muted.

Graph 1.1.10: Financial Services Confidence indicator

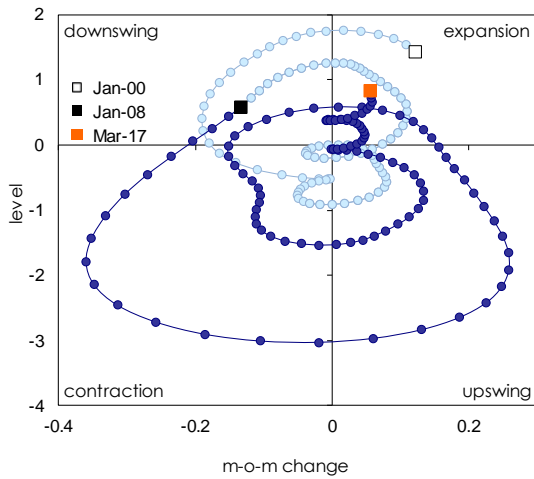


Graph 1.1.12: EU Climate Tracer



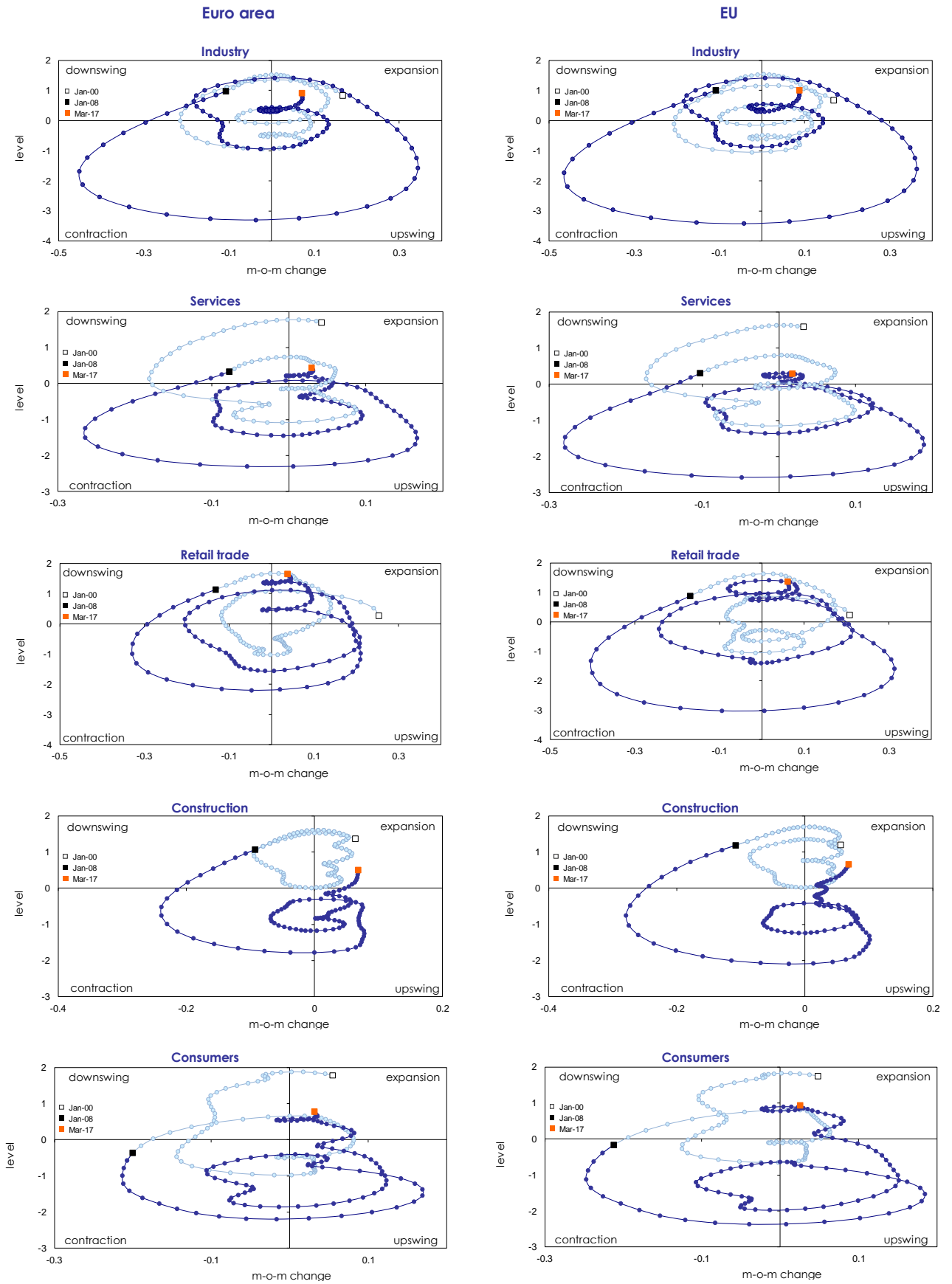
The positive developments in euro-area/EU survey data over the fourth quarter are illustrated by the evolution of the **climate tracers** (see Annex for details).

Graph 1.1.11: Euro area Climate Tracer



The economic climate tracers for the euro area and the EU are comfortably settled in the expansion area, even slightly firmer than in December 2016 (see Graphs 1.1.11 and 1.1.12). The sectoral climate tracers (see Graph 1.1.13) are in line with the overall tracers in so far as all of them indicate economic expansion, as in December. Furthermore, the services sector indicators, which were still close to the frontier to the downswing area, confirmed their position in the expansion area.

Graph 1.1.13: Economic climate tracers across sectors

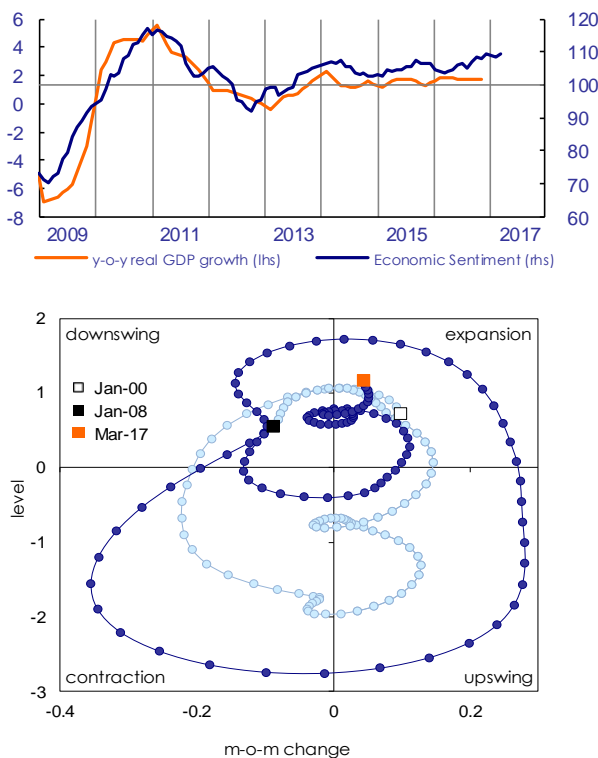


## 1.2. Selected Member States

Over the first quarter of 2017, changes in sentiment were rather contained. The differences between the national indicators at the end of 2016 and 2017 Q1 were positive in the UK (+1.7), Poland (+1.6), Italy (+1.4), the Netherlands (+1.1) and Spain (+0.9), and mildly negative in Germany (-0.2) and France (-0.6).

In **Germany**, a mild setback in economic sentiment over the first two months of 2017 was broadly offset by a commensurate increase in March, resulting in a broadly stable ESI in Q1. At 109.2 points, the indicator remained well above its long-term average of 100. In terms of the climate tracer (see Graph 1.2.1), the German economy confirmed its position in the expansion quadrant.

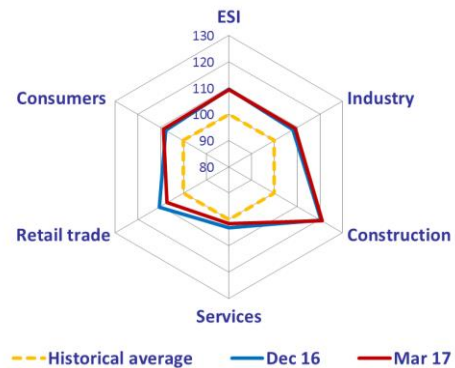
Graph 1.2.1: Economic Sentiment Indicator and Climate Tracer for Germany



From a sectoral perspective, the first quarter brought small improvements in industry and among consumers, while confidence clouded over in the services and retail trade sectors. Confidence in the construction sector remained virtually unchanged. While all indicators remained well above their respective long-term averages (see Graph 1.2.2), the construction

sector is clearly enjoying an exceptionally high confidence.

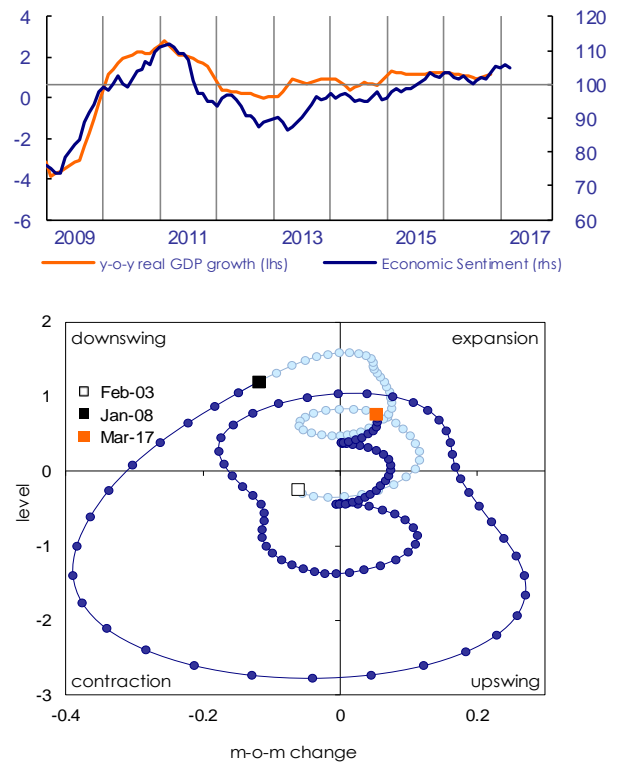
Graph 1.2.2: Radar Chart for Germany



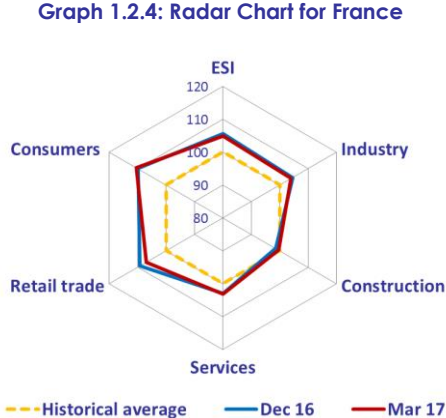
Note: Given the high level of construction confidence, the scale of the German radar chart extends to 130, unlike the other radar charts in this publication.

In **France**, deteriorating sentiment in January and March was mitigated by better readings in February, resulting in a mild cooling of sentiment in Q1. At 104.9 points, the headline indicator posts well above its long-term average of 100. Accordingly, the French climate tracer (see Graph 1.2.3) is firmly settled in the expansion quadrant.

Graph 1.2.3: Economic Sentiment Indicator and Climate Tracer for France

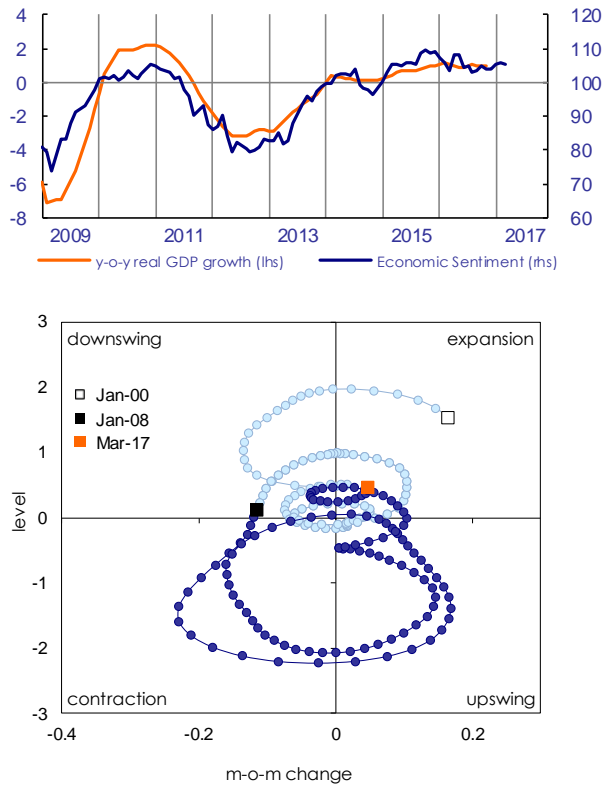


A look at the French radar chart (see Graph 1.2.4) shows that only the construction sector sent mildly positive signals, while confidence deteriorated in the retail trade sector. In all other sectors (industry, services and consumers), sentiment remained virtually unchanged. In terms of levels, sentiment remained comfortably above its long-term average in industry and services and, by a markedly greater margin, in retail trade and among consumers. In spite of its positive trend, construction confidence remained just below its long-term average.



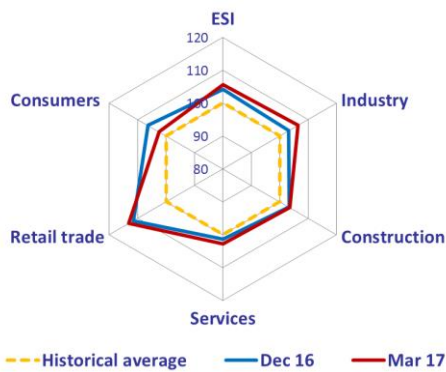
Due to an improvement in January followed by virtually stable sentiment in February and March, the ESI in **Italy** settled above its level at the end of 2016 (+1.4). At 105.5 points, the Italian ESI confirmed its position firmly above the long-term average of 100. As Graph 1.2.5 shows, mildly improved sentiment in Q1 carried the Italian climate tracer into the expansion area, coming from the frontier with the downswing quadrant.

**Graph 1.2.5: Economic Sentiment Indicator and Climate Tracer for Italy**



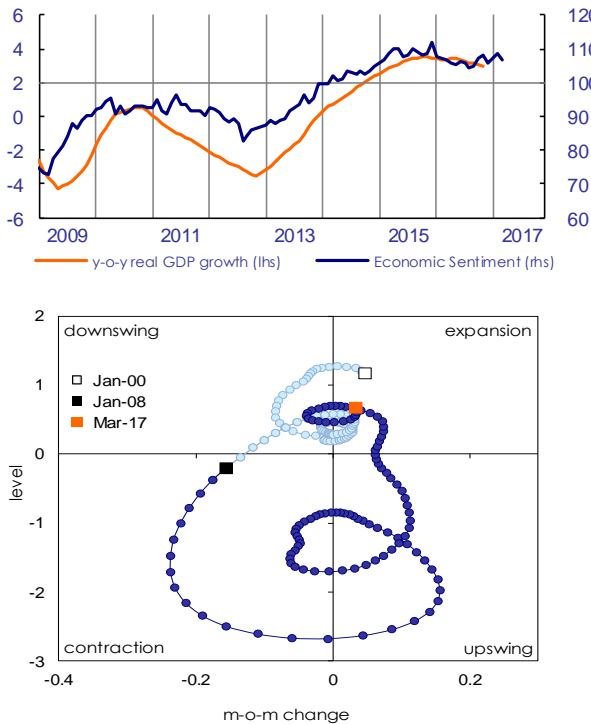
Looking at the evolution of sectoral confidence levels (see Graph 1.2.6), confidence brightened in industry, and to a lesser extent in retail trade and services, while it clouded over among consumers and remained broadly stable in the construction sector. As in Q4, all sectoral confidence indicators remained above their long-term averages, and most notably so the indicator in retail trade.

**Graph 1.2.6: Radar Chart for Italy**



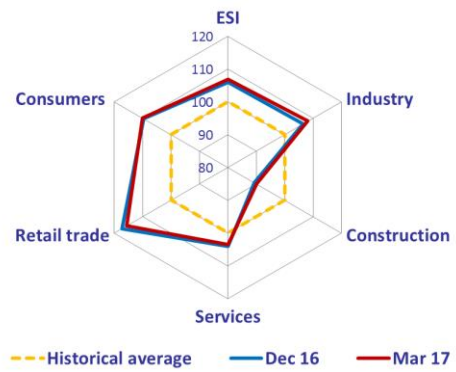
While sentiment in **Spain** gained momentum at the beginning of Q1 with increases in January and February, the last month of the quarter brought a small set-back, leaving the ESI just 0.9 points higher on the quarter. At 106.9 points, the indicator increased its distance to the long-term average of 100. The climate tracer for Spain stayed virtually unchanged, continuing to locate the economy in the expansion quadrant (see Graph 1.2.7).

**Graph 1.2.7: Economic Sentiment Indicator and Climate Tracer for Spain**



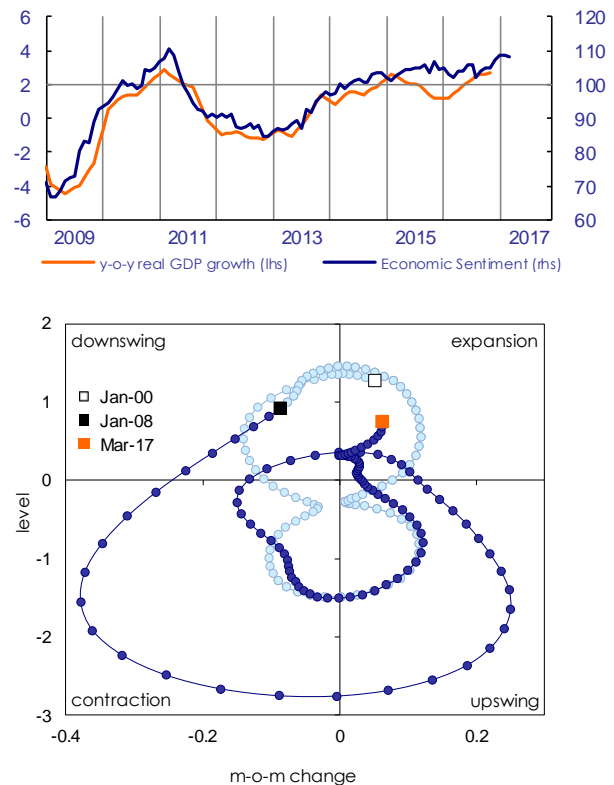
As the radar chart highlights (see Graph 1.2.8), only the industry sector posted noteworthy improvements in confidence, while sentiment in the retail trade sector deteriorated. Nonetheless, same as in Q4, all sectoral confidence indicators stayed well in excess of their respective long-term averages, with the notable exception of construction, which remained at historically low levels.

**Graph 1.2.8: Radar Chart for Spain**



Following positive developments in January, the **Dutch** sentiment reached a plateau at the end of the first quarter. At 108.2 points, the ESI finished 1.1 points higher on the quarter and remained well in excess of its long-term average of 100. Propelled by the improvement in sentiment, the Dutch climate tracer (see Graph 1.2.9) moved further into the expansion area over Q1.

**Graph 1.2.9: Economic Sentiment Indicator and Climate Tracer for the Netherlands**

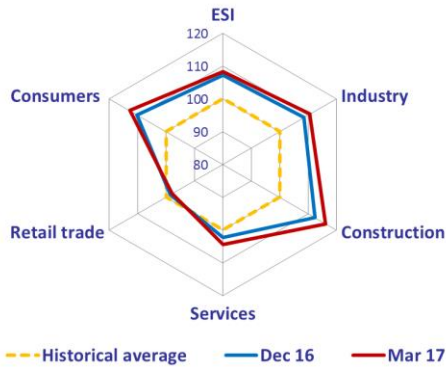


A glance at the Dutch radar chart (see Graph 1.2.10) shows that confidence improved in four sectors (industry, construction, services and consumers), and remained broadly unchanged in the retail trade sector. Compared to historic



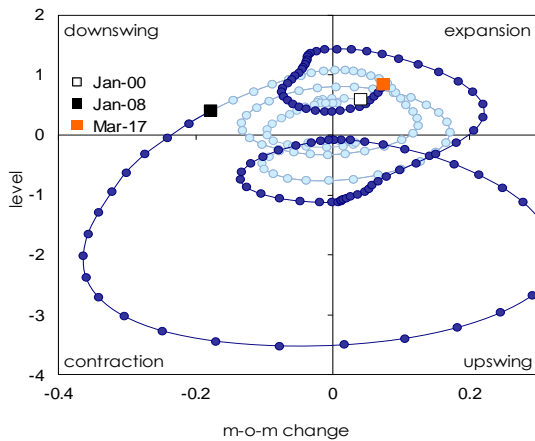
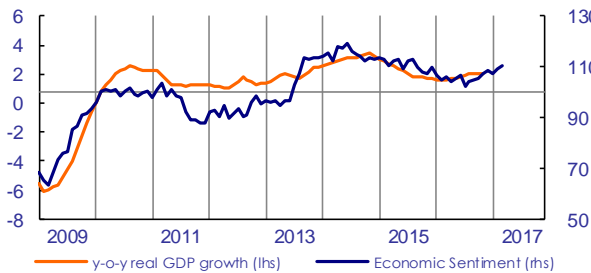
levels, confidence is high particularly among consumers and in construction, and rather low in retail trade.

Graph 1.2.10: Radar Chart for the Netherlands



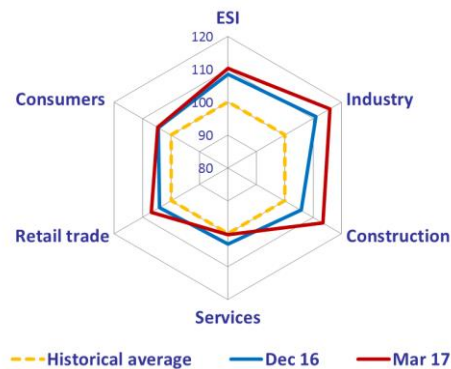
Sentiment in the **United Kingdom** continued the rally it had embarked upon after the initial shock of the Brexit referendum. March data came in 1.7 points higher on the quarter and above their pre-referendum peak of June 2016. At 110.2 points, the UK ESI is firmly above its long-term average of 100. The brighter sentiment moved the UK climate tracer (see Graph 1.2.11) further into the expansion quadrant.

Graph 1.2.11: Economic Sentiment Indicator and Climate Tracer for the United Kingdom



Focussing on sectoral developments, the radar chart for the UK (see Graph 1.2.12) shows that confidence increased markedly in construction and industry, and to a lesser extent in retail trade, while it cooled down in services and remained broadly unchanged among consumers. The levels of confidence indexes are well in excess of historic averages among consumers and in retail trade and, by a markedly greater margin, in industry and construction. In the services sector, the decrease between December and March brought the confidence indicator back to its long-term average.

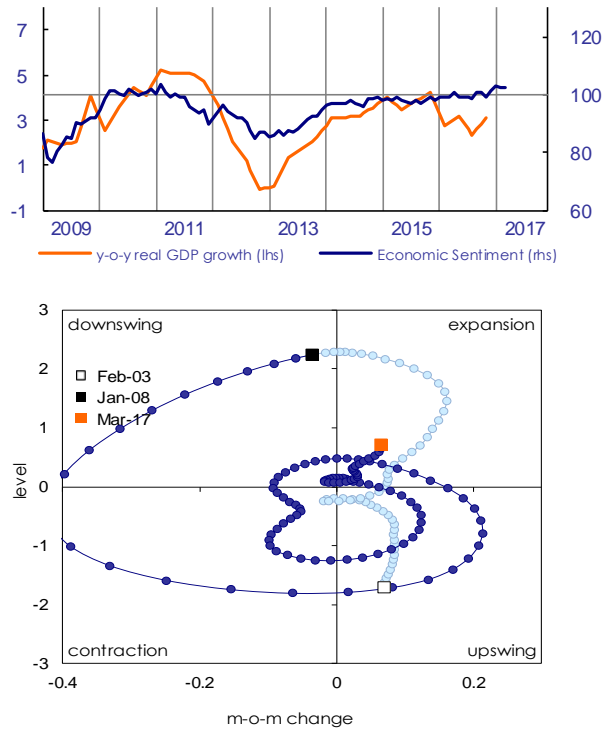
Graph 1.2.12: Radar Chart for the UK



Thanks mostly to a strong improvement in January, sentiment in **Poland** finished Q1 1.6 points above its Q4 level. At 102.7, the indicator stayed above its long-term average during the whole quarter, for the first time since 2011, and reached its highest level since 2008. The improvement in sentiment moved the climate tracer for Poland further into the expansion quadrant (see Graph 1.2.13).

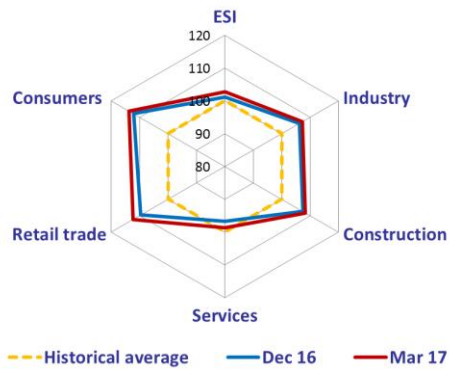


**Graph 1.2.13: Economic Sentiment Indicator and Climate Tracer for Poland**



As the Polish radar chart (see Graph 1.2.14) shows, confidence has firmed across all sectors of the economy. All indicators remained above their long-term averages, with the exception of the services sector which, in spite of its positive trend, remained below but close to its long-term average.

**Graph 1.2.14: Radar Chart for Poland**



## 2. SPECIAL TOPIC: NOWCASTING THE DIRECTION OF EURO-AREA GDP GROWTH

### Introduction

Economic and political decision-makers base their choices on an early understanding of the state of the economy. With the most comprehensive measure of economic activity, Gross Domestic Product (GDP), released with a significant time-lag<sup>1</sup>, a vast amount of econometric models have been developed to forecast GDP figures prior to their actual release. While there is abundant variety in terms of the econometric techniques applied and predictor variables deployed, the commonality of virtually all models is their focus on predicting the growth rate of GDP.

Although obviously a highly relevant estimation target, we argue that correctly predicting the profile of GDP growth (i.e. whether growth rates in- or decrease compared to the preceding quarter) can, at times, be even more important from an economic/policy point of view, especially at turning points, e.g. when GDP starts picking up after a recession.

In principle, the expected growth profile can simply be derived from a model's forecasts of GDP growth. However, experience shows that models producing high-quality point forecasts (in terms of root mean squared errors (RMSEs)), do not necessarily provide particularly reliable information on the growth profile.

Against that backdrop, the present article presents models which explicitly forecast the profile of GDP growth. Besides targeting a dummy variable (taking the value one, if GDP growth is higher than in the preceding quarter), the models differ from the current standard models in respect of the selection of predictor

variables, relying to a significant extent on interaction terms, which are shown to be particularly useful in the context of the exercise.

Our analysis constitutes, to the best of the authors' knowledge, the first attempt to explicitly forecast the quarterly growth profile of euro-area (EA) GDP growth and thus complements a 2011-note by the French Statistical Institute (Insee)<sup>2</sup> which documents the merits of such binary models for the case of French GDP.

### The need for directional change models

The pertinence of developing models explicitly tailored to forecasting the profile of GDP growth can be illustrated by looking at the reliability of information which other, existing models provide in respect of the GDP growth profile. Concretely, one can simply derive the GDP profile from the forecasts of standard bridge models targeting quarter-on-quarter (q-o-q) GDP growth. To test the merits of that approach, we rely on four short-term models regularly operated by DG ECFIN, whose performance in forecasting EA GDP growth is at par with other well-reputed models, like Bank of Italy's €-coin indicator,<sup>3</sup> and which cover a variety of different econometric approaches and types of predictor variables.

Two of them are standard bridge models based on survey indicators (BM1 and BM2). The

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<sup>1</sup> Eurostat publishes a first, preliminary flash estimate of EA GDP some 30 days after the reference quarter.

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<sup>2</sup> Mikol, F. and M. Cornec (2011). 'Will activity accelerate or slow down? A few tools to answer the question'. French National Institute of Statistics and Economic Studies, *Conjoncture in France*, December.

<sup>3</sup> The RMSEs of DG ECFIN's bridge models and the €-coin indicator produced at the end of the reference quarter cluster around 0.25 (percentage-points of q-o-q GDP growth) over the period 2010q1 to 2016q4.

time-varying parameter model (TVP) is also based on survey data, but differs from the former in that parameters are allowed to change over time. The last one (FM) is a factor model.<sup>4</sup> As another benchmark, a naïve autoregressive model is also run. Finally, the pooling approach (POOL) is based on the average of the nowcasts of the above models.

Table 2.1 summarises the forecasting performance of the different models, as generated by a pseudo real-time exercise, covering the period 2010q1 to 2016q4 (i.e. 28 quarters) and assuming that forecasts are conducted at the end of the third month of each quarter, i.e. 30 days before the first estimate of GDP (preliminary flash) is released.<sup>5</sup> As it turns out, even the best performing models do not achieve to correctly identify the GDP growth profile<sup>6</sup> in more than 20 out of 28 cases, which translates into a rate of 71%.<sup>7</sup>

**Table 2.1: Nowcasting performance by model (2010q1-2016q4) correct in-/decreases (out of 28)**

BM1	TVP	BM2	FM	AR	POOL
20	18	19	19	20	20

## Particularities of the target variable

Before turning to the presentation of the new (directional change) models, some thoughts on the target variable are warranted. Generally, to assess the performance of models nowcasting the (continuous) GDP growth rate, it is considered sufficient and valid to work in pseudo real-time, i.e. with the last revised vintage of GDP (see Diron, 2006<sup>8</sup>). This is due

to the fact that revisions of the target variable (GDP growth) are usually rather contained. Unfortunately, that does not necessarily hold true when forecasting the profile of GDP, since even small revisions in GDP growth can lead to changes in the GDP profile.

Against that backdrop, one has to make a conscious choice in respect of the version of GDP whose growth profile one wants to nowcast. We argue that most users of GDP nowcasts (analysts, policy makers, etc.) tend to judge their reliability by comparing them to timely releases of GDP, rather than revised figures getting available several months later. Accordingly, we choose to construct our target variable on the basis of the flash estimates of GDP, which get released some 45 days after the reference quarter.<sup>9</sup> In line with our theoretical considerations, the binary variable derived from real-time data is quite different from the one based on the last revised GDP series available on the Eurostat website: from 2001q1 to 2013q4, the growth profiles signalled by the two variables differ in 31% of cases.

## The dataset

In order to explicitly nowcast the quarterly growth profile of EA GDP, our target variable is a binary (dummy) series. Its value is defined as one whenever the real-time q-o-q GDP growth is higher than in the previous quarter, and zero otherwise.

In terms of potential predictor variables to choose from, we consider a wide array of time-series typically deployed in the context of GDP forecasting, ranging from business and consumer surveys (BCS) to hard data, such as industrial production (IP), etc. Since we focus on the development of models forecasting the GDP profile at the end of the third month of a quarter (where a number of variables relating to the forecasting quarter have not yet been

<sup>4</sup> For more details about the factor model, see Gayer, C., A. Girardi, and A. Reuter (2014). 'The role of survey data in nowcasting euro area GDP growth'. European Commission, *European Economy*, Economic Papers 538.

<sup>5</sup> Note that the preliminary flash only exists since 2016q2. Prior to that date, the first release of GDP (flash estimate) got available 45 days after the end of the reference quarter.

<sup>6</sup> The GDP growth profile is derived from the real-time flash estimates, as explained below.

<sup>7</sup> That percentage is statistically significantly different from the predictions of a random guess model (equivalent to repeatedly tossing a coin) at the 99% significance level.

<sup>8</sup> Diron, M. (2006). 'Short-term forecasts of euro area real GDP growth, an assessment of real-time performance based on

vintage data'. European Central Bank, *ECB working paper series*, No. 622, May.

<sup>9</sup> The data are retrieved from the Revisions Analysis Dataset provided by the OECD, which is available here: <http://stats.oecd.org/index.aspx?queryid=206>

released), some variables (e.g. IP) are only partially included in the dataset.

All variables considered in our analysis are, in a first step, subject to the typical transformations ensuring their stationarity (e.g. trending variables, such as IP, are expressed as growth rates). Given that our dependent variable is based on the difference of the usually targeted GDP growth rate, we also express each transformed variable (i) in terms of first differences and (ii) as a dummy variable indicating whether that difference is positive. We thus end up with three versions of each variable being included in the data-set.

Apart from the standard variables mentioned above, our data-set also includes a new variable called 'correction term', which is the difference between the fitted values of a survey (BCS)-based regression targeting GDP growth and the actual realisation of GDP growth. Given the close statistical relationship between GDP growth and the survey data (BCS), whenever the term is positive (i.e. GDP growth is lower than suggested by surveys), it signals an increased likelihood that GDP growth in the next quarter will accelerate (and vice versa).<sup>10</sup>

## The models

### Intermediate models

Following the approach developed by Insee, our first attempt to model the GDP growth profile involves the estimation of a logit model using only survey variables as predictors. While the resulting model performs quite well on French data, the approach turns out to be rather ineffective at EA level, presumably because EA GDP growth is much smoother. As a consequence, the approach is broadened so as to allow the inclusion of other types of variables (hard and financial data). Although variables typically considered in GDP models

are included (IP, retail sales, etc.), the performance of the models is rather unsatisfactory, with the best logit model achieving a correct identification of ac-/decelerations of output in just 77% of cases.<sup>11</sup>

The results can be rationalised when considering that the individual ability of the input variables to correctly signal ac-/decelerations of GDP growth is less pronounced than the co-movement of their trend-cycle component with that of GDP growth, which is exploited in the usual models targeting GDP growth. After all, even a variable like IP in the manufacturing sector, whose merits for the forecast of GDP growth are well-documented, moves only in 68% of the quarters in the same direction as GDP growth.<sup>12</sup>

### Final models

Given the limited qualification of the available input variables for the purpose of forecasting the GDP profile, the new models presented in this section follow a novel strategy which is to focus mainly on interactions of variables, rather than a number of isolated predictors. The approach is motivated by the consideration that for GDP not just to grow, but to grow faster than in the previous quarter, a particular constellation, or 'momentum', is required. Our assumption is that a decisive difference between episodes of growth and of accelerating growth is that, in the latter, certain positive developments happen at the same time. Put differently, the joint effect of certain developments occurring simultaneously is supposed to be higher than the sum of the effects of the two developments occurring in isolation. Econometrically, the joint effect is captured by interaction terms, i.e. series which

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<sup>10</sup> The exact regression underlying the indicator-construction is  $growth(GDP)_t = ESI_t + \Delta ESI_t$ . As a robustness check, the indicator has also been derived from other survey variables than the Economic Sentiment Indicator (ESI). The resulting variables generally displayed a high degree of comovement with the initial correction term.

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<sup>11</sup> The detailed results are not reported due to space constraints, but can be shared upon request.

<sup>12</sup> This percentage was computed over the period 2010q1-2016q4 with IP values restricted to the first month of the reference quarter (as is realistic in the light of the significant time-lag of IP releases). Every quarterly value corresponds to the IP q-o-q growth resulting from the level of IP in month 1 of the reference quarter (assumed to stay constant over months 2 and 3) compared to the average level of IP in the previous quarter.

represent the product of two independent variables.

Besides allowing a better measurement of 'momentum', the use of interaction terms also helps to render certain variables with a mixed effect on GDP growth more meaningful. Rising inflation, for instance, might be a proxy of rallying demand (associated with strong GDP growth), but also of rising input prices (e.g. oil), associated with weaker demand and GDP growth. While the effect of inflation might thus not be significant in a regression targeting GDP growth, the interaction of inflation and oil prices could well be (notably negative).

The selection of models presented in Table 2.2 is the result of a bottom-up testing approach, in which variables were incrementally added to the model<sup>13</sup> and their marginal effect on the proportion of explained variance of the target variable (R-squared) monitored. The range of possible input variables was determined based on variables' correlation with the target variable (i.e. the GDP profile) and whether their inclusion in the model made sense from an economic point of view.

**Table 2.2**

	coeff
<b>Model 1 (2001q2 - 2016q3) - R<sup>2</sup> 0.62</b>	
constant	0.56 ***
ESI-based correction term $t_{-1}$	1.01 ***
dummy ( $\Delta$ industry selling price expectations $t_{-1} > 0$ ) *	0.06 ***
$\Delta$ industry past orders development $t$	0.07 ***
$\Delta$ services past business situation $t$ *	0.07 ***
$\Delta$ %-change money supply M2 $t_{-1}$	0.02 ***
construction confidence $t_{-1}$ *	0.02 ***
dummy ( $\Delta$ industry confidence $t_{-1} > 0$ )	0.06 ***
dummy ( $\Delta$ PMI construction $t > 0$ ) *	0.06 ***
$\Delta$ construction employment expectations $t_{-1}$	
<b>Model 2 (2001q2 - 2016q3) - R<sup>2</sup> 0.58</b>	
constant	0.32 ***
dummy (%-change money supply M1 $t > 0$ )	0.23 ***
$\Delta$ %-change manufacturing production $t$ *	0.20 ***
dummy ( $\Delta$ %-change raw material price index $t < 0$ )	0.83 ***
dummy ( $\Delta$ %-change raw material price index $t > 0$ ) *	0.12 ***
$\Delta$ Ifo world economic climate $t$	0.12 ***
dummy ( $\Delta$ consumers' expected major purchases $t > 0$ ) *	0.12 ***
$\Delta$ presence of above-average stocks in retail sector $t$	
<b>Model 3 (2001q2 - 2016q3) - R<sup>2</sup> 0.63</b>	
constant	0.34 ***
dummy (%-change money supply M1 $t > 0$ )	0.20 **
ESI-based correction term $t_{-1}$	0.43 ***
$\Delta$ %-change manufacturing production $t$ *	0.18 ***
dummy ( $\Delta$ %-change raw material price index $t < 0$ )	0.73 ***
dummy ( $\Delta$ %-change raw material price index $t > 0$ ) *	0.12 ***
$\Delta$ Ifo world economic climate $t$	0.12 ***
dummy ( $\Delta$ consumers' expected major purchases $t > 0$ ) *	0.12 ***
$\Delta$ presence of above-average stocks in retail sector $t$	
<b>Model 4 (2001q2 - 2016q3) - R<sup>2</sup> 0.66</b>	
constant	0.40 ***
ESI-based correction term $t_{-1}$	1.06 ***
dummy ( $\Delta$ %-change retail sales $t_{-1} > 0$ ) *	0.10 ***
$\Delta$ PMI Composite $t$	0.05 ***
%-change exports of goods out of EA $t_{-1}$ *	0.05 ***
dummy ( $\Delta$ %-change commodity price index excl. energy $t > 0$ )	0.08 ***
$\Delta$ %-change production of machinery and equipment $t$ *	0.08 ***
dummy ( $\Delta$ %-change commodity price index $t_{-1} > 0$ )	0.005 ***
$\Delta$ consumers' savings expectations $t$ *	0.005 ***
consumers' expected major purchases $t$	

*Note: Three asterisks indicate significance at the 1%-level, two asterisks at the 5%-level.*

<sup>13</sup> The models are estimated with standard ordinary least squares (OLS) since they contain one or several dummy explanatory variables. Furthermore, the estimation of the variance has been rendered heteroskedasticity-robust (using Newey-West estimators).

While it would go beyond the scope of this article to discuss every model in detail, a number of commonalities among them can be pointed out. (i) Three of the models include the Economic Sentiment Indicator (ESI)-based correction term, highlighting its ability to signal increases in GDP growth rates. (ii) All models include at least one variable from the industry sector, which is in line with the well-documented impact of IP on the variation of GDP growth. Furthermore, the role of retail trade and consumer sentiment seems to be prominent, with elements of both featuring in three of the models. That contrasts with the services and construction sectors, which are only included in Model 1. (iii) There are four types of interaction terms, which all seem helpful to capture 'momentum' for GDP growth to increase:

- first, interactions which combine developments in different sectors of the economy, such as the penultimate variable of Model 1, which considers the level of construction confidence when it coincides with an increase in industry confidence. The justification for that type of interaction is that it captures whether a given tendency in the economy (here: buoyant confidence in construction) is an isolated trend or a phenomenon observed across different sectors of the economy. When the latter applies, the chances for an acceleration in GDP growth are arguably significantly enhanced.
- second, interactions which relate sector-specific developments to variables impacting on the entire economy, such as the third variable of Model 2, which captures changes in manufacturing production growth only when they coincide with a deceleration of raw material prices. The rationale of such interactions is that positive developments in a given economic sector are more likely to result in an acceleration of GDP growth, when they happen in a growth-friendly overall context (e.g. an environment of low input prices, low interest rates, etc.).
- third, interactions which capture the simultaneous occurrence of certain external developments with a potentially stimulating effect on the economy under investigation. The penultimate variable of Model 2 is an example of that category, considering changes in world economic climate, whenever growth in raw material prices is accelerating. Taking account of changes in the price levels of raw materials helps distilling particularly pronounced and sustained upswings in world demand, rather than temporary/short ones.
- fourth, there are interactions which render variables with a potentially mixed effect on GDP growth meaningful. For instance, the last variable of Model 3 considers changes in retail trade stocks only when they occur in conjunction with higher expected demand. The interaction thus filters out situations in which retail trade stocks pile up because of a lack of demand and retains only incidents where stocks are accumulated in the expectation of higher demand.

Having established a good in-sample fit of the four models, we test their performance in a (pseudo) out-of sample exercise over a period stretching from the financial crisis to the current edge (2008q2 to 2016q4).<sup>14</sup> The predictions of the models are interpreted as signalling accelerations whenever they attach a probability larger 0.5 to an increase in GDP growth. The opposite applies to decelerations. Figures 2.1 to 2.4 summarise the results.

As the graphs show, all four models perform very well at predicting output ac-/decelerations: in almost all cases in which the difference in GDP growth (black line) is in positive territory, the blue bars (which

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<sup>14</sup> The starting point for the out-of sample exercise could not be chosen earlier, since the models can only be run from 2001q1/2001q2 onwards (due to limited data availability) and some 20 quarters of in-sample observations were deemed necessary to estimate meaningful coefficients.



represent the forecasts, expressed as deviations from 0.5) are positive, too. The opposite holds true when the GDP line turns negative. The few incorrect predictions are highlighted as red bars. Depending on the model, there are one (Model 1) to five (Model 2) of them. Considering the length of the out-of sample exercise (35 quarters), the models are thus correct in 97% to 86% of cases, which represents a big improvement in precision compared to deriving directional nowcasts from the models presented in the above sections.

The forecasting performance appears even more convincing, when taking a closer look at the wrong predictions (red bars) and the associated actual changes in GDP growth rates. As regards the former, in at least half of the cases where the models fail, this is because they are 'forced' to produce a clear-cut judgment (increase or decrease of GDP growth), although they actually cannot distil any clear signal from the data at all (i.e. the predicted values are close to 0.5). Against that backdrop, one might consider introducing a 'blind zone' for the interpretation of the models' predictions, i.e. a range of predicted probabilities, which are so close to 0.5 that forecasts falling into the interval are interpreted as signalling neither an ac- nor a deceleration of GDP growth. A visual inspection of the graphs suggests that the interval from 0.42 to 0.58 might be an appropriate 'blind zone', allowing to increase the percentage of correctly identified ac-/decelerations, while, at the same time, keeping the amount of quarters where the models fail to deliver forecasts reasonably limited. Indeed, when applying an 0.42-0.58 blind zone, Model 1 gets flawless, Model 3 produces a single, while Models 2/4 just two wrong predictions. At the same time, applying the 'blind zone' causes models to be unable to produce nowcasts in just 2 (Model 4) to 5 (Model 3) quarters and thus less than 15% of the observed period.

Turning to the actual differences in GDP growth rates observed in the quarters where our models produce wrong forecasts, several of those differences are very marginal and would probably be interpreted as signalling stable output, rather than ac- or decelerations of economic activity. When the models err in

those circumstances, one might argue that the mistake is less grave than usual, since the actual economic developments are not the exact opposite of the models' predictions. As evidenced by graphs 2.1 to 2.4, several of our models' errors can thus be relativized, notably wrong predictions in 2008q3 (by Model 3), 2011q3 (by Model 2) and 2016q4 (by Models 2 and 4).

Figure 2.1: Model 1

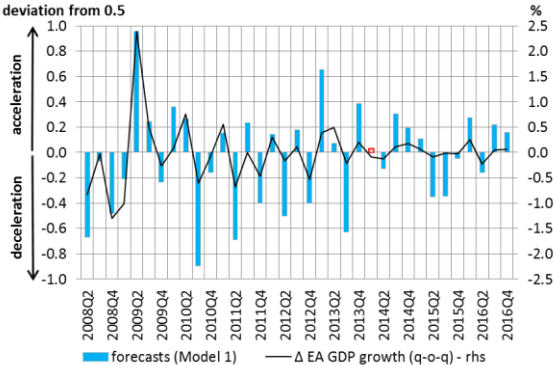


Figure 2.2: Model 2

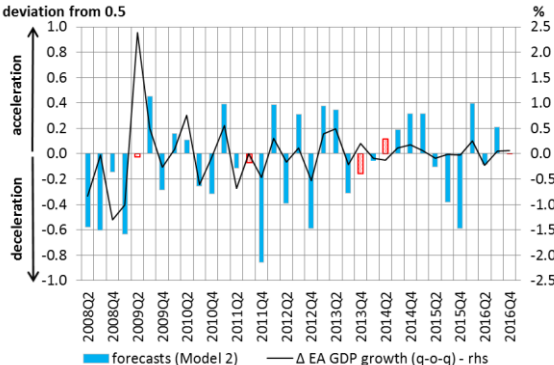


Figure 2.3: Model 3

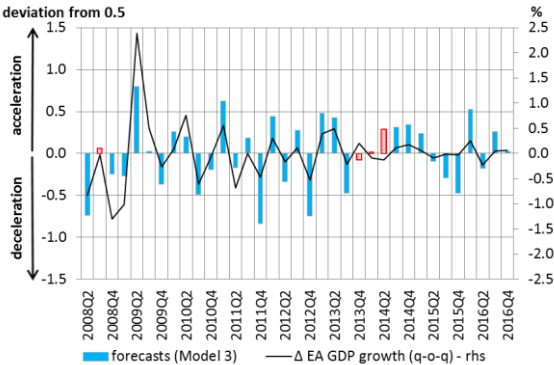
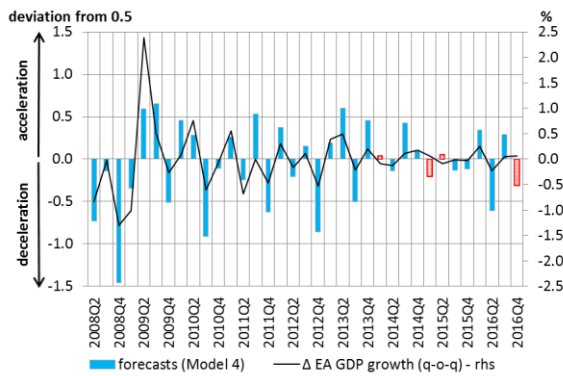


Figure 2.4: Model 4



*Note: The black lines represent the q-o-q differences in GDP growth, i.e. values above (below) 0 indicate accelerations (decelerations) of economic activity. Since the cut-off for the categorisation of the models' predictions into accelerations and decelerations of output is 0.5, the blue bars represent the predicted values minus 0.5.*

## Conclusions

Departing from the observation that correctly predicting the profile of GDP growth can, at times, be more important from an economic/policy point of view than getting a reasonable estimate of the actual growth rate, this special topic presents a number of new models explicitly tailored to forecast the profile of GDP growth. The models have in common that they rely to a large extent on interaction terms, i.e. variables measuring the effect of two developments happening at the same time (e.g. IP and retail sales rising simultaneously). It appears that those interaction terms do a good job capturing the 'momentum' that is required for GDP not just to grow, but to grow faster than in the preceding quarter.

In a pseudo out-of-sample exercise the new models are shown to provide rather reliable forecasts of the GDP profile, with the best model producing just a single and the worst a total of five wrong predictions over a sample of 35 quarters. The resulting 'hit ratios' of 97% to 86% are shown to be superior to the performance of alternative approaches, such as the derivation of the GDP profile from the point forecasts of conventional bridge models predicting GDP growth.

In addition to their merits for the forecast of in-/decreases in GDP growth, the new models also have the potential to enhance the quality of the point forecasts of GDP growth generated by

conventional bridge models. Concretely, when the latter indicate a growth rate whose error bands include the level of the previous quarter's growth rate, the forecasts from the new models could justify considering some part of the error bands irrelevant (namely the part which lies between last quarter's growth rate and the lower (upper) end of the error band, when the new models predict an acceleration (deceleration) of output). The combined reading of the two approaches can thus help reduce the uncertainty around the nowcasts.



## ANNEX

### Reference series

Confidence indicators	Reference series from Eurostat, via Ecwin (volume/year-on-year growth rates)
Total economy (ESI)	GDP, seasonally- and calendar-adjusted
Industry	Industrial production, working day-adjusted
Services	Gross value added for the private services sector, seasonally- and calendar-adjusted
Consumption	Household and NPISH final consumption expenditure, seasonally- and calendar-adjusted
Retail	Household and NPISH final consumption expenditure, seasonally- and calendar-adjusted
Building	Production index for building and civil engineering, trend-cycle component

### Economic Sentiment Indicator

The economic sentiment indicator (ESI) is a weighted average of the balances of replies to selected questions addressed to firms and consumers in five sectors covered by the EU Business and Consumer Surveys Programme. The sectors covered are industry (weight 40 %), services (30 %), consumers (20 %), retail (5 %) and construction (5 %).

Balances are constructed as the difference between the percentages of respondents giving positive and negative replies. EU and euro-area aggregates are calculated on the basis of the national results and seasonally adjusted. The ESI is scaled to a long-term mean of 100 and a standard deviation of 10. Thus, values above 100 indicate above-average economic sentiment and vice versa. Further details on the construction of the ESI can be found [here](#).

Long time series (ESI and confidence indices) are available [here](#).

### Economic Climate Tracer

The economic climate tracer is a two-stage procedure. The first stage consists of building economic climate indicators, based on principal component analyses of balance series (s.a.) from five surveys. The input series are as follows: industry: five of the monthly survey questions (employment and selling-price expectations are excluded); services: all five monthly questions; consumers: nine questions (price-related questions and the question about the current financial situation are excluded); retail: all five monthly questions; building: all four monthly questions. The economic climate indicator (ECI) is a weighted average of the five sector climate indicators. The sector weights are equal to those underlying the Economic Sentiment Indicator (ESI, see above).

In the second stage, all climate indicators are smoothed using the HP filter in order to eliminate short-term fluctuations of a period of less than 18 months. The smoothed series are then normalised (zero mean and unit standard deviation). The resulting series are plotted against their first differences. The four quadrants of the graph, corresponding to the four business cycle phases, are crossed in an anti-clockwise movement and can be described as: above average and increasing (top right, 'expansion'), above average but decreasing (top left, 'downswing'), below average and decreasing (bottom left, 'contraction') and below average but increasing (bottom right, 'upswing'). Cyclical peaks are positioned in the top centre of the graph and troughs in the bottom centre. In order to make the graphs more readable, two colours have been used for the tracer. The darker line shows developments in the current cycle, which in the EU and euro area roughly started in January 2008.







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