European Commission

Directorate General Economic and Financial Affairs

New uncertainty measures for the euro area using survey data

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

7th Joint EC / OECD Workshop on Recent Developments in Business and Consumer Surveys – Paris, 30 November 2015

Structure

- I) **Motivation** for design of new indicators
- II) **Construction methods** of the new indicators
- III) The indicators' **performance**:
  - a) **graphical** inspection
  - b) **VAR models**:
    >>>>**impulse-response functions**
    >>>>**forecast-error variance decomposition**
- IV) **Conclusions**

I) Motivation for design of new indicators

a) existing uncertainty indicators

input data:	mathematical operation:	main advantages:	main disadvantages:
financial: ▪ prices of options with identical maturity-times	dispersion	timely available	▪ financial markets differ from real economy
purposefully collected: ▪ uncertainty-words in newspapers	frequency	timely available	subjectivity in choosing: ▪ uncertainty-words ▪ newspapers
professional forecasts	dispersion	timely available	▪ few respondents
survey data I: ▪ expectation-questions	dispersion	timely available	▪ constructed from *single* survey question (Bachmann, 2013)
survey data II: ▪ question-pairs inquiring expectations & retrospective assessment of concept	dispersion of forecast errors	original alternative to only considering the dispersion of "raw" responses to the survey	▪ delayed availability ▪ use of micro-data (confidential + require panel)
extensive panel of real + financial data series	magnitude of error of forecasting model using the data-set	developments in many economic sectors considered	▪ ex-post measure

I) Motivation for design of new indicators

a) existing uncertainty indicators

assumption: uncertainty can be best derived **directly** from main economic agents (i.e. consumers, enterprises)

Bachmann et al.'s (2013) uncertainty measures can be improved

Focus of this presentation:

survey data I: ▪ expectation-questions	dispersion	timely available	▪ constructed from *single* survey question (Bachmann, 2013)
survey data II: ▪ question-pairs inquiring expectations & retrospective assessment of concept	dispersion of forecast errors	original alternative to only considering the dispersion of "raw" responses to the survey	▪ delayed availability ▪ use of micro-data (confidential + require panel)

b) new uncertainty indicators

input data:	operation:	main advantages:	main disadvantages:
survey data I: ▪ expectation-questions	dispersion	timely available	▪ constructed from *single* survey question (Bachmann, 2013)
		constructed from **multitude** of survey questions **across sectors**	
survey data II: ▪ question-pairs inquiring expectations & retrospective assessment of concept	dispersion of forecast errors	original alternative to only considering the dispersion of "raw" responses to the survey	▪ delayed availability ▪ use of micro-data (confidential + require panel)
		use of macro-data (accessible to anyone + no panel structure required)	

NEW: survey data III:	**operation:**	**main advantages:**
▪ based on all survey-questions	dispersion (but: **across**, rather than within questions)	new kind of dispersion considered; possibly complementing existing measures

II) Construction methods of the new indicators

a) uncertainty measure based on expectation-questions:

UNC1

data used:

- all forward-looking survey question of the Joint Harmonised EU BCS Programme:
  - **industry** (future production / selling prices / employment / (export) order books)
  - **services** (future demand / employment / prices charged)
  - **retail trade** (future orders placed with suppliers / sales / employment / prices charged)
  - **construction** (future employment / prices charged)
  - **consumers** (future financial situation / economic situation in country / prices / unemployment / spending on major purchases)

- **18 questions** (from 4 sectors + consumers)
- questions refer to **euro area** level

calculation method:

UNC1

separately for each survey question:

cross-sectional **standard deviation** (for every point in time t)

$$\sqrt{\%age\ POS_t + \%age\ NEG_t - (\%age\ POS_t - \%age\ NEG_t)^2}$$

If more respondents give POS/NEG answer (rather than NEUTRAL), uncertainty increases.

If difference between POS and NEG drops, uncertainty increases.

opposing opinions interpreted as uncertainty-indication

across all questions:

standardisation of question-specific time-series

averaging of time-series

+

rescaling so that resulting time-series has average 100 and standard deviation 10

b) ex-post uncertainty measure based on respondents' forecast errors: UNC2

data used:

- all questions of EU BCS programme existing in "**pairs**" (**forward**- and **backward**-looking version)

INDU: production SERV: turnover SERV: firm's employment RETA: sales	next 3 months	past 3 months
CONS: financial situation CONS: macro situation CONS: prices	next 12 months	past 12 months

calculation method:

UNC2

Bachmann: for a given point in time t, e.g. Jan 2007:

January 2007	
respondent	INDU: prod. next 3 months
A	+ **+1**
B	+ **+1**
C	- **-1**
D	= **0**

absolute difference

April 2007	
respondent	INDU: prod. past 3 months
A	+ **+1**
B	- **-1**
C	= **0**
D	= **0**

calculation of **standard deviation** = uncertainty in January 2007

repetition over all subsequent months gives uncertainty time-series

new calculation method (developed by DG ECFIN):

UNC2

- no use of micro-data (ensuring feasibility of indicator for everyone)
  >> individuals' forecast errors remain unknown
  >> distribution of forecast errors unknown

solution: indirect derivation of forecast error dispersion

step 1) separately for each survey question: **cross-sectional standard deviation**

$$\sqrt{\%age\ POS_t + \%age\ NEG_t - (\%age\ POS_t - \%age\ NEG_t)^2}$$

	industry production:		services turnover:	
time	next 3 months	past 3 months	next 3 months	past 3 months
01/'07	0,65	0,50	0,70	0,60
02/'07	0,50	0,50	0,60	0,55
03/'07	0,35	0,30	0,40	0,30
04/'07	0,35	0,30	0,40	0,35
05/'07	0,55	0,40	0,50	0,50
06/'07	0,55	0,50	0,45	0,30
07/'07	0,45	0,40	0,50	0,30
...	…	…	…	…

dispersion reflects…
(i) …differences in production expectations across respondents
(ii) …**degree of uncertainty** (higher uncertainty leads to higher dispersion)

dispersion reflects…
…differences in production across respondents (over past 3 months)

"**true**" dispersion, free of any uncertainty effects

new calculation method (developed by DG ECFIN):

UNC2

	industry production:		services turnover:	
time	next 3 months	past 3 months	next 3 months	past 3 months
01/'07	0,65	0,50	0,70	0,60
02/'07	0,50	0,50	0,60	0,55
03/'07	0,35	0,30	0,40	0,30
04/'07	0,35	0,30	0,40	0,35
05/'07	0,55	0,40	0,50	0,50
06/'07	0,55	0,50	0,45	0,30
07/'07	0,45	0,40	0,50	0,30
...	…	…	…	…

step 2) for every question "**pair**":

$$dispersion_t = \ln\left(\frac{dispersion\ (question\ on\ future)_{t-3}}{dispersion\ (question\ on\ past)_t}\right)$$

repetition over subsequent months produces uncertainty **time-series**

standardisation of all time-series

step 3) **average** across all time-series produces uncertainty series

rescaling so that resulting time-series has average 100 and st. deviation 10

c) uncertainty measure based on inter-question dispersion: UNC3

rationale:

- commonality of previous uncertainty indicators:
  - uncertainty derived from dispersion **at level of individual questions**

UNC1 / UNC2:
- look at individual survey questions
- derive cross-sectional st. deviation from the share of pos. & neg. answers

UNC1:
- average across (expectations) questions

UNC2:
- make ratio of st. deviations for each question "pair"
- average ratios across question "pairs"

c) uncertainty measure based on inter-question dispersion:

UNC3

rationale:

- commonality of previous uncertainty indicators:
  - uncertainty derived from dispersion **at level of individual questions**
- **new** approach:
  - uncertainty derived from dispersion **across questions**
    - consider the balance scores (i.e. %POS - %NEG) for each question
    - calculate the dispersion of balance scores **across questions**
- assumption:
  - **in times of high certainty** (e.g. during downswing):
    assessments change in uniform way ("*everything gets worse*")
  - **in times of high un-certainty** (e.g. when approaching a trough):
    assessments change into different directions:
    - e.g. consumers more positive on future financial situation, but…
    - **…due to remaining doubt**, (still) hesitant to increase their likelihood of making major purchases

data used:

UNC3

- all questions of the Joint Harmonised EU BCS Programme:

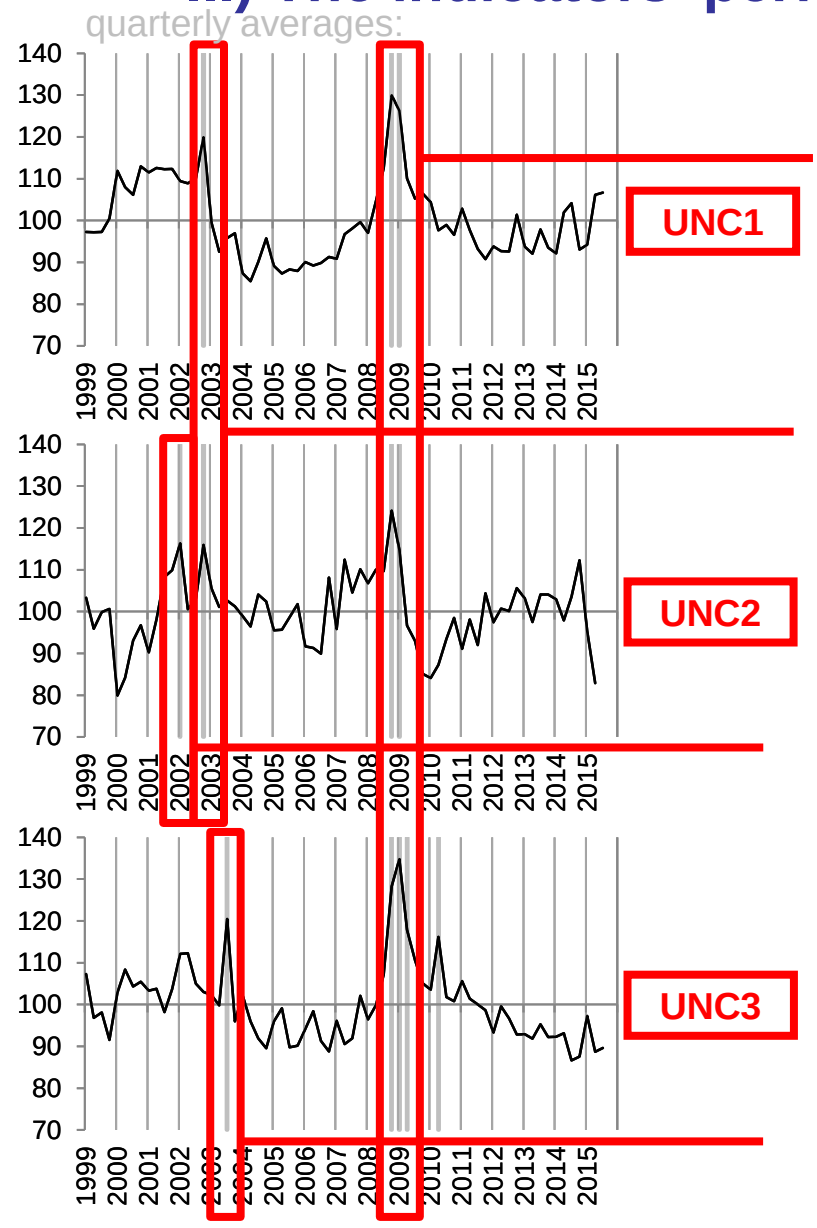
no restrictions: (i.e. questions on past / present / future & across all 5 surveyed sectors)

35 questions

calculation method:

- transformation of monthly balances into changes vs. 3 months ago
- **standardisation** of all time-series
- for each point in time t, calculation of **standard deviation across questions**
- **rescaling** of indicator to have 100 mean and standard deviation 10

III) The indicators' performance: a) graphical inspection



financial crisis:

- **Lehman Brothers** bankruptcy in 2008q3
- economic downturn, culminating in 2009q2 (EA q-o-q GDP growth at -3,0%)

2002q4:

- discussions about **Iraq invasion** (which materialised in March 2003)

2002q1:

- peak resulting from 3 subsequent sharp rises (starting in 2001q3 where World Trade Center was attacked)

2003q3:

- Iraq war ongoing
- August 2003: press unveiling DE / FR / IT having entered recession

b) VAR models:

impulse-response functions:

aim: quantifying the independent impact of a variable A on a variable B, but:

- allowing for causal links between the variables, which run in **both** directions (from A to B & from B to A)
- controlling for the effect of other variables potentially related to variable A and/or B
- identifying the impact **over time**, taking account of the dynamic links between the variables

b) VAR models:

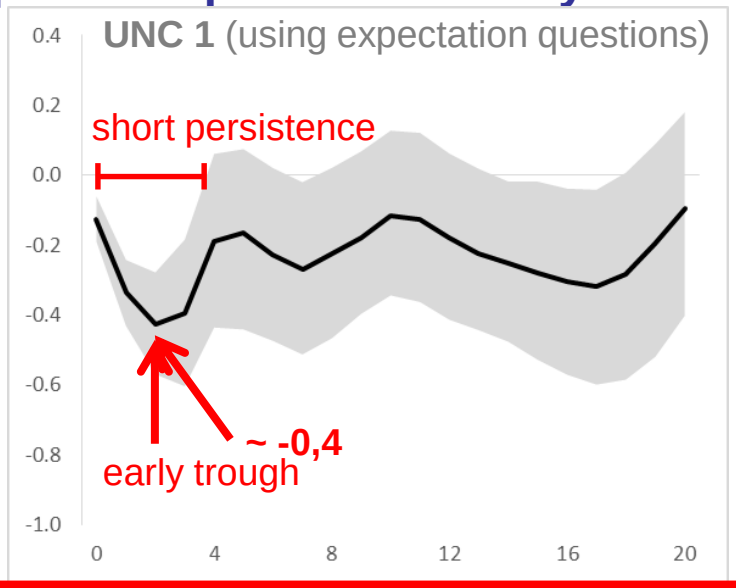
impulse-response functions:

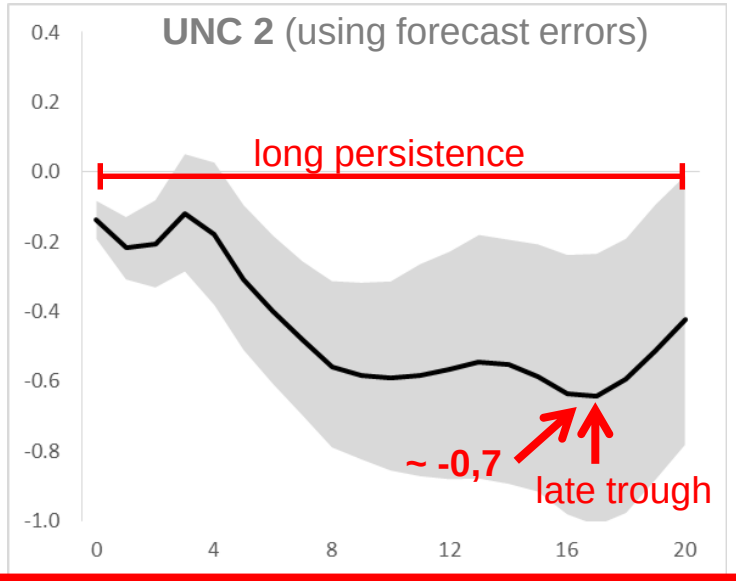
- **variable of interest 1:** **uncertainty** (proxied by three new indicators)
  GDP - appropriate, since new indicators capture uncertainty throughout **entire** economy (variables derived from industry/services/etc. questions)
- **other variables:** similar to selection advocated in Bloom ('09) & Jurado et al. ('15):
  - Economic Sentiment Indicator (ESI)
  - (log of) euro-area employment levels
  - (log of) hours worked
  - (log of) wage level
  - harmonised index of consumer prices
  - nominal short-term interest-rate

system contains **8 variables** & a constant

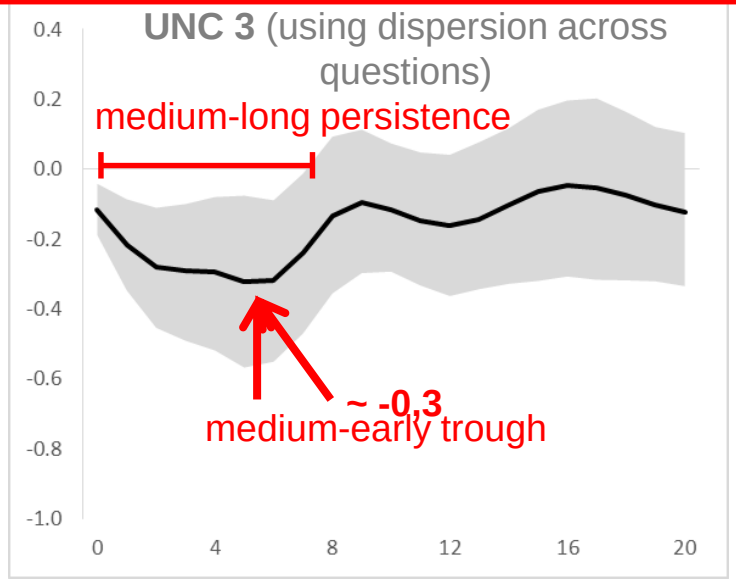
- variables are quarterly (i.e. (i) genuinely quarterly or (ii) quarterly averaged)
- four lags per variable
- estimation period: 1999q1 to 2014q1
- simulation horizon: 20 quarters

impulse-response results by indicator





Results robust to various tests (inclusion of time-trend, dropping constant, dropping variables, adding controls (oil prices), extending estimation period) !!!



commonalities:

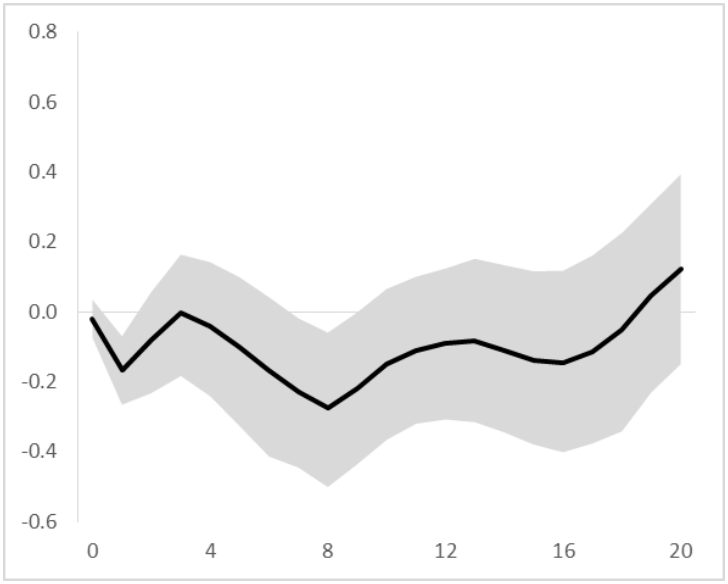
- all indicators have negative & significant impact on GDP
- negative impact fades out over time
- **no** signs of overshooting (as reported in Bloom (2009))

differences:

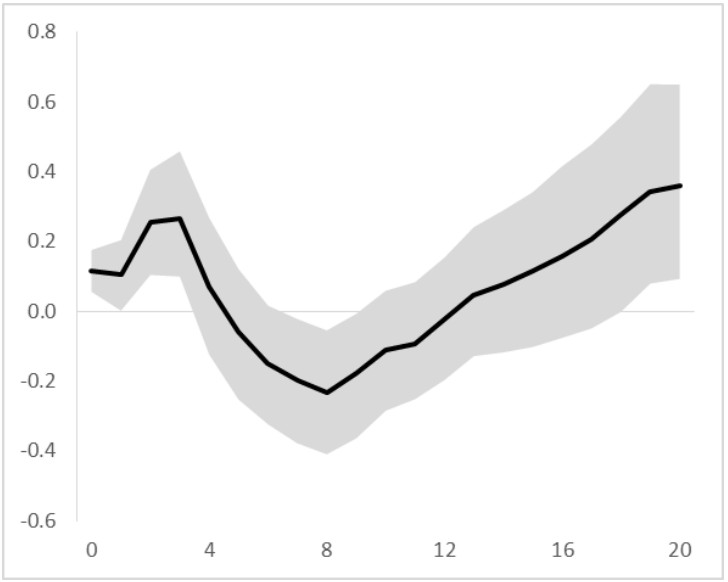
- magnitude of maximum impact differs
- timing & persistence differ

comparison with impact of other uncertainty indicators

stock market volatility index



Economic Policy Uncertainty Index (Baker et al. (2013))



observations:

- negative impact of shocks is only on brink of statistical significance
- for EPUI:
  - odd positive and significant effect on GDP in quarters 2 / 3 after shock
  - signs of an "overshooting" effect at end of simulation horizon (in line with Bloom (2009))

forecast-error variance decomposition

- VAR set-up
- focus is not on *absolute* magnitude of the impact of
- instead: technique determines ***%age*** of ***variability***

	horizon (in quarters):			
	0	**4**	**8**	**20**
stock market volatility	0.01	0.04	0.11	0.12
Economic Policy Uncertainty Index	0.08	0.12	0.08	0.06
UNC 1 (= based on expectation-questions)	0.11	0.22	0.17	0.14
UNC 2 (= ex-post measure based on respondents' forecast errors)	0.11	0.10	0.28	0.41
UNC 3 (= based on inter-question dispersion)	0.06	0.17	0.19	0.11

observations:

- for every time-horizon:
  new uncertainty measures account for larger share of GDP variation than "classical" measures
- UNC1 and UNC3 cause – at every horizon – roughly the same %age of variation
- UNC2 deviates from UNC1 / UNC3: has highest impact in medium term

IV) Conclusions

- 3 new uncertainty measures **with several advantages:**
  - based on publicly-available survey data (rather than micro-data)
    >>>>replication for wide range of users possible
  - survey-questions used stretch across different sectors & include consumer survey
    >>>>lower likelihood of missing important episodes of elevated uncertainty

- new measures show **convincing empirical performance**:
  - peaks coincide with major uncertainty-enhancing events of the past
  - measures appear counter-cyclical with regard to GDP
  - VAR simulations show shocks to the new indicators having significant negative impact on GDP growth (fading out over time)
  - forecast-error decomposition exercise shows: new indicators account for larger %age of GDP variations than "classical" measures

- **practical considerations**:
  - UNC1 / UNC3 are particularly useful, since they can be constructed in real time
  - UNC2 (based on respondents' forecast-errors) can only be constructed with delay and is thus less useful in practice