European Commission

Directorate-General for Economic and Financial Affairs

The European Commission's Composite Indicators of Business and Consumer Surveys – Ad-hoc- vs. Data-driven Techniques

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The Role of NSOs in the Production of LCS Indicators – UN Geneva, 6-7 July 2017

Structure

- (i) The Joint Harmonised EU Programme of Business and Consumer Surveys
- (ii) **Established** Composite Indicators & their performance
  - a) Confidence Indicators (CIs)
  - b) Economic Sentiment Indicator (ESI)
  - c) Business Climate Indicator (BCI)
- (iii) **Motivation** for design of **new/alternative indicators**
- (iv) **Construction methods** of new indicators
- (v) **Comparison of new indicators** & Consumer Confidence Indicator **(CCI):**
  - (a) **graphical** inspection
  - (b) **ability to track** reference series
  - (c) **ability to forecast** expansions/contractions
- (vi) **Conclusions**

The Joint Harmonised EU Programme of Business and Consumer Surveys: History

since 1962: monthly survey in **Industry**
since 1966: monthly survey in **Construction**
since 1972: monthly survey among **Consumers**
since 1984: monthly survey in **Retail Trade**
since 1996: monthly survey in **Services**
since 2007: monthly survey in **Financial Services**

<u>additionally:</u>
since 1966: bi-annual **investment survey** of the manufacturing sector

Geographical scope

EU-28

+

candidate countries:

- Turkey (2007)
- FYROM (2008)
- Montenegro (2012)
- Serbia (2013)
- Albania (2016)

Business Survey questions (monthly)

	last 3 months	currently	next 3 months
production / business situation / business activity	   		 
demand for firm's services/turnover			
order books		 	
export order books			
stock of (finished) products		 	
prices charged			   
firm's employment			   
orders placed with suppliers			
Factors limiting activity			

 = Industry  = Services (incl. fin.)  = Retail  = Construction

Consumer Survey questions (monthly)

	last 12 months	currently	next 12 months
micro questions	development household's financial position	right moment for people to make major purchases?	development household's financial position
		good moment to save money?	spending more or less on major purchases?
		household's position (from running into debt to saving a lot)	household's likelihood of saving money
macro questions	development general economic situation in MS		development general economic situation in the MS
	development consumer prices		development consumer prices
			development unemployment in MS

ii. Composite Indicators & their performance

a) Confidence Indicators (CIs)

purpose:

summarising overall perceptions and expectations at the individual sector level (industry, services, construction, retail, consumers) in a one-dimensional index

calculation:

for every sector: arithmetic mean of (seasonally adjusted) balances for specific questions

selection criteria for questions to be included:

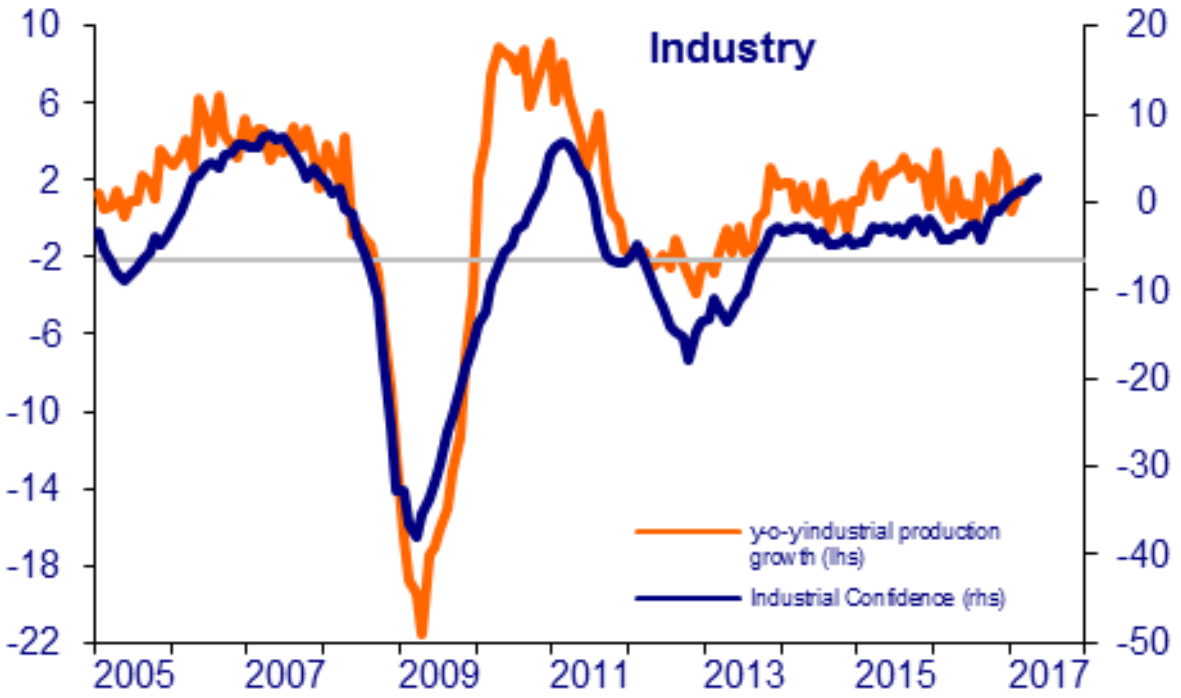
- relevance
- high correlation of CI with reference series
- smoothness

Questions included in CIs

Industry	Services	Construction	Retail Trade	Consumers
order books - currently	business - last 3 months	order books - currently	business activity (sales) - last 3 months	household's fin. position - next 12 months
stock of (finished) products - currently	demand for firm's services - last 3 months	firm's employment - next 3 months	volume of stock - currently	econ. situa-tion in MS - next 12 months
production - next 3 months	demand for firm's services - next 3 months		business activity (sales) - next 3 months	unemploy-ment in MS - next 12 months
				likelihood of saving money - next 12 months

Performance of the CIs

Industry CI and reference series (y-o-y growth):



Coincident correlation: 0,89
Correlation leading 1: 0,87
Correlation leading 2: 0,83

Notabene: *given substantial publication lead of CIs the coincident correlation is practically a leading correlation.*

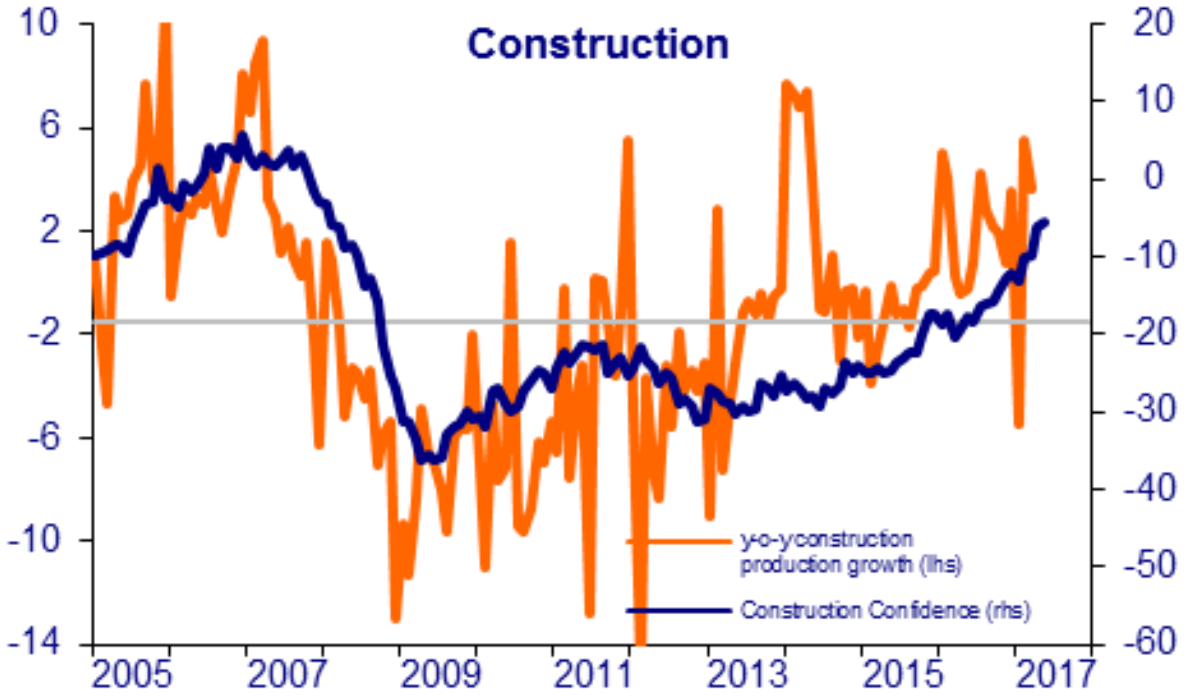
Performance of the CIs

Services CI:

Coincident correlation: 0,94
Correlation leading 1: 0,95
Correlation leading 2: 0,94

Performance of the CIs

Construction CI:



Coincident correlation: 0,57
Correlation leading 1: 0,55
Correlation leading 2: 0,52

Performance of the CIs

Retail Trade CI:

Coincident correlation: 0,81
Correlation leading 1: 0,80
Correlation leading 2: 0,78

Performance of the CIs

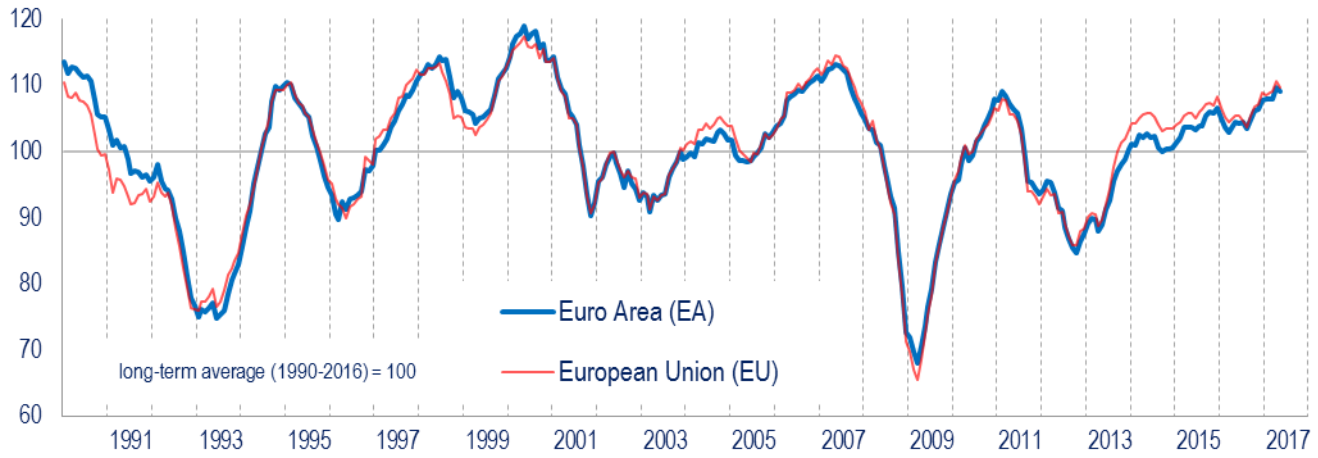
Consumer CI:

Coincident correlation: 0,87
Correlation leading 1: 0,86
Correlation leading 2: 0,85

b) Economic Sentiment Indicator (ESI)

Purpose:

- summarising overall economic developments, in all 5 surveyed sectors
- tracking GDP growth at Member State, EU and euro-area level



source: European Commission services

Calculation of the ESI

components: 15 balance series of the 5 sectoral CIs

- seasonally adjusted
- standardised

allocating weights per sector:

Industry: 40% ; Services: 30% ; Consumers: 20% ; Construction: 5% ; Retail Trade: 5%

→ individual INDU question has weight of 13.3% (= 40% / 3 questions)

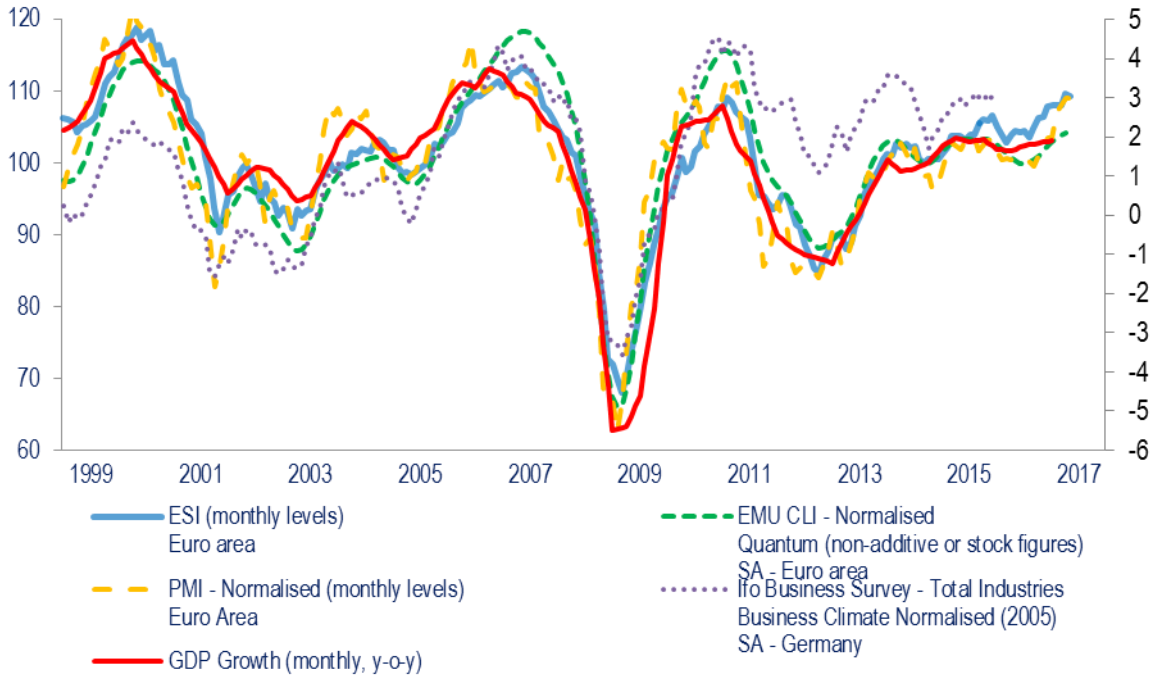
calculation of arithmetic mean of weighted balances

standardisation of the ESI and:

- addition of 100
- multiplication by 10

- values >100 indicate above-average economic sentiment
- 2/3 of observations will be in the interval [90 ; 110] (assuming normality)

Performance of the ESI

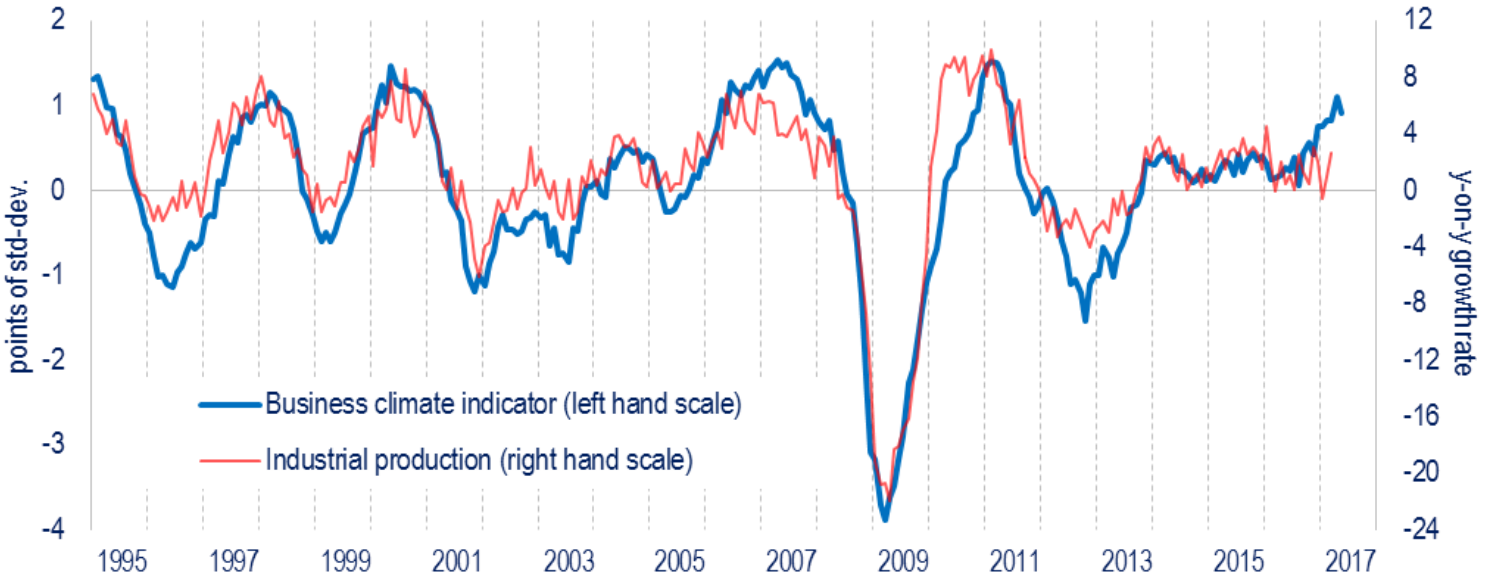


Correlations:	ESI	EMU CLI	PMI	IFO BCI
coincident	0.92	0.84	0.88	0.50
leading 1	0.91	0.83	0.91	0.49
leading 2	0.88	0.80	0.91	0.46
leading 3	0.84	0.75	0.90	0.42

c) Business Climate Indicator (BCI)

Purpose:

- timely tracking of IP/gross value added growth in the manufacturing sector



source: European Commission services

Calculation of the BCI

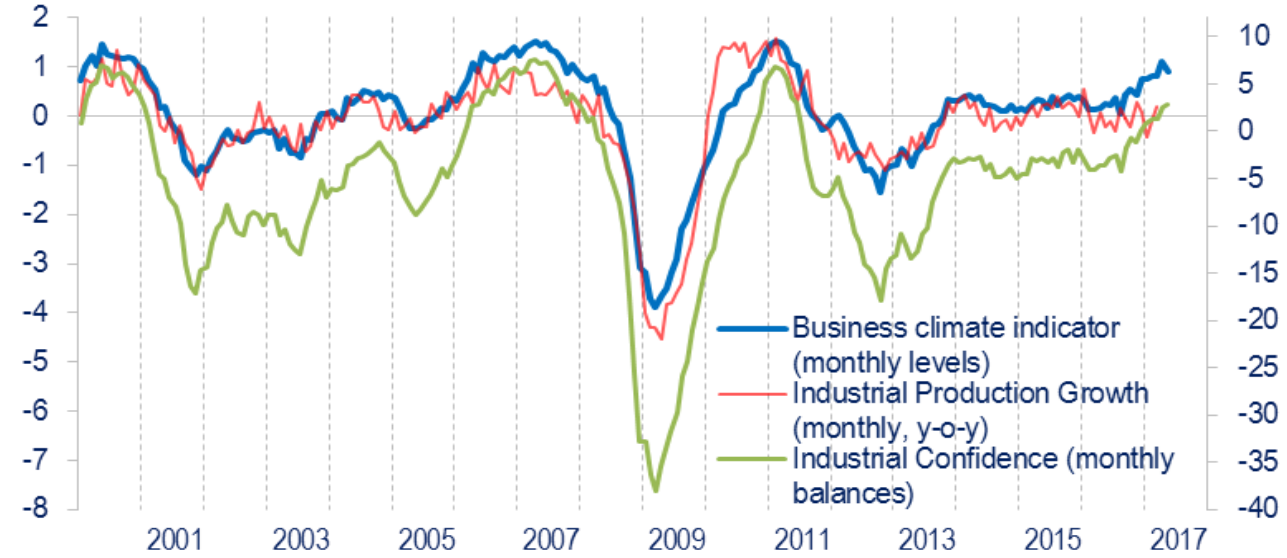
components: 5 balance series from the industry survey:

- production last 3 months
- production next 3 months
- order books currently
- export order books currently
- stock of finished products currently

conducting **factor analysis**:

- only one factor retained
  (*assumption is: business cycle can be represented by a single variable*)

Performance of the BCI



source: European Commission services

Correlations:	BCI	INDU COF
coincident	0,89	0.87
leading 1	0.87	0.85
leading 2	0.83	0.80
leading 3	0.76	0.73

no significant difference…

(i) new/alternative indicators: Motivation

Example: current Consumer Confidence Indicator (CCI):

- uses **4** out of 12 consumer **survey questions**
- **arithmetic mean** of the four questions' **balance series**

  %age of pos. replies ***minus*** %age of neg. replies

advantages:

- easy calculation
  >>**easy communication**
  >>**easy interpretability**

  changes in indicator attributable to changes in individual questions

disadvantages:

- no statistical foundation (**ad-hoc**)
  >>risk of **sub-optimal performance** (in tracking + forecasting reference series)

(ii) Construction methods of the new indicators

input variables:

"rich" set of time-series, namely: **balance series of all 11 cons. survey questions**

household specific questions
financial situation,
saving behaviour, etc.
macro-economic questions
general economic situation,
unemployment

past 12 months and/or
currently and/or
next 12 months

series for 10 EA countries stretching sufficiently far back (to 1985)
(11 questions * 10 countries = **110 time-series**)

reference series:

EA private consumption growth (y-o-y)

aggregation technique:

…straight-forward solution would be: ~~**OLS regression** of ref. series on all survey series (algorithm determining questions' weights)~~

→ OLS estimator fails if number of expl. variables too large for sample size

→ inflated variance of estimated parameters (=inaccurate estimates) if predictors are (near) collinear

→ likelihood of collinearity increasing with number of variables

need of genuine "**data-reduction**" methods to generate confidence indicator

→ **Principal Component Analysis (PCA)**:

- summarises information in (limited number of) "factors"
- "factor" reflects tendency shared by several (or all) series
- "factors" are uncorrelated
- first "factor" summarises largest share of variables' co-movement

→ **Partial Least Squares (PLS)**:

- like PCA, but co-variance of input series with reference series is considered

first "factor" = confidence indicator

→ **Ridge Regression (RR)**:

- regularised regression (i.e. imposes thresholds on values of coefficients)
- works even if more regressors than observations

fitted values = confidence indicator

aggregation "issue": combining different frequencies:

- survey series are monthly
- private consumption growth (= ref. series) is quarterly

solution: render survey series quarterly… **BUT**
…keep monthly interpretation of survey series
(*remember:* confidence indicator shall be monthly)

'blocking approach'

monthly question 1			**quarterly** question 1 (M1)			**quarterly** question 1 (M2)			…	△ **quarterly** question 1 (M1)		…
Q1	M1	10,1	Q1	M1	10,1	Q1	M2	12,3		Q1		
	M2	12,3										
	M3	15,5										
Q2	M1	13,5	Q2	M1	13,5	Q2	M2	13,7		Q2	= 13,5-10,1	
	M2	13,7										
	M3	14,3										
Q3	M1	18,5	Q3	M1	18,5	Q3	M2	19,2		Q3	= 18,5-13,5	
	M2	19,2										
	M3	20,7										
…	…	…	…	…	…	…	…	…		…	…	

calculation of indicators happens in real time…

↳ *To calculate value for **January 2015**, only **data released until 31 January 2015** may be used.*

PCA-based indicator	indicator value for **January 2015**	▪ use only the **M1-versions** of each survey series ▪ time-series stop in 2015 Q1 ▪ conduct PCA: 2015-Q1-value of the first factor = confidence indicator's reading in January 2015
	indicator value for **February 2015**	▪ use only the **M2-versions** of each survey series ▪ time-series stop in 2015 Q1 ▪ conduct PCA: 2015-Q1-value of the first factor = confidence indicator's reading in February 2015
	…	…

finally: transform the confidence indicator from first-differences into **levels**

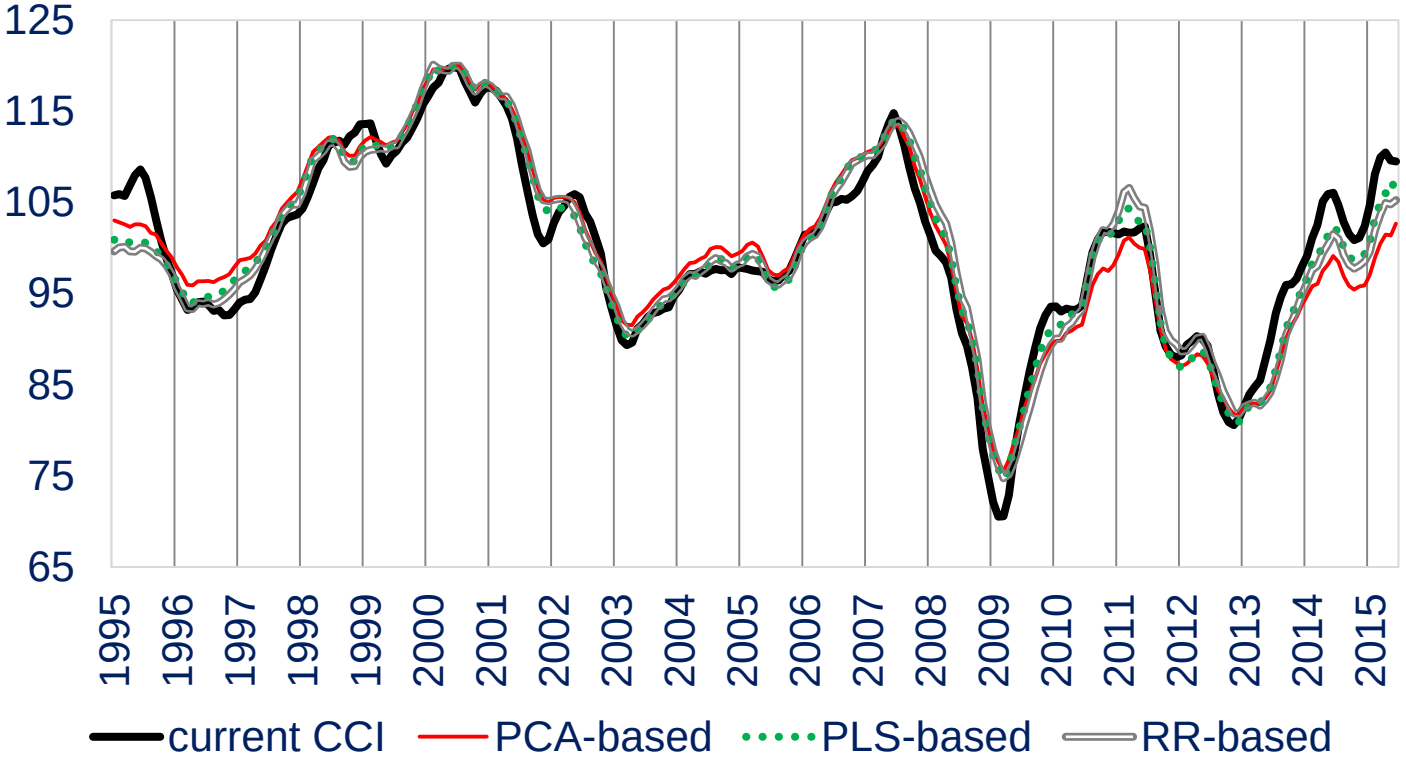
PLS- / RR- based indicator

indicator value for **January 2015**	▪ use only the **M1-versions** of each survey series ▪ time-series stop in **2015 Q1** ▪ include quarterly reference series (last value = **2014 Q3**) priv. consumption growth published with 65 days delay ▪ conduct PLS / Ridge regression: result is a **weighting scheme** for the combination of survey series into a confidence indicator ▪ **plug Q1 values** of survey series **into equation** to produce confidence indicator's value for January 2015
…	…
indicator value for **March 2015**	▪ use only the **M3-versions** of each survey series ▪ time-series stop in **2015 Q1** ▪ include quarterly reference series (last value = **2014 Q4**) ▪ conduct PLS / Ridge regression ▪ **plug Q1 values** of survey series **into equation** to produce confidence indicator's value for March 2015
…	…

finally: transform the confidence indicator from first-differences into **levels**

(iii) Comparison of new indicators & official EA Consumer Confidence Indicator **(CCI)**

(a) **graphical** inspection



indicators very similar!

(b) **tracking** performance: **correlation with EA priv. cons. growth (y-o-y)**

1995-2015	**current CCI:**	**PCA-based:**	**PLS-based:**	**RR-based:**
coincident:	0.82	0.89	0.86	0.84
1-Q-lead:	0.79	0.82	0.79	0.76

no significant differences in tracking performance!

(c) ability to forecast reference series

↳ expansions & contractions in EA private consumption

questions:

- Do new CIs contain **information additional** to that contained in current CCI?
- If yes, is this supplementary info **complementary** to timely released hard data?

set-up:

- for every new CI, run **two probit-models** predicting recession probabilities:
  - **restricted model:** only CI (+ constant) predict probabilities
  - **augmented model:** CI (+ timely available hard-data) predict probabilities
    - short-term int. rates
    - EuroStoxx 50
    - EA HICP
- out-of-sample period: 2005q2 to 2015q1
- **pseudo-real time** set-up with assumption that…

…forecast of q_t is **conducted at end of M3 of q_t**

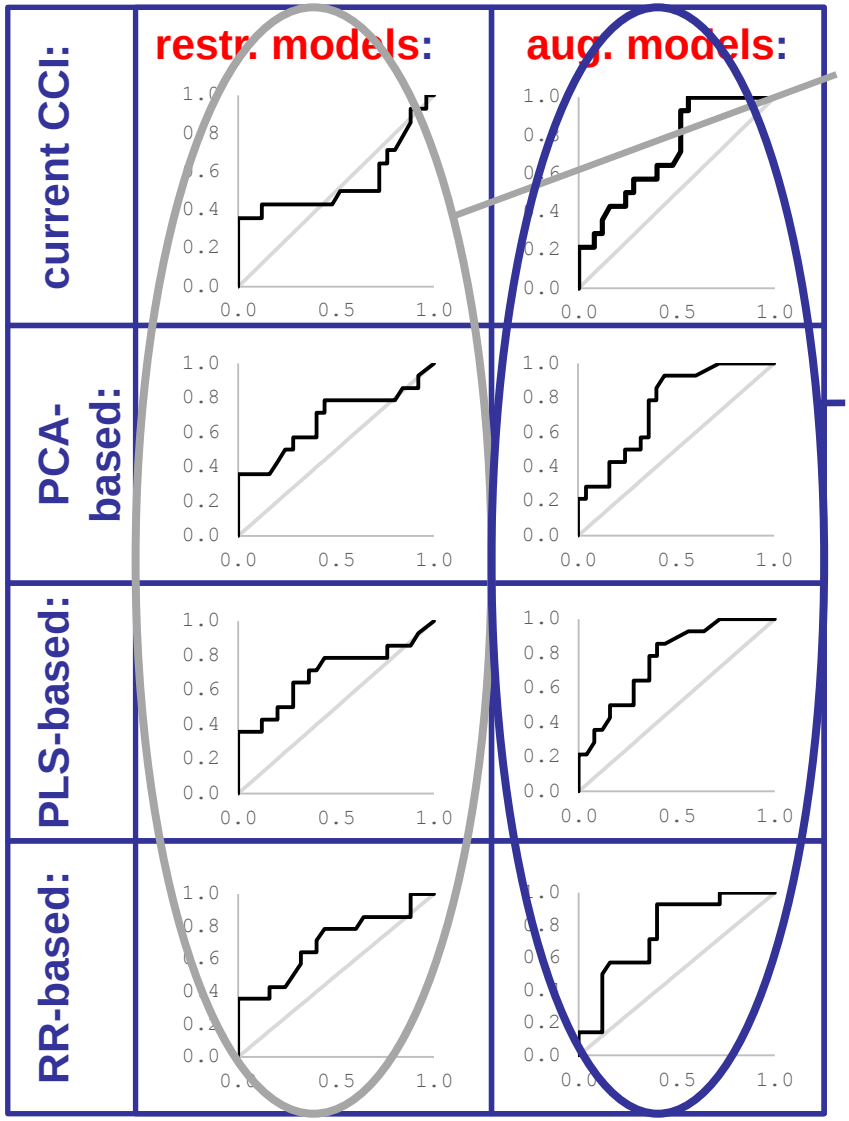
results:

Usually: cut-off probability of 0.5 as a recession signal when comparing forecasts

Here: visual inspection of receiver operating characteristic (**ROC**) curves:

for different cut-off values (0 to 1), plot:
false positives rate (x-axis) vs.
true positives rate (y-axis)

good models tend to lie above 45-degree line
(= *higher true positives than false positives rate*)



conclusions:

- models tend to be above 45-degrees line
- all cof. indicators contain forecast-relevant info, no matter which cut-off value is used
- current CCI carries least forecast info
- hard-data improves models
- current-CCI model NOT inferior to other models

statistical test* if new cof.-models are better than current-CCI-model

- **restricted models:** new cof's make better forecasts
- **augmented models:** new cof's **don't** make better forecasts

new cof's have (a bit) more forecasting-relevant info…**but:** new info largely covered by timely-released hard data

No added value in realistic forecasting scenarios!

*1) integrate area under new cof's ROC curve
2) integrate area under current-CCI's ROC curve
3) calculate if surface area of new cof.'s model is larger than that of current-CCI model

(iv) Conclusions

current CCI has potential **shortcomings**:

- ad-hoc aggregation method
- just 4 input questions
- not tailored to target-series by design

we addressed all **shortcomings**:

- PCA/PLS/RR
- 110 time-series
- (PLS/RR): tailored to target-series

results:

- **only slight improvements in tracking** private consumption growth
- **only slight improvements in forecasting** expansions/contractions in private consumption **+ all improvements fading in realistic forecasting scenario (i.e. when timely hard data are included)**

interpretation:

- **more complicated cof. indicators no compelling alternative to current CCI**, especially since:
  - …current CCI easy to communicate
  - …upswings / downswings in CCI easily attributable to developments in individual underlying survey questions

Thanks for your attention!