An experimental sentiment indicator for the euro area – tracking and nowcasting q-o-q GDP growth

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*Business and consumer surveys and short-term forecast (ECFIN A4.2)*
Outline

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2. Strengths / Weaknesses of the Economic Sentiment Indicator (ESI)

3. Refresher on ESI Construction Method

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   - step a: re-constructing the ESI based on "best-performing" survey questions
   - step b: an ESI with amplified changes

5. The nowcasting performance of the experimental ESI
   - step a: Model selection (based on regression analyses)
   - step b: out-of-sample properties (sim. real-time scenario)
1. Introduction: the Economic Sentiment Indicator (ESI)

**Purpose of the ESI:**
- summarising developments in all 5 sectors covered by DG ECFIN's Business and Consumer Surveys (BCS):
  - industry
  - services
  - construction
  - retail trade
  - consumers
- tracking GDP growth at Member State, EU and euro-area level
- ingredient for bridge models now-/forecasting GDP growth

**Added value:**
- timeliness (complementing delayed quantitative statistics)
- high frequency
2. Strengths / Weaknesses of the Economic Sentiment Indicator (ESI)

Note: monthly BCS data are converted into quarterly by averaging the balances over 3 months. GDP figures refer to y-o-y changes (%). Source: European Commission.

Correlations (1996q2-2013q2):

- coincident: 0.93
- leading 1: 0.88

excellent

Correlations (1996q2-2013q2):

- coincident: 0.72
- leading 1: 0.49

sub-optimal

Note: monthly BCS data are converted into quarterly by averaging the balances over 3 months. GDP figures refer to q-o-q changes (%). Source: European Commission.

pace of recovery underestimated by ESI

see-sawing movement absent in ESI
3. Refresher on ESI Construction Method

**ingredients:** balance series of 15 survey questions

- % of positive answers \( \text{minus} \) % of negative answers

The questions are:
- seasonally adjusted
- standardised

**effect:**
- comparability of balance series in terms of mean and volatility
- no series dominates development of ESI due to a higher amplitude

allocating weights per sector:
- Industry: 40%
- Services: 30%
- Consumers: 20%
- Construction: 5%
- Retail Trade: 5%

- individual indu question has weight of 13.3% (=40% weight / 3 questions)

calculation of arithmetic mean of weighted balances

standardisation of the ESI and:
- addition of 100
- multiplication by 10

**effect:**
- values >100 indicate above-average economic sentiment
- 2/3 of observations will be in the interval \([90 ; 110]\) if norm. distr.
4. Improving the ESI's tracking performance of q-o-q GDP growth

step a: re-constructing the ESI based on "best-performing" survey questions

- correlation of all individual EU BCS survey questions (quarterly averages) with:
  - i) the respective reference series (e.g. Gross Value added in Manufacturing for the industry questions, etc.)
  - ii) q-o-q GDP growth (EA)

- construction of 3 new Confidence Indicators (CIs) for every sector observed:
  - arithmetic mean of the respective (s.a.) balance series
  - i) based on 2/3 best performing questions of respective sector
  - iii) based on all forward-looking questions of respective sector

- for each sector: selection of best sectoral CI (reg. correlation with ref. series & q-o-q GDP growth (EA))

- questions contained in the best CIs make up the new ESI
4. Improving the ESI's tracking performance of q-o-q GDP growth – step a: reconstructing the ESI based on "best-performing" survey questions

Intermediate Results:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Services</th>
<th>Consumers</th>
<th>Retail Trade</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>order books - currently</td>
<td>business - last 3 months</td>
<td>household's fin. position - next 12 months</td>
<td>business activity (sales) - last 3 months</td>
<td>order books - currently</td>
</tr>
<tr>
<td>stock of (finished) products - currently</td>
<td>demand for firm's services - last 3 months</td>
<td>econ. situation in MS - next 12 months</td>
<td>volume of stock - currently</td>
<td>firm's employment - next 3 months</td>
</tr>
<tr>
<td>production - next 3 months</td>
<td>demand for firm's services - next 3 months</td>
<td>unemploy-ment in MS - next 12 months</td>
<td>business activity (sales) - next 3 months</td>
<td>building activity - last 3 months</td>
</tr>
<tr>
<td>production - last 3 months</td>
<td>demand for firm's services - next 3 months</td>
<td>expected orders with suppliers - next 3 months</td>
<td>expected level of major purchases - next 12 months</td>
<td></td>
</tr>
<tr>
<td>expected level of major purchases - next 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

correlations with GDP q-o-q:

<table>
<thead>
<tr>
<th>current ESI</th>
<th>ESI (new questions)</th>
<th>improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>coincident</td>
<td>0.72</td>
<td>0.77</td>
</tr>
<tr>
<td>leading 1</td>
<td>0.40</td>
<td>0.54</td>
</tr>
</tbody>
</table>
4. Improving the ESI’s tracking performance of q-o-q GDP growth

**Intuition of the approach:**

Comparable changes in the ESI should be taken more "seriously", when reflected by **many** survey questions.

> change in ESI should be multiplied, if a critical amount of questions changes in the same direction

we propose: 8 (out of 11) questions

**Example:**

*Instead:* change in ESI should be \(-2^x\) (with \(x > 1\))

Change in modified ESI: -1.8

Change in modified ESI: -2

-2 * standard deviation of balance series

-2 -1.5 -1 -0.5 0 0.5

Industry Q1 Industry Q5 Services Q2 Services Q3 Consumption Q2 Consumption Q4 Consumption Q9 Retail Q3 Retail Q4 Construction Q1 Construction Q3

change in 1999Q1 (compared to previous quarter)
change in 2000Q4 (compared to previous quarter)
Calculation method for the experimental ESI

**Ingredients:** balance series from 11 EU BCS questions

- questions expressed as:
  - quarterly averages
  - standardised
  - weighted (remember: industry questions get 40%, services questions 30%, etc.)

i) make **sum of all balance series** (*series A*)

ii) calculate absolute **q-o-q change** in *series A* (*series B*)

iii) make **dummy-variable** taking value 1 if, in a given quarter, >=8 balance series increase/decrease (*series C*)

iv) **re-calculate q-o-q changes:**
  - if *series C* = 1: *series B * 3
  - if *series C* = 0: *series B*

v) **re-calculate series A:**
  - for quarter q: *series A* (q-1) + *series D* (q)

  "classical" sum of balance series (previous quarter)

  amplified q-o-q change of current quarter (unamplified if not enough questions move up/down)

vi) standardise & re-scale the new series >>>>**experimental ESI**

4. Improving the ESI's tracking performance of q-o-q GDP growth – step b: an ESI with amplified changes
Improving the ESI's tracking performance of q-o-q GDP growth – step b: an ESI with amplified changes

Results:

Correlation with GDP growth q-o-q (in brackets: leading 1 correlations)

<table>
<thead>
<tr>
<th>time-period</th>
<th>current ESI</th>
<th>ESINEW (ampl.)</th>
<th>PMI</th>
<th>increase compared to current ESI</th>
<th>increase compared to PMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>98Q3 – 08Q1</td>
<td>0.61 (0.38)</td>
<td>0.76 (0.56)</td>
<td>0.77 (0.55)</td>
<td>26% (47%)</td>
<td>0% (2%)</td>
</tr>
<tr>
<td>08Q2 – 13Q2</td>
<td>0.69 (0.31)</td>
<td>0.89 (0.71)</td>
<td>0.86 (0.56)</td>
<td>28% (131%)</td>
<td>3% (28%)</td>
</tr>
<tr>
<td>98Q3 – 13Q2</td>
<td>0.75 (0.50)</td>
<td>0.89 (0.75)</td>
<td>0.86 (0.65)</td>
<td>19% (48%)</td>
<td>3% (14%)</td>
</tr>
</tbody>
</table>
5. The nowcasting performance of the experimental ESI

step a: Model selection (based on regression analyses):

- exp. ESI is based on **quarterly averages** of BCS questions
  >>>>> any nowcast using exp. ESI can only be produced at the end of a given quarter (when quarterly average of BCS questions is known)

- several hard-data are available at the end of a given quarter and can thus be included in the now-casting model:
  - $\Delta$ index of industrial production
  - $\Delta$ index of production in construction
  - $\Delta$ index of turnover in retail trade (except of motor vehicles/motorcycles)
  - $\Delta$ value of euro-area exports (extra- and intra-euro-area)
  - unemployment rate
  - $\Delta$ new passenger car registrations
  - VStoxx (measure of volatility on European stock markets)

Calculation of quarterly changes ($\Delta$):

i) **in-sample:**
for a quarter $q$:
\[
\frac{\text{monthly average over quarter } q}{\text{monthly average over quarter } q-1}
\]

ii) **out-of-sample:**
for a quarter $q$:
\[
\frac{\text{month 1 value of quarter } q}{\text{month 1 value of quarter } q-1}
\]
5. The nowcasting performance of the experimental ESI – step a: Model selection (based on regression analyses)

<table>
<thead>
<tr>
<th>Benchm’k Model(s)</th>
<th>New Model(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>constant</td>
</tr>
<tr>
<td>GDP(-1)</td>
<td>exp. ESI</td>
</tr>
<tr>
<td>GDP(-2)</td>
<td>ΔIPI</td>
</tr>
<tr>
<td>GDP(-3)</td>
<td>ΔIPC</td>
</tr>
<tr>
<td>VSt'x(-1)</td>
<td>ΔIPI</td>
</tr>
<tr>
<td></td>
<td>ΔIPI</td>
</tr>
</tbody>
</table>

R2: 0.49 R2: 0.03 R2: 0.48 R2: 0.80 R2: 0.91 R2: 0.84 R2: 0.90 R2: 0.90 R2: 0.88

The nowcasting performance of the experimental ESI – step a: Model selection (based on regression analyses)
5. The nowcasting performance of the experimental ESI

step b: out-of-sample properties (simulated real-time scenario):

<table>
<thead>
<tr>
<th>time-period</th>
<th>GDP(-1)</th>
<th>exp. ESI</th>
<th>ΔIPI</th>
<th>exp. ESI</th>
<th>ΔIPI</th>
<th>exp. ESI</th>
<th>ΔIPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04q1 - 08q1</td>
<td>0.18</td>
<td>0.16</td>
<td>0.15</td>
<td>0.15</td>
<td>0.16</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>08q2 - 09q4</td>
<td>1.10</td>
<td>0.49</td>
<td>0.42</td>
<td>0.41</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>10q1 - 13q2</td>
<td>0.28</td>
<td>0.28</td>
<td>0.16</td>
<td>0.15</td>
<td>0.17</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>RMSE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04q1 – 08q1</td>
<td>1.45</td>
<td>0.61</td>
<td>0.51</td>
<td>0.43</td>
<td>0.44</td>
<td>0.44</td>
<td>0.44</td>
</tr>
<tr>
<td>08q2 – 09q4</td>
<td>0.34</td>
<td>0.34</td>
<td>0.22</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
</tr>
<tr>
<td>10q1 – 13q2</td>
<td>0.34</td>
<td>0.34</td>
<td>0.22</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
</tr>
<tr>
<td>Hit ratio 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04q1 – 08q1</td>
<td>17/17</td>
<td>17/17</td>
<td>17/17</td>
<td>17/17</td>
<td>17/17</td>
<td>17/17</td>
<td>17/17</td>
</tr>
<tr>
<td>08q2 – 09q4</td>
<td>5/7</td>
<td>7/7</td>
<td>7/7</td>
<td>7/7</td>
<td>7/7</td>
<td>6/7</td>
<td>6/7</td>
</tr>
<tr>
<td>10q1 – 13q2</td>
<td>10/14</td>
<td>10/14</td>
<td>11/14</td>
<td>13/14</td>
<td>13/14</td>
<td>13/14</td>
<td>13/14</td>
</tr>
<tr>
<td>Hit ratio 2:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>04q2 – 08q1</td>
<td>11/16</td>
<td>11/16</td>
<td>11/16</td>
<td>11/16</td>
<td>11/16</td>
<td>11/16</td>
<td>11/16</td>
</tr>
<tr>
<td>08q2 – 09q4</td>
<td>5/7</td>
<td>7/7</td>
<td>7/7</td>
<td>7/7</td>
<td>7/7</td>
<td>6/7</td>
<td>6/7</td>
</tr>
<tr>
<td>10q1 – 13q2</td>
<td>4/14</td>
<td>8/14</td>
<td>12/14</td>
<td>12/14</td>
<td>12/14</td>
<td>12/14</td>
<td>12/14</td>
</tr>
</tbody>
</table>

Observations:
- AR-model's nowcasts on average 0.40 pp off actual GDP (>bad)
- AR-model: MAE/RMSE highest in crisis-period, lowest in pre-crisis period
- exp. ESI model: clearly outperforming AR-model; added value of exp. ESI lies in crisis period (logical: amplification technique captures "momentum")
- addition of hard-data helps in terms of:
  - MAE/RMSE;
  - hit ratios
- improvements mainly in calm times (post-crisis)
- best model is "exp. ESI, IPI, Vstox(-1)"
  - lowest MAE
  - highest hit-ratio 1
  - highest hit-ratio 2
Comparative advantage of new model most obvious in:

- crisis-period
- last 2 years (correct sign of GDP just once missed, although GDP hovered around 0)
Conclusion:

- BCS data can be used to construct indicator tracking q-o-q GDP growth satisfactorily

- **Step 1:** choose the BCS questions best correlated with q-o-q GDP growth

- **Step 2:** (artificially) amplify q-o-q changes of the sentiment indicator, in case a vast majority of questions displays q-o-q changes in the same direction

- Experimental sentiment indicator produces better GDP nowcasts than simple AR-model

- In combination with hard-data, the experimental sentiment indicator allows producing GDP nowcasts of excellent quality
Shortcomings of the approach

Calculations are done with **quarterly** averages of BCS questions

>>> indicator could only be published once a quarter

Is it possible to apply the same construction method to monthly data? 

→ **technically yes!**

Will quarterly averages of the resulting monthly ESI-series remain well-correlated with q-o-q GDP growth?

→ **yes:**
  - even slightly higher correlations with GDP q-o-q
  - correlation of the two quarterly ESI series is at 0.97

However…
Improving the ESI's tracking performance of q-o-q GDP growth – step b: an ESI with amplified growth – Shortcomings of the approach

Problem of constructing ESI with amplified changes for monthly data:

→ too high volatility

Sep 2009: in upswing-period, ESINEW with amplified changes drops by 10 points (=1 standard deviation)
Source of volatility (note: amplifying changes does not only increase the amplitude of the series, but also its volatility):

- If amplification is applied in t-1, but not in t, ESI will usually suggest a drop in sentiment in t (also in case the underlying data continues the upward/downward trend of t-1)
  
  \[+2 \times 3 = +6\]

- This additional volatility improves the fit of our quarterly series, but renders the monthly series TOO volatile.

- **Main reason for this difference:** criterion for amplification is more restrictive in case of quarterly set-up:
  
  - for quarterly: >= 8 questions must have gone up/down over 3 months-period (amplification in 63% of quarters)
  - for monthly: >= 8 questions must have gone up just one month (amplification in 73% of the months)
Solution:

- When multiplying change of t (compared to t-1), the resulting amplified change should be added to ESI for month t, but also ESI of t+1 and t+2 (1/3 of the change respectively should be added).

Approach smoothens the monthly curve substantially...

When constructing quarterly averages, correlations with q-o-q GDP growth remain high.