European Business Cycle Indicators

3rd Quarter 2018

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3rd Quarter 2018

Special topic

- Using fat survey data to nowcast euro area GDP growth

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Recent developments in survey indicators

- After losses in 2018-Q1 and a broad sideways movement in Q2, the euro-area (EA) and EU Economic Sentiment Indicators (ESI) posted moderate decreases of 0.9 (EU) and 1.4 (EA) points in the third quarter. In both cases, the losses were concentrated in the last (EU) / last two (EA) months of the quarter. At 111.3 (EU) and 110.9 (EA) points, both indicators remain nevertheless at historically elevated levels.

- EU- and EA-confidence decreased among industry managers and consumers, while confidence in retail trade and construction brightened, especially in the EA. Confidence in services remained broadly unchanged in both regions.

- Among the seven largest EU economies, 2018-Q3 brought significant losses in economic sentiment in Spain (-3.9) and France (-3.3), as well as more contained ones in Poland (-2.2) and Italy (-1.6). Sentiment in Germany (+0.6) and the Netherlands (-0.4) changed only little. The UK defied the trend, gaining 1.5 points on the quarter.

- Capacity utilisation in manufacturing decreased in both the EA and the EU by 0.2 percentage points (pp) compared to the last survey wave in April. Currently, capacity utilisation is at 84.1% (EA) and 83.8% (EU), i.e. markedly above the two regions' respective long-term averages of around 81%. Capacity utilisation in services saw a 0.4pp-increase in the EA and a 0.3pp-decrease in the EU. The current rates of 90.6% (EA) and 89.7% (EU) correspond to levels well above the series' long-term averages of around 88.7%.

## Special topic: Using fat survey data to nowcast euro area GDP growth

The special topic presents a new tool to nowcast euro area GDP growth, exploiting the wealth of data collected under the harmonised EU-wide business and consumer survey (BCS) program. The general idea is to summarise all the available BCS questions with partial least squares regression (PLS), as it is particularly well suited to extract information from many collinear variables. The 'fat data' set includes up to 2500 variables (including transformations such as quarter-on-quarter differences). The nowcasts are shown to improve slightly but significantly the accuracy of quarter-on-quarter euro-area GDP growth nowcasts in real time, compared to a benchmark model based on the Economic Sentiment Indicator (ESI). However, exploiting the fat data with the help of PLS does not seem to improve the prediction of the direction of changes in GDP growth (acceleration/deceleration). The model's current nowcast for GDP growth in 2018Q3 is 0.45%. The analysis of the composition of the PLS-nowcasts in terms of sectoral and country weights points to a continued dominant role of the industry sector for overall economic activity; country size does not seem to play a decisive role in the data selection, pointing to strong business cycle synchronisation across euro area countries.

1. RECENT DEVELOPMENTS IN SURVEY INDICATORS

1.1. EU and euro area

After losses in 2018-Q1 and a broad sideways movement in Q2, the euro-area (EA) and EU Economic Sentiment Indicators (ESI) posted moderate decreases of 0.9 (EU) and 1.4 (EA) points in the third quarter. In both cases, the losses were concentrated in the last (EU) / last two (EA) months of the quarter. At 111.3 (EU) and 110.9 (EA) points respectively, both indicators remain nevertheless at historically elevated levels.

Graph 1.1.1: Economic Sentiment Indicator
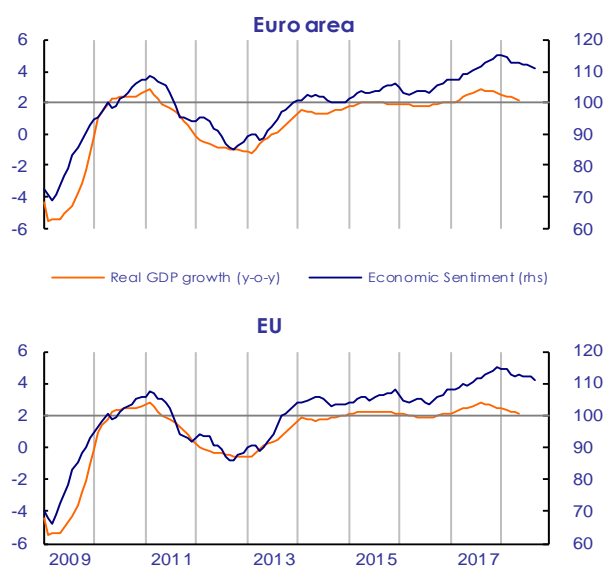
Note: The horizontal line (rhs) marks the long-term average of the survey indicators. Confidence indicators are expressed in balances of opinion and hard data in y-o-y changes. If necessary, monthly frequency is obtained by linear interpolation of quarterly data.

In line with the ESI results, Markit Economics' Composite PMI for the euro area booked decreases in Q3, which were, however, even milder than those of the ESI. Bucking the trend, the Ifo Business Climate Index (for Germany) gained some ground in Q3, after two quarters of fading confidence.

Graph 1.1.2: Radar Charts
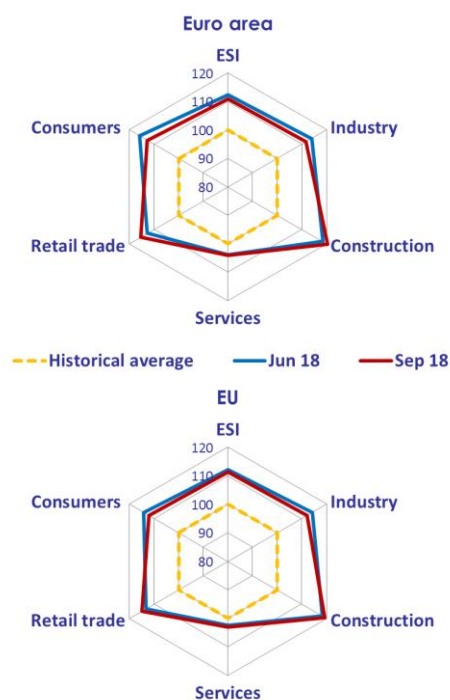
Note: A development away from the centre reflects an improvement of a given indicator. The ESI is computed with the following sector weights: industry 40%, services 30%, consumers 20%, construction 5%, retail trade 5%. Series are normalised to a mean of 100 and a standard deviation of 10. Historical averages are generally calculated from 1990q1. For more information on the radar charts see the Special Topic in the 2016q1 EBCI.

From a sectoral perspective, EU- and EA-confidence weakened among industry managers and consumers, while sentiment in retail trade and construction brightened somewhat, especially in the EA. Confidence in services remained broadly unchanged in both regions (see Graph 1.1.2).

In terms of levels, all EA and EU confidence indicators remain well above their respective long-term averages. In the case of construction confidence, the September readings correspond to the indicators' highest readings on record.

Focussing on the seven largest EU economies, 2018-Q3 brought significant losses in Spain (-3.9) and France (-3.3), as well as more contained ones in Poland (-2.2) and Italy (-1.6). Sentiment in Germany (+0.6) and the Netherlands (-0.4) changed only little. The UK

defied the trend, gaining 1.5 points on the quarter.

Sector developments

Following hefty losses in 2018-Q1 and some stabilisation in Q2, the third quarter was, again, characterised by weakening **industry confidence**. The respective EA and EU indicators lost 2.2 / 2.0 points on the quarter. Irrespective of their latest evolution, both indicators are still very high by historic standards, as illustrated in Graph 1.1.3.

**Graph 1.1.3: Industry Confidence indicator**
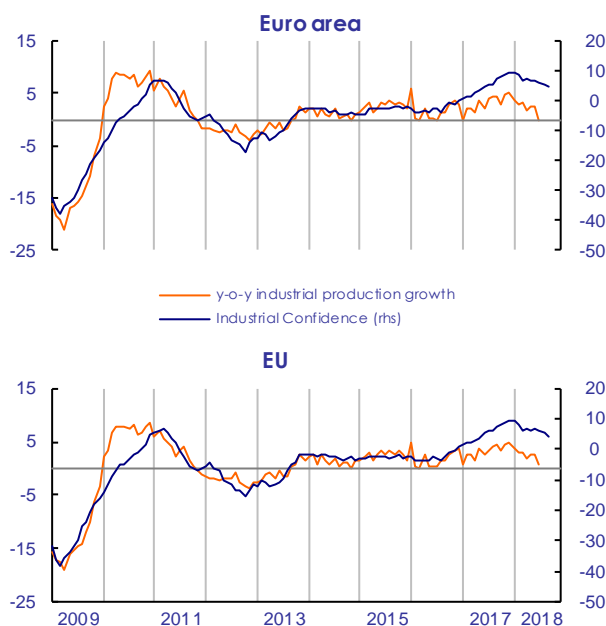
The drop in confidence resulted from negative developments in all components entering the indicator, i.e. managers' assessments of overall order books, the stocks of finished products and their production expectations.

Of the components not included in the confidence indicator, both managers' appraisals of export order books, as well as past production worsened. The latter is worth highlighting, as it constitutes the third significant, quarterly decline in a row (no concept has seen worse assessments in 2018 than past production).

During 2018-Q3, selling price expectations picked up in both the EA and the EU, while managers' employment expectations clouded over. In combination with their decline in Q1,

the latest figures on employment expectations mean that about a third of their upswing over 2016 and 2017 has been reversed by now (see Graph 1.1.4).

**Graph 1.1.4: Employment - Industry Confidence indicator**
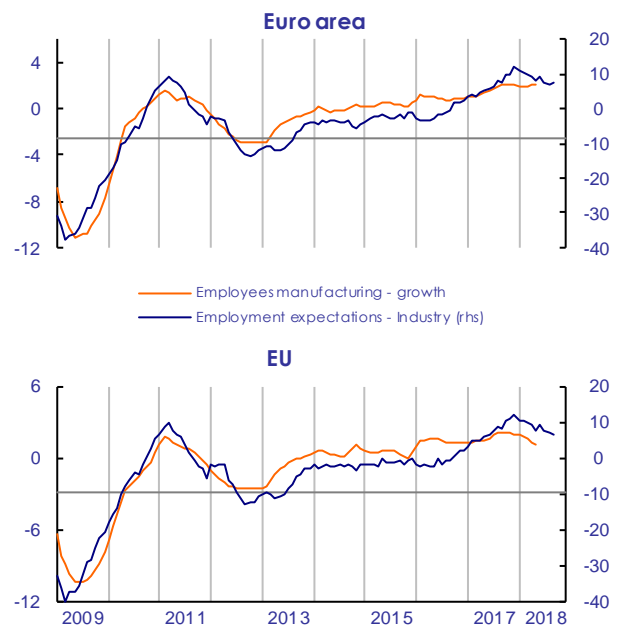
Among the seven largest EU Member States, industry confidence plummeted in France (-5.5) and saw more contained decreases in Poland (-2.7), Spain (-2.5), Germany (-2.2) and the Netherlands (-1.5). Developments in Italy (-0.9) and the UK (-0.5) were broadly flat.

According to the quarterly manufacturing survey (carried out in July), **capacity utilisation in manufacturing** decreased in both the EA and the EU by 0.2 percentage points (pp) compared to the last survey wave in April. Currently, capacity utilisation is at 84.1% (EA) and 83.8% (EU), i.e. markedly above the two regions' respective long-term averages of around 81%.

Following two quarters of weakening sentiment, confidence in the **services sector** stabilised in 2018-Q3 (+0.8 in the EU; +0.2 in the EA). Both indicators stayed comfortably above their respective long-term averages (see Graph 1.1.5).

Graph 1.1.5: Services Confidence indicator

Euro area

Services value added growth — Service Confidence (rhs)

EU
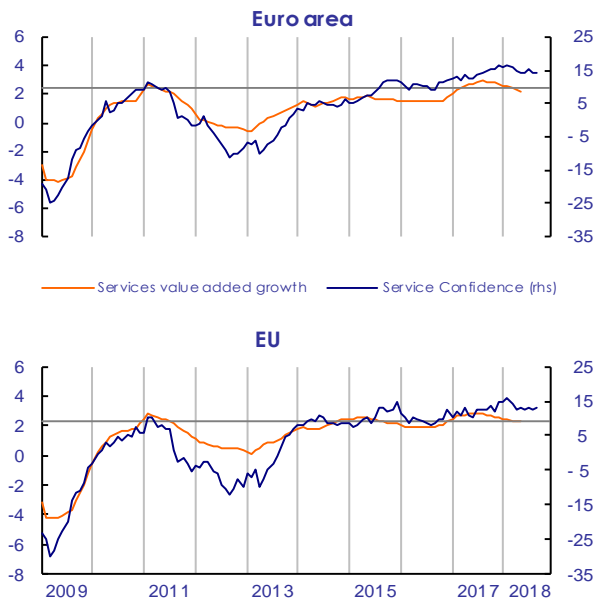
Graph 1.1.6: Employment - Services Confidence indicator

Euro area

Employees services - growth
Employment expectations - Service (rhs)

EU
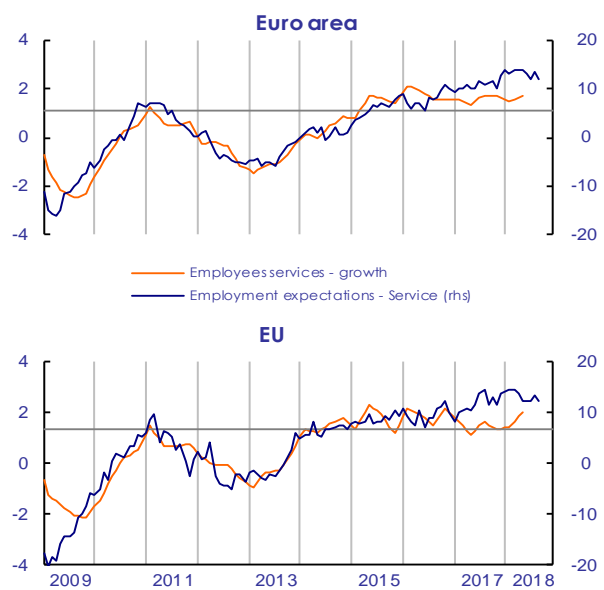
In both regions, the stabilisation resulted from managers' upbeat demand expectations being counterbalanced by broadly unchanged views on past demand and stable (EU) / mildly deteriorated (EA) assessments of the past business situation.

Employment expectations deteriorated mildly among services managers in the EA, while they remained stable in the EU. They thus confirm Q2's tentative signs of the broad, two-year upswing in employment expectations having faltered (see Graph 1.1.6). Meanwhile, EU/EA selling price expectations continued the sideways movement which had already characterised the first two quarters of the year.

Focussing on the seven largest EU economies, services confidence powered ahead in Germany (+5.8) and the UK (+4.0), while it plummeted in Spain (-4.3) and posted (more moderate) decreases in Italy (-2.4), France (-1.4) and Poland (-1.1). Sentiment in the Netherlands (-0.6) stayed broadly inert.

Capacity utilisation in services, as measured by the quarterly survey in July, saw a 0.4pp-increase in the EA and a 0.3pp-decrease in the EU. The current rates of 90.6% (EA) and 89.7% (EU) correspond to levels well above the series' long-term averages (calculated from 2011 onwards) of around 88.7%.

Retail trade confidence improved in 2018-Q3 by 2.0 (EA) and 1.2 (EU) points respectively. In a broader context, those developments mean a continuation of the indicators' see-sawing around a historically high, horizontal trend, which has characterised their evolution since late 2016/early 2017 (see Graph 1.1.7).

Graph 1.1.7: Retail Trade Confidence indicator

Euro area

Consumption growth — Retail Confidence (rhs)

EU
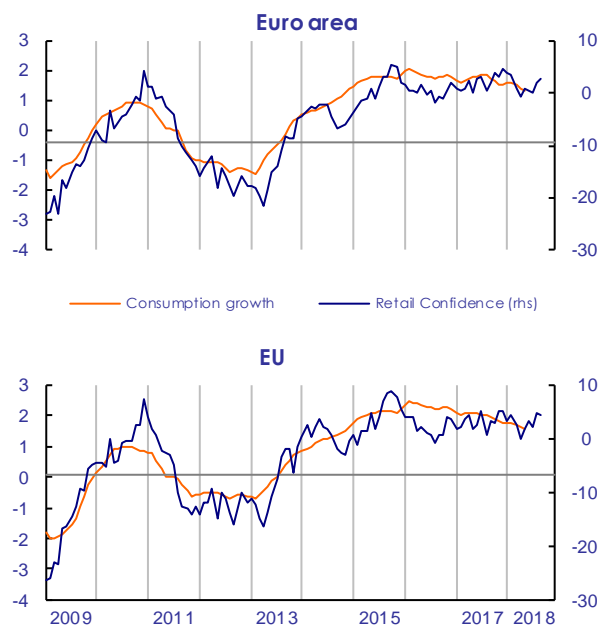
In both areas, the uptick was driven by more benign views on the past business situation and, in the EA, moderately improved assessments of the level of stocks. Managers' expectations in respect of the future business situation stayed

virtually unchanged, the same holding true for the appraisal of stocks in the EU.

At the level of the seven largest EU economies, confidence firmed in Germany (+3.7), the Netherlands (+3.2) and France (+2.5), while drops were posted in the UK (-2.6) and Spain (-2.2). Developments in Italy (-0.1) and Poland (+0.7) were practically flat.

2018-Q3 saw **construction confidence** continue the broad recovery it had embarked upon in 2014 (see Graph 1.1.8). The indicator increased in the EU (+1.1) and, more so, the EA (+2.7) on the back of better (EU) / much better (EA) assessments of firms' order books. Employment expectations improved only moderately (EA) or stayed virtually unchanged (EU).

**Graph 1.1.8: Construction Confidence indicator**
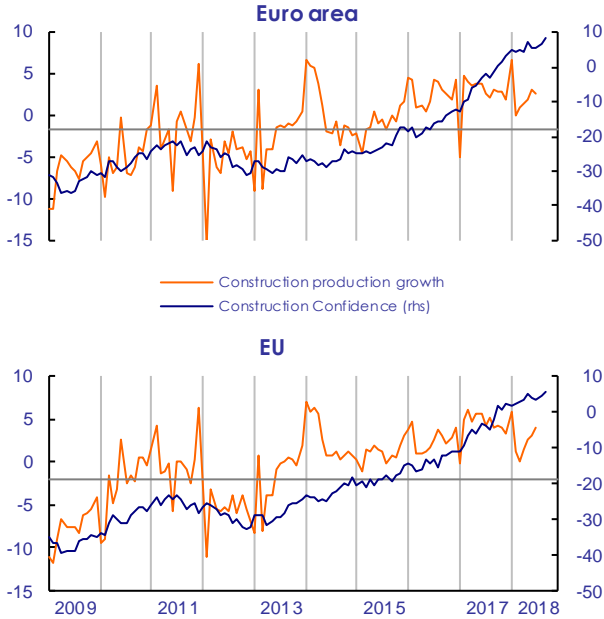
Five of the seven largest EU economies posted brighter sentiment in construction, notably Spain (+3.9), the Netherlands (+3.7), Germany (+3.0), France (+2.9) and Italy (+1.6), while signals emerging from Poland (-1.0) and the UK (-3.1) were more downbeat.

2018-Q3 brought the second consecutive decrease of **consumer confidence** (-1.5 in the EU; -2.3 in the EA). Both indicators are now a clear notch below their 17-year high of January 2018, but still at exceptionally high levels by historic standards (see Graph 1.1.9).

The driving force behind the deterioration in sentiment was consumers' markedly worsened unemployment expectations and, to a much lesser extent, more pessimistic views on the general economic situation in their respective countries. Consumers' expectations regarding their future savings, by contrast, were moderately up (EU) or flat (EA), the latter also holding true for EU and EA consumers' guesses about their future personal financial situation.

**Graph 1.1.9: Consumer Confidence indicator**
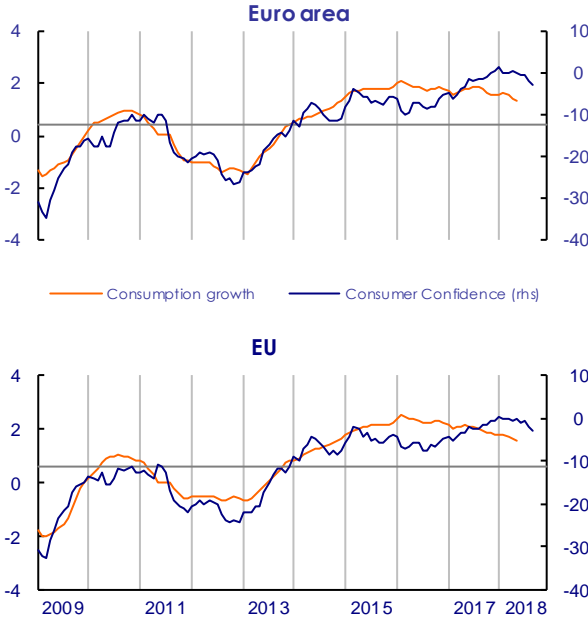
Five of the seven largest EU economies posted declining consumer confidence, notably Spain, where sentiment plunged (-9.8), France (-3.9), Italy (-2.9), Poland (-2.4) and the Netherlands (-1.7). Confidence in Germany stayed broadly unchanged (-0.1), while UK consumers were somewhat more upbeat (+1.2).

Confidence in the **financial services** sector (not included in the ESI) took a dive in 2018-Q3, with the EA indicator losing 6.3 and its EU-peer 4.8 points on the quarter. The drops brought both indicators down to their respective long term averages (see Graph 1.1.10).

In both regions, the downbeat signals resulted from significant deteriorations of managers' appraisals of past demand, as well as their demand expectations, which contrasted with broadly unchanged views on the past business situation.

**Graph 1.1.10: Financial Services Confidence indicator**

Euro area

Financial Services Confidence

EU
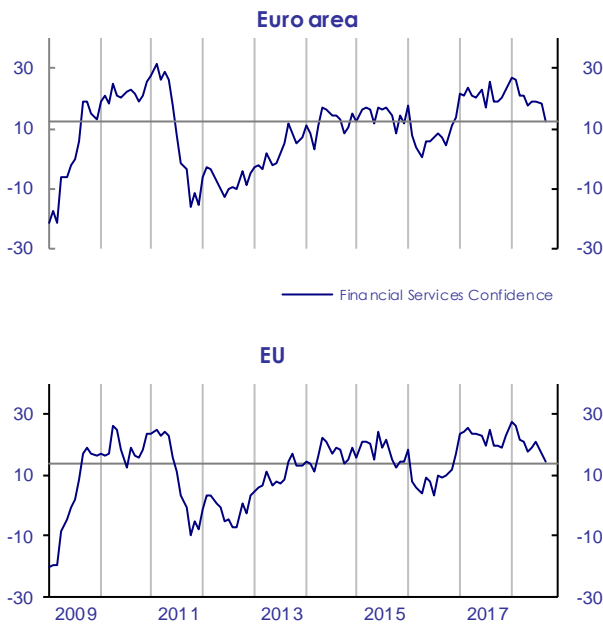
the expansion quadrant, while its EU-peer remained inert in the expansion area.

Graph 1.1.12: EU Climate Tracer
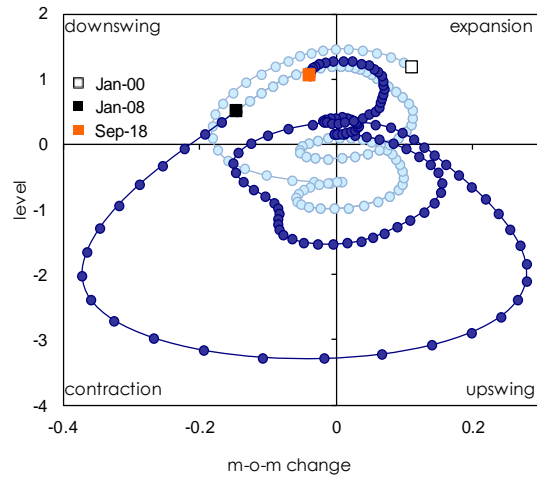
Reflecting the moderate deterioration in overall sentiment in 2018-Q3, both the EA and EU **climate tracers** (see Annex for details) inched slightly deeper into the downswing quadrant (see Graphs 1.1.11 and 1.1.12).

Graph 1.1.11: Euro area Climate Tracer
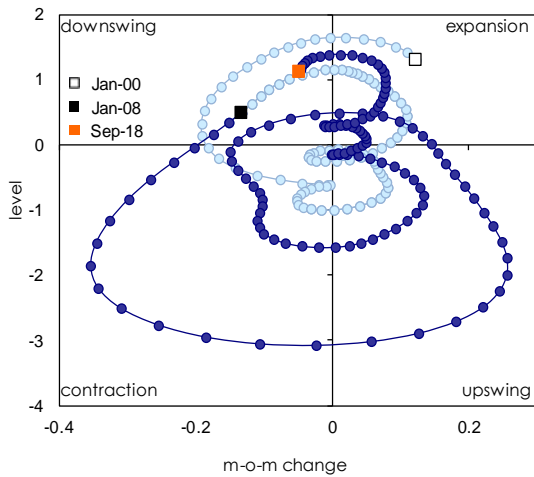
The sectoral climate tracers (see Graph 1.1.13) are mostly in line with the overall tracers in so far as they either moved deeper into the downswing quadrant (EU/EA industry), or, from the intersection between the expansion and downswing area, firmly into the latter (EU/EA services and consumers). The EU/EA construction tracer, although continuing to signal expansion, approximated the downswing quadrant. Against the trend in the other sectors, the EA retail trade tracer moved closer towards

Graph 1.1.13: Economic climate tracers across sectors

Euro area

EU

Industry

Services

Retail trade

Construction

Consumers
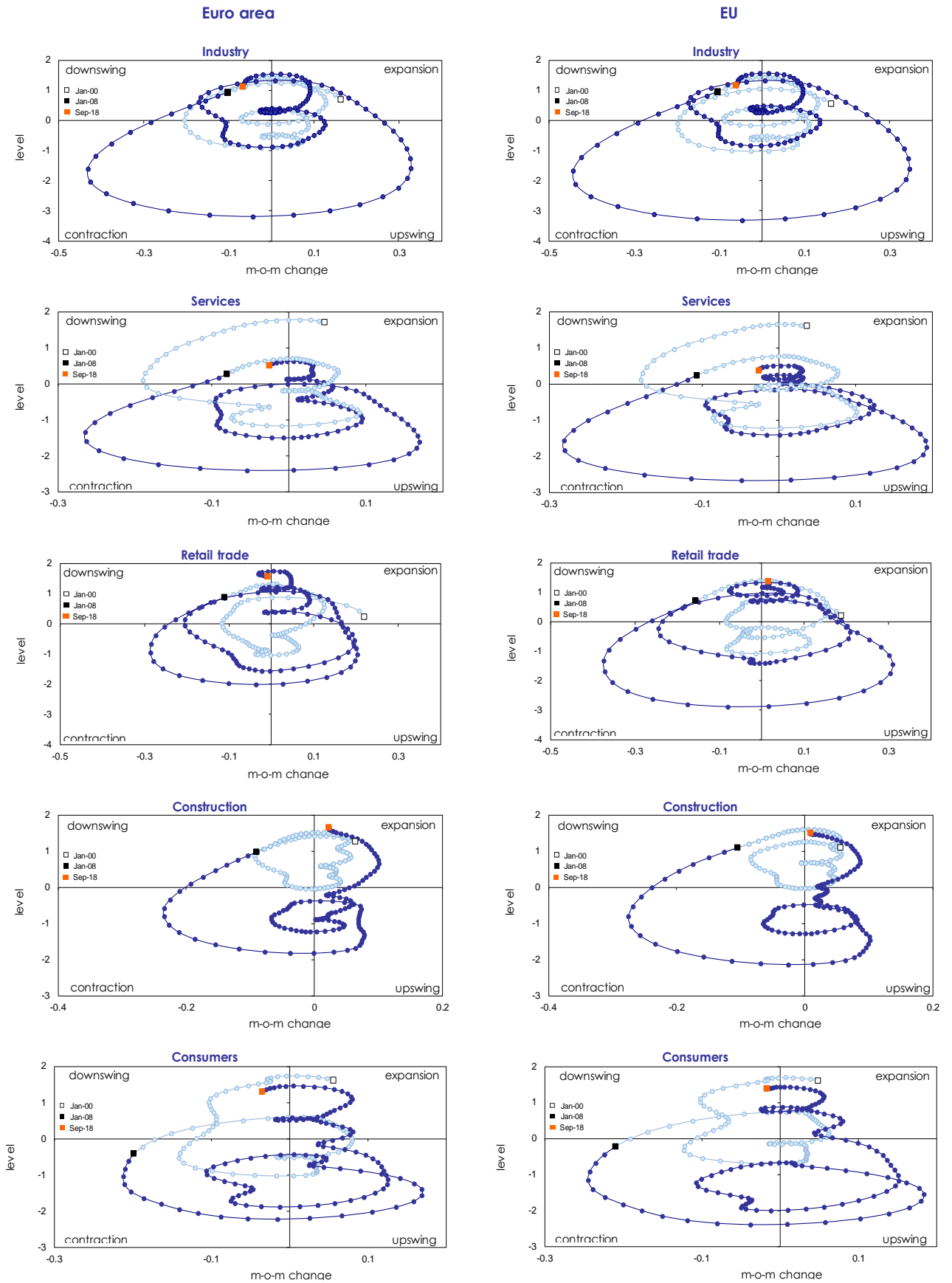
1.2. Selected Member States

2018-Q3 brought significant losses in economic sentiment in Spain (-3.9) and France (-3.3), as well as more contained ones in Poland (-2.2) and Italy (-1.6). Sentiment in Germany (+0.6) and the Netherlands (-0.4) remained virtually unchanged. The UK defied the trend, gaining 1.5 points on the quarter.

Sentiment in **Germany** stayed virtually unchanged in 2018-Q3 (+0.6 points), continuing the sideways movement which had already characterised Q2. At 112.5 points, the indicator remained very comfortably above its long-term average of 100. In terms of the climate tracer (see Graph 1.2.1), the German economy remained in the downswing quadrant, notably its upper right corner, which is still relatively close to the expansion area it had left at the beginning of Q2.

Graph 1.2.1: Economic Sentiment Indicator and Climate Tracer for Germany
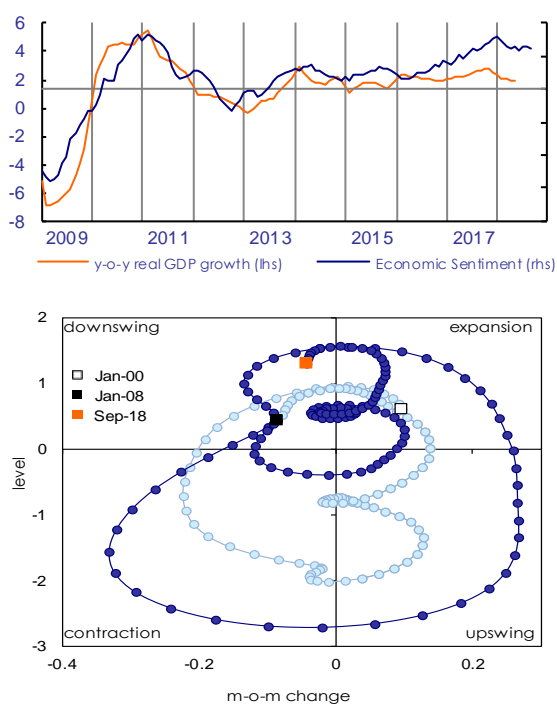
From a sectoral perspective, confidence improved in 2018-Q3 in services, retail trade and the construction sector. Industry confidence, by contrast, weakened, while consumer morale remained broadly unchanged.

In line with the ESI, all sectoral confidence indicators, except for the one covering services, are at levels well in excess of their respective historical averages (see Graph 1.2.2). The level of confidence is particularly high in the German construction sector.

Graph 1.2.2: Radar Chart for Germany
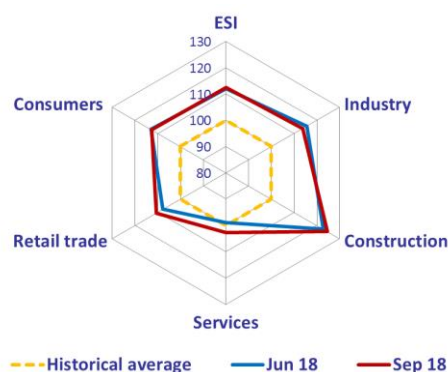
Sentiment in **France** took a hit in 2018-Q3 (-3.3 points). In combination with the significant losses of Q1, the indicator has followed a broad downward trend throughout the year. At 106.3 points, the current level of the ESI is nevertheless still high by historic standards (long-term average of 100).

Graph 1.2.3: Economic Sentiment Indicator and Climate Tracer for France

13
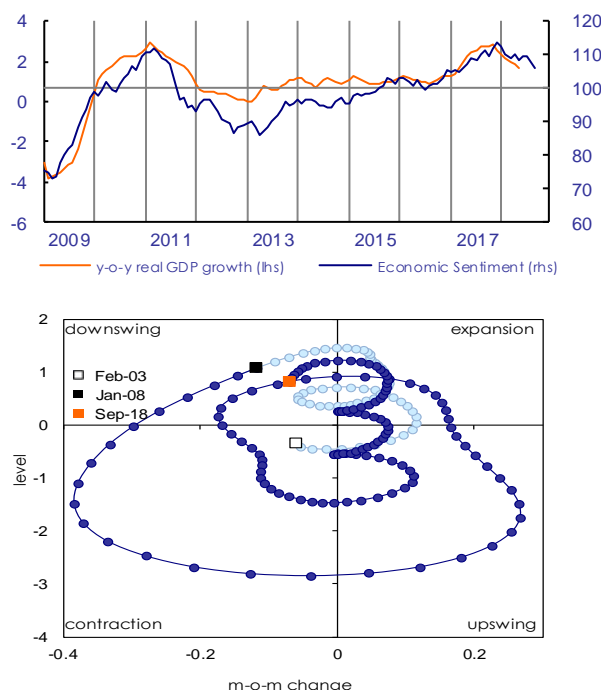
Weaker sentiment in Q3 also left its mark on the French climate tracer, which moved deeper into the downswing quadrant (see Graph 1.2.3).

A look at the French radar chart (see Graph 1.2.4) reveals downbeat sentiment to be caused by significant drops in confidence among industry managers and consumers. Service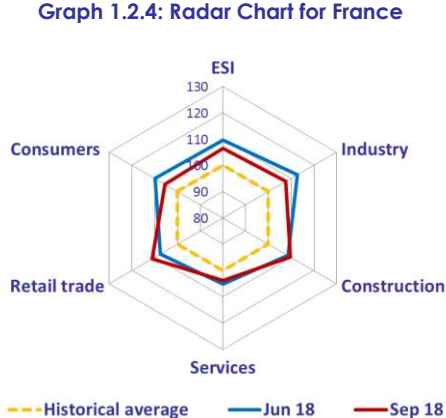s confidence ebbed to a lesser extent. Bucking the trend, construction and retail trade confidence firmed in Q3. In terms of levels, sentiment continued to exceed its long-term average in all surveyed parts of the economy.

Graph 1.2.4: Radar Chart for France

The **Italian** ESI eased moderately in 2018-Q3 (-1.6 points), continuing the mild downward-trend observed throughout the year. At 108.0 points, it sits still comfortably above its long-term average of 100 though. The deterioration in sentiment sent the Italian climate tracer deeper into the downswing quadrant (see Graph 1.2.5).

Graph 1.2.5: Economic Sentiment Indicator and Climate Tracer for Italy
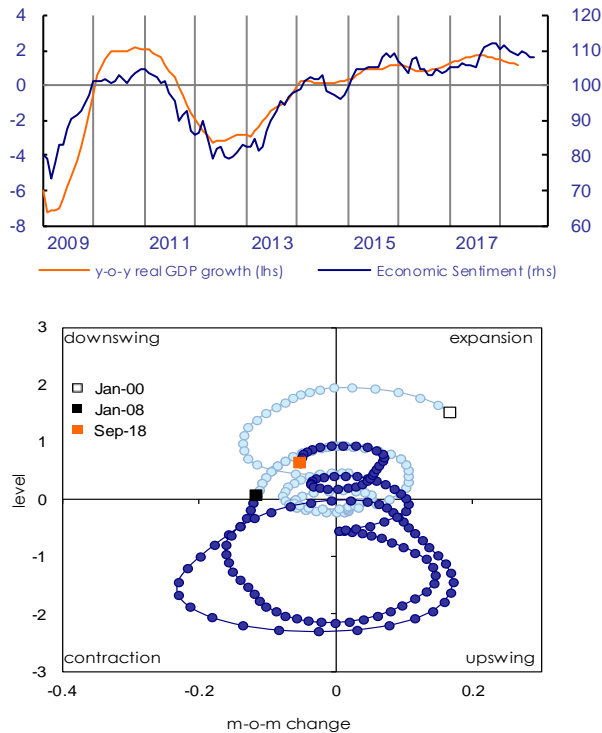
A look at the Italian radar chart (see Graph 1.2.6) shows confidence to have eased in the services sector and, particularly, among consumers, while industry, construction and retail trade held up well. Irrespective of their most recent evolution, all sectoral indicators continued scoring high compared to their respective historical averages.

Graph 1.2.6: Radar Chart for Italy
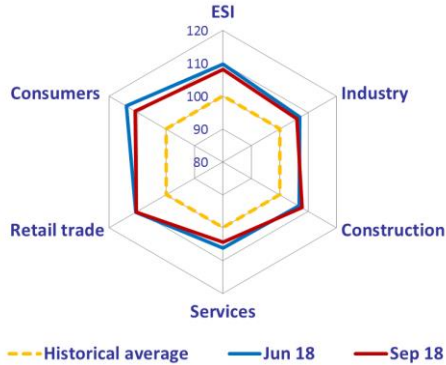
Spanish sentiment took a dive in 2018-Q3 (-3.9 points), putting an end to three quarters of broadly flat readings. Coming in at 105.5 points, the ESI stayed comfortably above its long-term average of 100 though. Paralleling the ESI's slide, the Spanish climate tracer entered the downswing quadrant (see Graph

1.2.7), after it had remained on the intersection between the expansion and downswing area for two quarters.

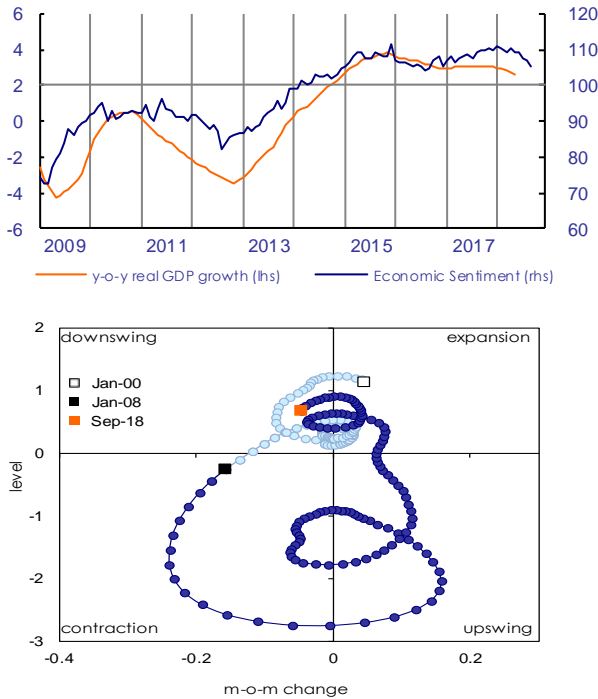**Graph 1.2.7: Economic Sentiment Indicator and Climate Tracer for Spain**

As highlighted in the radar-chart (see Graph 1.2.8), the drop in overall sentiment was mainly caused by plummeting confidence among consumers, but also supported by withering sentiment in industry, services and retail trade. Construction confidence stood out with the eighth quarterly increase in a row. Despite their recent evolution, all confidence indicators remained clearly above their respective long-term averages.

Graph 1.2.8: Radar Chart for Spain
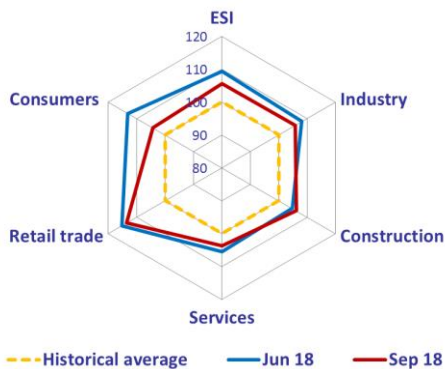
Following a significant deterioration in the second quarter, **Dutch** sentiment stayed

virtually unchanged (-0.4 points) throughout 2018-Q3. Sitting at 109.5 points, the indicator remains exceptionally high by historic standards (long-term average of 100). The slight deterioration in sentiment has nudged the climate tracer from its former position on the expansion/downswing frontier into the downswing quadrant (see Graph 1.2.9).

Graph 1.2.9: Economic Sentiment Indicator and Climate Tracer for the Netherlands
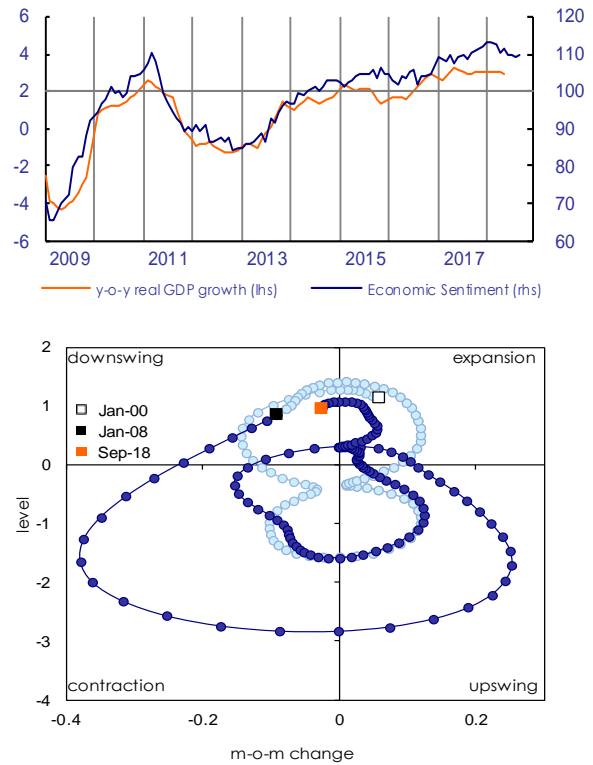
The Dutch radar chart (see Graph 1.2.10) shows confidence having eased in industry and among consumers. Construction and retail trade, by contrast, gained some ground, while sentiment in the services sector remained virtually unchanged. In terms of levels, confidence in all sectors is quite high by historic standards, with the exception of retail trade whose current confidence score corresponds roughly to the indicator's long-term average.

Graph 1.2.10: Radar Chart for the Netherlands

- - - Historical average   —— Jun 18   —— Sep 18
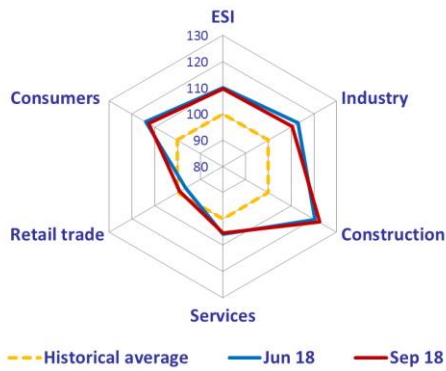
2018-Q3 saw sentiment in the **United Kingdom** moderately improve for the second quarter in a row (+1.5 points). Taken together, the upticks in Q2 and Q3 have compensated for about half of the hefty decline in Q1. At 108.4 points, the indicator remains above its long-term average of 100. In terms of the UK climate tracer, the confidence gains have translated into a rightward movement, bringing the tracer, which still signals economic downswing, closer to the upswing quadrant (see Graph 1.2.11).

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

—— y-o-y real GDP growth (lhs)   —— Economic Sentiment (rhs)
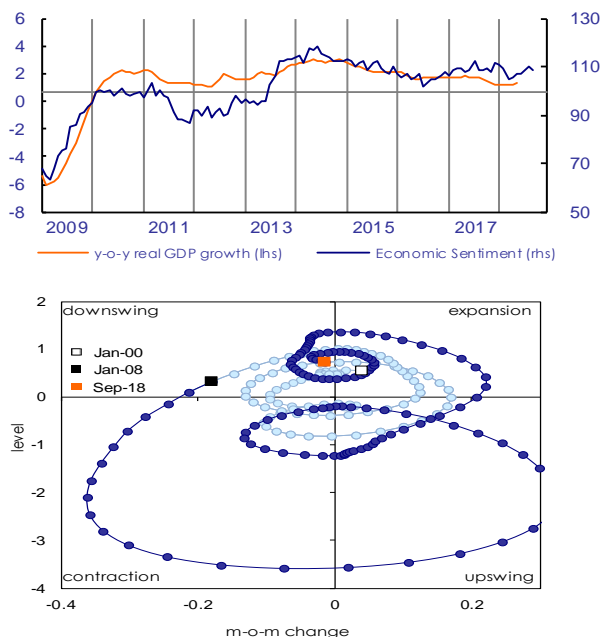
Focussing on sectoral developments (see Graph 1.2.12), confidence improved in services and, to a lesser extent, among consumers. Sentiment in retail trade and construction, by contrast, clouded over, while it stayed virtually unchanged among industry managers. Compared to historic long-term averages, the current level of confidence in industry and

construction is exceptionally high, contrasting with only moderately elevated levels in retail trade and among consumers, as well as a perfectly average score for the services sector.

Graph 1.2.12: Radar Chart for the UK

- - - Historical average   —— Jun 18   —— Sep 18
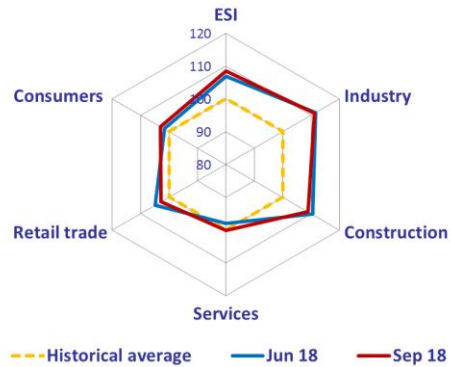
The **Polish** ESI deteriorated by 2.2 points in 2018-Q3. At 107.7 points, the indicator has remained significantly above its long-term average of 100 though. The slip in sentiment caused the climate tracer to move from the upswing to the rightmost part of the downswing quadrant (see Graph 1.2.13).

Graph 1.2.13: Economic Sentiment Indicator and Climate Tracer for Poland

—— y-o-y real GDP growth (lhs)   —— Economic Sentiment (rhs)
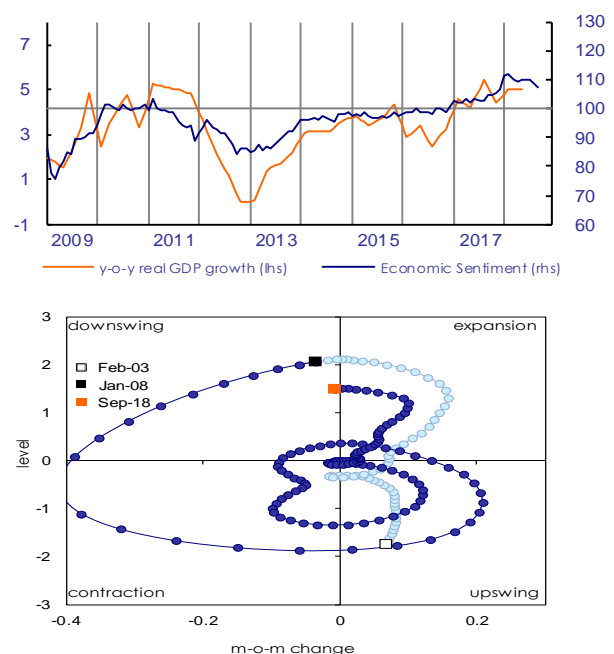
As the Polish radar chart shows (see Graph 1.2.14), confidence weakened significantly in industry and among consumers, while in the other surveyed sectors (services, retail trade and construction) it held up comparatively well. All

the indicators remained above their respective long-term averages.

Graph 1.2.14: Radar Chart for Poland

- - - Historical average   —— Jun 18   —— Sep 18
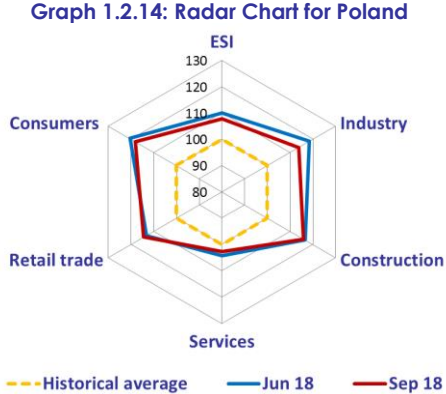
2. SPECIAL TOPIC: USING FAT SURVEY DATA TO NOWCAST EURO AREA GDP GROWTH

Introduction

This special topic presents a new tool to nowcast euro area GDP growth, exploiting the wealth of data collected under the European Commission's harmonised EU-wide business and consumer survey (BCS) program.

While the BCS headline indicator for the euro area, the Economic Sentiment Indicator (ESI), is computed from 15 survey questions, the presented nowcast is based on a much richer dataset, including all 35 monthly survey questions from the BCS program for the 19 countries in the euro area. Taking into account various transformations of the balance series, the dataset includes close to 1700 variables. Taking on board 13 additional quarterly survey series, this increases further to 2500. According to the terminology in Doornik and Hendry (2015), this qualifies as 'fat data', as there are many more variables than observations.

As a consequence, one needs to use some dimensionality reduction technique to use this rich dataset. To this end, factor models based on principal component analysis are widely used, as in Stock and Watson (2002). Contrary to ad hoc variable selection, these models can then be used to design data-driven composite indicators, as e.g. in Gayer et al. (2016).

However, principal component analysis (PCA) has the drawback that it depends closely on the variable selection process. For instance, let us imagine a dataset containing one very good predictor of GDP (e.g. industrial production), and 50 low quality predictors of GDP but all of them being closely correlated with each other (for instance, industrial producer prices in 50 NACE2 divisions). PCA would in this case compute the first factors on the low quality predictors, discarding the information in the 'good' GDP predictor. Similarly, if applied to the data included in the BCS program, PCA would in principle be guided by the number of survey questions per sector, instead of the share of the individual sectors in the economy. This shows that PCA has to be associated with (or steered by) a thorough variable selection in order to deliver. This is often done arbitrarily, usually implying a selection based on past correlation performance of the candidate indicators. If correlation patterns change over time (which is generally the case), the composition and weighting scheme underlying the indicator is changing constantly, implying regular revisions of past data.[1]

As an alternative to PCA, partial least squares regression (PLS) has the advantage of taking into account the target variable (here GDP), making the thorough preselection of variables unnecessary. PLS has already been used by Gelper and Croux (2010) to nowcast euro-area GDP growth. However the authors restrict their dataset to the very limited number of questions entering the ESI. Nevertheless, they show that their PLS based indicator outperforms the ESI (and a PCA-based alternative indicator) in terms of comovement with economic activity, but does not really improve forecast accuracy. Clearly, also PLS suffers from the slight practical drawback that it leads to backward revisions each time it is run on an updated data set.

Data

The data is taken from the harmonised EU-wide BCS program.[2] It includes four business sectors (industry, services, construction and retail trade) and sentiment among consumers.

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[1] In order to reduce arbitrariness in the variable selection process and the frequency and timing of indicator revisions, Abberger et al. (2018) suggest a rule-based procedure that would be run once a year.

[2] Data is downloadable at https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys_en

The ESI is designed to summarise developments in all five surveyed sectors, in total using 15 of the monthly surveyed questions for the euro area with fixed weights.[3] However, the BCS program provides a much richer dataset, as it includes 35 monthly questions per country. With 19 countries in the euro-area, this adds up to 665 variables. In addition, two transformations are included: quarter-on-quarter differences and squared values (the balance series multiplied by the absolute value of the series, to keep the sign intact), the latter in order to account for possible non-linearities between GDP growth and sentiment levels. This results in a total theoretical dataset of close to 2000 variables. Moreover, all quarterly questions available since 1998 are included on top of that. This includes quarterly questions from the industry, building and consumer surveys, while those from the services survey only start in 2001. This could result in a theoretical additional dataset of more than 1000 quarterly variables. In practice, the analysed sample starts in 1998 in order to maximise the number of questions included in the dataset, as the services survey is missing in many countries before this date. Due to (temporarily) missing values for some questions in some countries, around 1700 monthly variables and 800 quarterly are kept, for a total dataset of around 2500 variables.

As regards the target variable to be nowcast, real time GDP data is downloaded from the OECD website, including monthly vintages from 2011 to 2018.

Partial least squares methodology

PLS is a regression method suited for datasets with more variables than observations, or with collinearities. This applies particularly well to the aforementioned BCS dataset. Similarly to principal components analysis, PLS computes latent factors, but contrary to PCA, the target variable is taken into account to compute the factors.[4] In the PLS case, the factors are derived such that the covariance between them and the target variable is maximised. Once the latent factors are computed, ordinary least square regression is used to nowcast ('project') GDP growth using the factors. Two factors were found to be sufficient for the estimation.

(1) $F_1 = W_1 X$ and $F_2 = W_2 X$
(2) $qoq(GDP) = \alpha + \beta_1 F_1 + \beta_2 F_2 + \varepsilon$,

where F_1 and F_2 are the two factors, W_1 and W_2 the weights associated to the factors and X is the full BCS dataset.

Note that, unlike the ESI, which is a dimensionless indicator scaled arbitrarily to a mean of 100 and a standard deviation of 10, the outcome of the PLS method is directly a projection of quarter-on-quarter GDP growth.

Nowcasting performance

This section presents the real-time nowcasting performance of standard PLS regression based on the full 'fat' BCS dataset, compared to a benchmark model using the ESI, i.e. a significantly more limited information set. The assessment is carried out in real-time, using data vintages from 2011 to 2017. Unlike the PLS-based indicators, the ESI is not directly a projection of GDP growth. The benchmark model to nowcast GDP growth using the ESI is simple and widely used: it includes the level of the ESI and its first difference.[5]

$$qoq(GDP)_t = \alpha_0 + \alpha_1 ESI_t + \alpha_2 \Delta ESI_t + \eta_t$$

The nowcasts are performed at the end of the 3rd month of each quarter, based on quarterly averages of the monthly survey series and all quarterly questions. Table 1 shows the real-time nowcasting performance of the two models with regard to revised GDP, as of July 2018. The

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[3] Three questions from the industry, services and retail trade surveys, respectively, four questions from the consumer survey and two from the construction survey. See the User Guide to the BCS Programme for details:
https://ec.europa.eu/info/files/user-guide-joint-harmonised-eu-programme-business-and-consumer-surveys_en

[4] Note that this requires the survey input data set to be transformed into quarterly frequency, e.g. by taking the average of the available monthly observations as the quarterly observation.

[5] This model has been used for instance in Gayer and Marc (2018), Rioust De Largentaye and Roucher (2015) or European Commission (2011).

RMSE between 2011Q1 and 2017Q4 for a standard OLS model based on the ESI is 0.26, while it goes down to 0.22 for the PLS-based model exploiting the fat BCS data set.[6] The improvement compared to the benchmark ESI model is significant (at the 5% threshold) according to the Diebold-Mariano test. However, PLS does not seem to improve significantly the frequency of comovements with GDP (i.e. the correct prediction of directional change in GDP growth).

**Table 1: Performance with regard to revised GDP as of July 2018 (3rd month)**

	Benchmark (ESI)	PLS
RMSE	0.26	0.22
Diebold-Mariano p-value	*Ref.*	0.016
Comovements	71.4%	75.0%

Notes: estimation sample starts in 1998Q2. Real-time out of sample performance between 2011Q1 and 2017Q4, nowcasted at the end of the 3rd month of the quarter.

Graph 1 shows the real-time nowcasts derived from the two models, compared to actual quarter-on-quarter euro-area GDP growth. The graph illustrates that the nowcasts based on the standard PLS regression were closer to the GDP outcomes around 2015/16 and, more notably, throughout 2017.

Based on BCS data up to and including September 2018, the PLS model's current nowcast for GDP growth in 2018Q3 is 0.45% (qoq).

Graph 1: Out of sample nowcasts and actual q-o-q GDP growth in the euro area
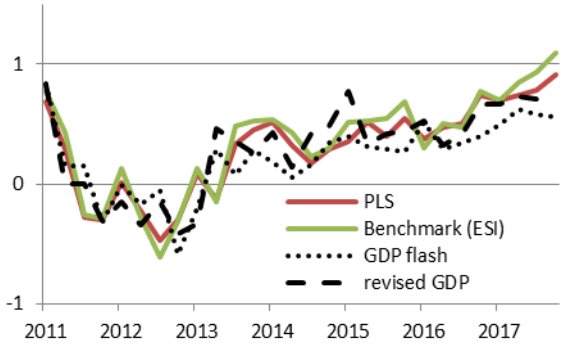
The results presented above are based on quarterly averages, and therefore require information for all three months of the quarter, which is only available at the end of the quarter. But given the high demand for early nowcasts including all available information, it would be desirable to produce monthly nowcasts, as early as at the end of the first month of the quarter. To this end, in the PLS projections the quarterly averages of survey data for the current quarter need to be replaced with partial information, namely the average of the available monthly values.[7]

Tables 2 and 3 show the real-time nowcasting performance of the models with regard to revised GDP, like Table 1, except that the nowcasts are conducted at the end of the first and second month of the quarter, respectively. In both cases, results are very close to that presented in table 1. For both models, nowcasts are already very accurate at the end of the first month of the quarter and RMSEs remain virtually stable over the course of the quarter. The PLS-based model exploiting the fat BCS data set shows a significant improvement compared to the benchmark ESI model (at the 10% significance level at the end of the first month of the quarter, and at the 5% level at the end of the second month). Again, PLS does not seem to improve significantly the frequency of comovements with GDP (i.e. the correct prediction of directional change in GDP

[6] The performance of a model based on PCA extracting two factors from the data and a preselection threshold of 0.7 (bivariate correlation with qoq GDP) is comparable to the PLS model. However, for other correlation thresholds (both lower and higher), the RMSEs turn out higher than those of the PLS model and, in most cases, also the ESI benchmark model.

[7] At the end of January, the January reading is taken as the quarterly observation. At the end of February, the average of the January and February readings are used, etc.

growth), in line with the results at the end of the third month of the quarter.

Table 2: Performance with regard to revised GDP as of July 2018 (1st month)

	Benchmark (ESI)	PLS
RMSE	0.26	0.23
Diebold-Mariano p-value	*Ref.*	0.057
Comovements	67.9%	71.4%

Notes: estimation sample starts in 1998Q2. Real-time out of sample performance between 2011Q1 and 2017Q4, nowcasted at the end of the 1st month of the quarter.

Table 3: Performance with regard to revised GDP as of July 2018 (2nd month)

	Benchmark (ESI)	PLS
RMSE	0.25	0.22
Diebold-Mariano p-value	*Ref.*	0.033
Comovements	71.4%	71.4%

Notes: estimation sample starts in 1998Q2. Real-time out of sample performance between 2011Q1 and 2017Q4, nowcasted at the end of the 2nd month of the quarter.

Closer analysis of the weights

In addition to the nowcasting performance, it is interesting to compare the weights of the components entering the ESI and the PLS-based indicator. While the weights of the latter are purely data-driven, the weights used for the ESI are based on the following rules. First, the individual questions across countries are aggregated at the euro-area level based on the respective share of the country in term of sectoral gross value added (or private consumption in the case of the consumer survey). The resulting 15 euro-area series are aggregated based on fixed ad hoc sectoral weights. The three question from the industry survey receive a joint weight of 40%, the three question from the services survey a joint weight of 30%, the four consumer questions jointly 20% and the two (three) question of the construction and retail trade surveys receive jointly 5% each.[8] So while the sector weights in the ESI are fixed and ad hoc, the final country weights are broadly in line with the share of their economy in the euro area, although not exactly proportional to GDP. The high weight given to the industry sector arguably results in attributing more weight to countries with a strong industry sector (like e.g. Germany).

Graph 2 shows a comparison of the weights in term of sectors. Overall, our results are quite similar to those in Gelper and Croux (2010). First, we see a strong positive correlation between the weights used for the ESI and those from PLS, as illustrated by the slope of the ordinary least squares regression fit of the weights (represented as a solid line). A closer look at the data shows that the PLS weight for the services sector is significantly lower than that used for the ESI. On the other hand, for all the other sectors, weights are slightly higher with PLS than with ESI, and broadly proportional. All in all, this confirms the prominent role of the industry sector in nowcasting overall economic activity, with a 43% weight. It also confirms that the services sector is less relevant for nowcasting overall activity, with a weight of 12%, very close to that of the retail trade and construction sectors (respectively 11% and 10%), definitely lower than what gross value added would suggest and even markedly lower than the already low share used in the ESI calculation.

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[8] For details, see the User Guide of the Joint Harmonised EU Programme, available at:
https://ec.europa.eu/info/files/user-guide-joint-harmonised-eu-programme-business-and-consumer-surveys_en.
The weights are based on a joint analysis of the following aspects: 1. Approximate size/contribution of the sector in/to the economy; 2. Sensitivity of the sector to business cycle fluctuations; Volatility of the sectoral survey data.
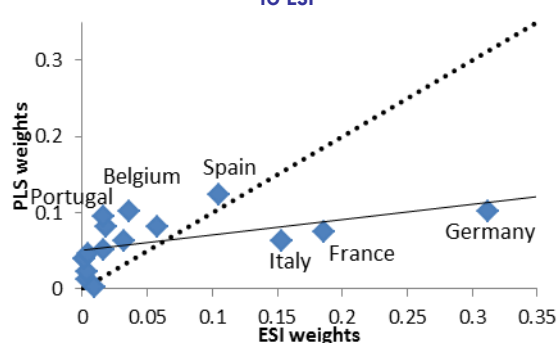
Graph 2: Sector weights obtained with PLS compared to ESI

Graph 3: Country weights obtained with PLS compared to ESI
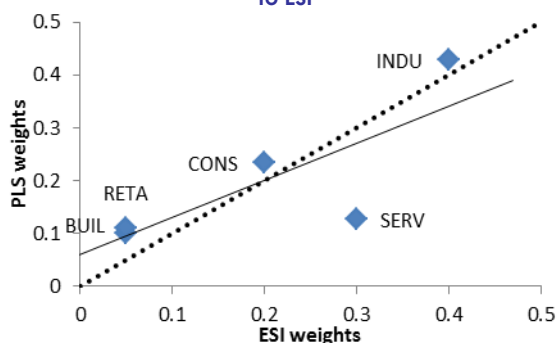
In terms of countries (see Graph 3), PLS weights are significantly different from those of the ESI, in contrast to the findings of Gelper and Croux (2010). PLS gives markedly lower weights to the largest economies. Germany has a weight of 10%, France 8% and Italy 6%. On the other hand, almost all the other countries receive a larger weight with PLS than in the ESI. Spain shows the biggest weight of all countries (12%), followed by Belgium 10%, Portugal 9% and the Netherlands 8%. In the case of Belgium and the Netherlands it is arguably the strong exposure to international trade of these small open economies which justifies a prominent role as economic 'cycle-makers' in the euro area. By contrast, the disproportionally high weights of Spain and, in particular, Portugal, may point to the need to take into account distinct business cycle dynamics of countries relatively remote from the economic and geographical heart of the euro area to get the full picture.

Overall, the size of the economy does not seem to be an important driver of the weights, resulting in a low correlation with the ESI weights, as suggested by the different slopes of the ordinary least squares regressions. The 'flattening' of the PLS weights is pointing to the prevalence of international comovements, with most countries of the euro area showing parallel developments and highly synchronized cycles.

Conclusion

PLS is particularly well suited to extract information from all BCS questions, which represent a very rich dataset ('fat data'). Using PLS to nowcast q-o-q euro-area GDP growth in real time from the fat BCS data set is shown to improve slightly but significantly the accuracy of the nowcasts compared to a benchmark model based on the ESI. However, PLS does not seem to help in improving the prediction of the direction of changes in GDP growth. These results are also shown to be true already at the end of the first two months of the quarter, with remarkably stable nowcast accuracy throughout the quarter.

Clearly, the gains in nowcast accuracy have to be weighed against the increased complexity and opacity of the PLS based nowcasts, where the weights are data-driven, compared to the ESI. The latter is based on fixed ad hoc weights, and developments in the composite indicator and the derived nowcasts for GDP growth can rather easily be traced back to developments in the underlying limited set of components.

To throw some light into the PLS 'black-box', the derived sector and country weights can be compared to those of the ESI. The analysis confirms the prominent role of the industry sector in nowcasting overall economic activity (as reflected in the fixed ESI composition), while the weight of the services sector is significantly lower than expected and even lower than in the ESI. Moreover, the size of the economy does not emerge as an important driver of the country weights, pointing to a high degree of synchronisation of business cycles across euro area countries.

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ANNEX

Reference series

Confidence indicators	Reference series from Eurostat, via Ecowin (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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  (European Business Cycle Indicators)