



Complementing scoreboards with composite indicators: The new business cycle clock

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Outline

- Introduction
- Dashboards and scoreboards
- The PEEIs dashboard
- Summarising information and composite indicators
- Multivariate coincident indicators for turning points detection
- Business cycle clock
- Conclusions

Introduction

- Key users of official statistics expecting to receive a clear, reliable and as much as possible timely picture of main economic and socio-economic phenomena of interest
- Two main alternatives available for statistical authorities
 - **Selecting key indicators and presenting them in a friendly and attractive way**
 - Dashboards and scoreboards
 - **Summarising statistical information to highlight key signals**
 - Composite indicators

Dashboards and scoreboards (I)

- Selecting key statistical indicators to describe given phenomena
 - **Not an easy task**
- Continuous interaction between data producers and users
 - **Developing new indicators to fill existing gaps**
 - **Enhancing existing indicators to increase their relevance**
- Selected indicators often coming from different statistical domains
 - **Full harmonisation across statistical domains difficult to achieve**

Dashboards and scoreboards (II)

- Proliferation in the last year of graphical and/or tabular ways to display large sets of indicators
 - **Business Cycle Dashboard developed by the CBS Netherlands**
 - **Economic Data Dashboard developed by the ONS**
- **Dashboards:** presenting statistics describing the development of a given social, economic or socio-economic phenomenon
 - **no need of specific quantified political objectives**
 - **PEEI's dashboard**
- **Scoreboards:** presenting statistics related to policy objectives and/or thresholds
 - **MIP and SDI scoreboards**

Dashboards and scoreboards (III)

- Positive impact of dashboard and scoreboards development on the overall quality of component statistics
 - **Coverage**
 - **Relevance**
 - **Harmonisation**
 - **Reliability**
 - **Timeliness**
- Good example of cooperation between data producers and users

Dashboards and scoreboards (IV)

- While providing very detailed, precise and often almost exhaustive pictures of a given phenomenon, dashboards and scoreboards do not necessarily allow for a quick and easy identification of the key messages delivered by the constituent indicators
- Large number of indicators often complicating the extraction of synthetic messages
 - **Not infrequently indicators moving into different directions**
- Statistics in dashboards not necessarily allowing for an easy detection of some features
 - **Cyclical, trend and other behaviours often hidden**
 - **Need for extracting hidden signals**

The PEEIs dashboard (I)

- "Selected PEEIs page" released in October 2007
 - **Mixing up data with different time frequencies**
 - **Indicators coming from different areas of statistical production**
- Further information provided:
 - **Data availability**
 - **Link to latest and next foreseen press releases**
 - **Harmonised set of short descriptions by indicator**
 - **Access to full metadata**

The PEEIs dashboard (II)

- Statistical coverage
 - **All available PEEIs**
 - **Small number of monetary, financial and balance of payments indicators**
 - **Economic sentiment indicator**
- Geographical coverage
 - **Euro area and European Union only**
- Good picture of the short-term macroeconomic evolution

The PEEIs dashboard (III)

- "Selected PEEIs page" as a reference for the development of wider dashboards
 - **PGIs and UNSD data template**
- Need for regular and almost real-time short-term monitoring as a consequence of the global economic and financial crisis
 - **More detailed and timely dashboards**

The PEEIs dashboard (IV)

- New PEEIs dashboard developed by Eurostat in 2015
 - **Released in August**
 - **Accessible at:**
<http://ec.europa.eu/eurostat/web/euro-indicators/peeis>
- Enhanced statistical coverage
 - **Data structured in two layers: key and additional indicators**
- Enhanced geographical coverage
 - **Euro area, European Union and Member States**
- New design, keeping the same features of the selected PEEIs page + additional ones
 - **Direct data download, full screen view**

The PEEIs dashboard (V)

- Some uncertainties persisting when looking at the PEEIs dashboard
 - **GDP and IPI showing not very similar trends**
 - **No clear evidence on the end of the price stagnation when comparing HICP and PPIs data**
- Lack of clear answers to the following questions:
 - **Are the European economies growing below or above the trend?**
 - **How synchronised are European economies?**
 - **Which economies are still in a slowdown or in a recessionary phase in their economic cycle?**

The PEEIs dashboard (VI)

- Very detailed and reliable picture of the short-term macroeconomic evolution
- Few drawbacks emerged
 - **Lack of timeliness of some indicators**
 - Especially in comparison to US ones
 - **No clear identification of cyclical features**
 - Turning points, degree of synchronisation
- Better reading of the macroeconomic evolution by combining dashboard with more sophisticated indicators
 - **Based on advanced statistical and econometric techniques**

Summarising information and composite indicators (I)

- Summarising information to overcome drawbacks and limitations of dashboards and scoreboards
- Summarising information tools capturing and highlighting
 - **Driving forces**
 - **Key events**
- Privileging synthetic information instead of detailed pictures

Summarising information and composite indicators (II)

- Wide variety of methods and tools
 - **graphical vs. mathematical techniques**
 - **non-parametric statistical methods vs. parametric ones**
 - **linear vs. non-linear approaches**
- Composite indicators: the most popular way to summarise information
 - **Often criticised in social and socio-economic fields**
 - **Widely used in the macroeconomic area**

Summarising information and composite indicators (III)

- Social and socio-economic phenomena
 - **Simultaneous presence of quantitative and ordinal variables**
 - **Reference variable not necessarily measurable in a cardinal way**
 - **Non unique way of measuring the reference variable**
- Macroeconomic phenomena
 - **Almost all data quantitative or quantified**
 - **Reference variable represented by a quantitatively measured indicator or by a combination of quantitative ones**
- Applying standard statistical techniques for constructing composite indicators not appropriate for social and socio-economic phenomena

Summarising information and composite indicators (IV)

- Composite indicators often replaced by ranking techniques or social and socio-economic phenomena
 - **POSET (Partially ordered sets)**
- In macroeconomic area, composite indicators widely used
 - **Still ongoing debate on pooling techniques vs. Model based ones**
 - **Role of subjectivity**
- In macroeconomics , composite indicators not intended to approximate an unobserved or unmeasurable reference variable but for
 - **Filling data gaps**
 - **Highlight hidden components**

Summarising information and composite indicators (V)

- Composite indicators mainly used to estimate in real-time or anticipate:
 - **The evolution of the reference variable**
 - **The behaviour of unobserved components such as trend and cycle**
 - **Occurrence of rare events such as turning points**
- Composite indicators by timing
 - **Leading, coincident, lagging**
- Composite indicator by construction method
 - **Pooling, parametric, non-parametric, linear and non-linear**

Multivariate coincident indicators for turning points detection (I)

- Great interest of users in a detailed picture of the cyclical situation
- Growing attention to cyclical facts, especially after the global economic and financial crisis
- Cyclical features often hidden when looking at PEEIs and more generally to official statistics
 - Irregular component, trend, etc.
- Need of extracting cyclical signals from PEEIs
 - Constructing turning points coincident indicators

Multivariate coincident indicators for turning points detection (II)

- **Step 1:** Identification of the reference cycle
 - Classical business, growth and acceleration cycles
- Classical business cycle: detecting recessions but not informative during long recession phases
- Growth cycle: Positioning the economic growth above or below the trend; anticipating recessions phases but not providing clear information on recessions start
- Acceleration cycle: highest number of fluctuations but very volatile
- Eurostat approach: jointly monitoring cycles
 - ABCD sequence and $\alpha AB\beta CD$ sequence
 - α and β : peaks and troughs of the acceleration cycle
 - A and D: peaks and troughs of the growth cycle
 - B and C: peaks and troughs of the classical business cycle

Multivariate coincident indicators for turning points detection (III)

- **Step 2:** Calculation and regular update of historical dating chronologies
 - Business cycle, growth cycle, acceleration cycle
 - $\alpha AB\beta CD$ sequence
- Non-parametric dating algorithm
 - GDP, Unemployment, IPI
 - Turning points frozen after a given number of years
- Dating chronologies available for euro area and 11 member countries
 - Soon available for the remaining ones

Multivariate coincident indicators for turning points detection (IV)

- **Step 3:** Construction of a middle-sized dataset mainly containing original PEEIs and opinion surveys indicators together with their most appropriate data transformation highlighting cyclical movements.
- **Step 4:** Variable selection based on the ability of timely and precisely detecting turning points within a real-time simulation exercise against the non-parametric historical turning point historical dating (Step 2).

Multivariate coincident indicators for turning points detection (V)

- **Step 5:** Selected variables are used to identify and estimate a number of autoregressive Markov-Switching models (MS-VAR):

$$\text{MSIH (K) – VAR (L)}$$

Where H indicates the presence of heteroskedasticity, (K) is the number of regimes and (L) the number of lags of the autoregressive part

- Step 5 remark : dealing simultaneously with growth cycle and business cycle implies a number of regimes not smaller than 4 , while the heteroskedastic part can or cannot be present depending on the degree of asymmetry of fluctuations

Multivariate coincident indicators for turning points detection (VI)

- **Step 6:** From step 5, N best fitting models are identified, each of them producing a pair of coincident indicators:

MS-VAR GCCI (j) and MS-VAR BCCI (j); $j=1\dots n$

- Step 6 remark 1: each composite indicator is defined between 0 and 1, and can be viewed as a composite probability of being in a recessionary phase for the MS-VAR BCCI (j) and in a slowdown phase for the MS-VAR GCCI (j)
 - Recession/slowdown regions defined on the basis of a threshold, usually equal to 0,5
 - Step 6 remark 2: MS-VAR BCCI (j) > 0.5 = recession
MS-VAR GCCI (j) > 0.5 = slowdown
- By construction, MS-VAR BCCI (j) > 0.5 \rightarrow MS-VAR GCCI (j) > 0.5
- ABCD sequence always fulfilled

Multivariate coincident indicators for turning points detection (VII)

- **Step 7:** The indicator for the acceleration cycle, labelled as ACCI (acceleration cycle coincident indicator), cannot be modelled within the multivariate framework described in step 6 for the growth cycle and business cycle coincident indicators due to purely mathematical reasons. It is then independently computed by means of a univariate two regimes Markov-Switching model fit to the economic sentiment indicator.

Multivariate coincident indicators for turning points detection (VIII)

- **Step 8:** Within a real-time simulation exercise, the N pair of composite coincident indicators is compared with the non-parametric historical turning point dating.

Multivariate coincident indicators for turning points detection (IX)

- **Step 9:** Identification of the best performing pair of coincident indicators based on the outcome of step 7 using the following criteria:
 - Maximisation of the Concordance Index
 - Minimisation of the Brier's Score (QPS)
 - Minimisation of type-2 errors: detection of false cycles
 - Minimisation of type-1 errors: missing cycles
- Step 9 remark: due to the trade-off between type-2 and type-1 errors, the simultaneous minimisation of both is unachievable
 - A conservative approach suggests to privilege the minimisation of type-2 errors: detection of false cycles

Multivariate coincident indicators for turning points detection (X)

- **Step 10:** Steps 1 to 9 are then replicated for each euro area country to construct national multivariate coincident indicators for turning point detection.
- Step 10 remark 1: In a first stage the euro area model specification is tested and then amended taking into account countries' specificities.
- Step 10 remark 2: Currently seven euro area countries are available (Germany, France, Italy, the Netherlands, Spain, Belgium and Portugal), while the full coverage will be achieved soon.

Multivariate coincident indicators for turning points detection (XI)

Models summary

Country	Model	Recession s	Slowdown s	Variables (differentiation order)						NPCR	IN DE A7
				IPI	UR	BUIL	IND	CONS	RETA		
Belgium	MSI(4)-VAR(0)	R1	R1+R2	6	3	6	3	-	3		
France	MSIH(4)-VAR(0)	R1	R1+R2	6	1	3	-	1	12		
Germany	MSIH(4)-VAR(0)	R1	R1+R2	3	3	3	-	6	12		
Italy	MSIH(5)-VAR(0)	R1	R1+R2	3	3	-	12	12	3		
Netherlands	MSIH(4)-VAR(0)	R1	R1+R2	12	-	6	3	1	1		
Portugal	MSI(5)-VAR(0)	R1+R2	R1+R2+R3	6	-	3	3	12	1		
Spain	MSIH(4)-VAR(0)	R1	R1+R2	12	12	3	6	12	-		
EA	MSIH(4)-VAR(0)	R1	R1+R2	6	1	-	-	-	-	4+ MA(6)	1

Multivariate coincident indicators for turning points detection (XII)

Growth cycle outcome summary

Country	Slowdown missed	False slowdown	Average delay in locating Slowdowns start (in months)	Accuracy in signalling slowdown	
				Brier's Score (QPS)	Concordance Index
Belgium	0	1 (2005)	0.7	0.16	0.83
France	1 (1998)	0	3.2	0.16	0.82
Germany	1 (1998)	0	2.5	0.20	0.79
Italy	0	0	4.3	0.22	0.77
Netherlands	1 (1995 – 1997)	0	2.0	0.18	0.80
Portugal	0	3	0.6	0.18	0.80
Spain	1 (1997-1998)	0	4.3	0.27	0.72
EA direct	0	1 (2004-2005)	2.0	0.15	0.83
EA indirect	1 (1998)	0	3.0	0.10	0.87

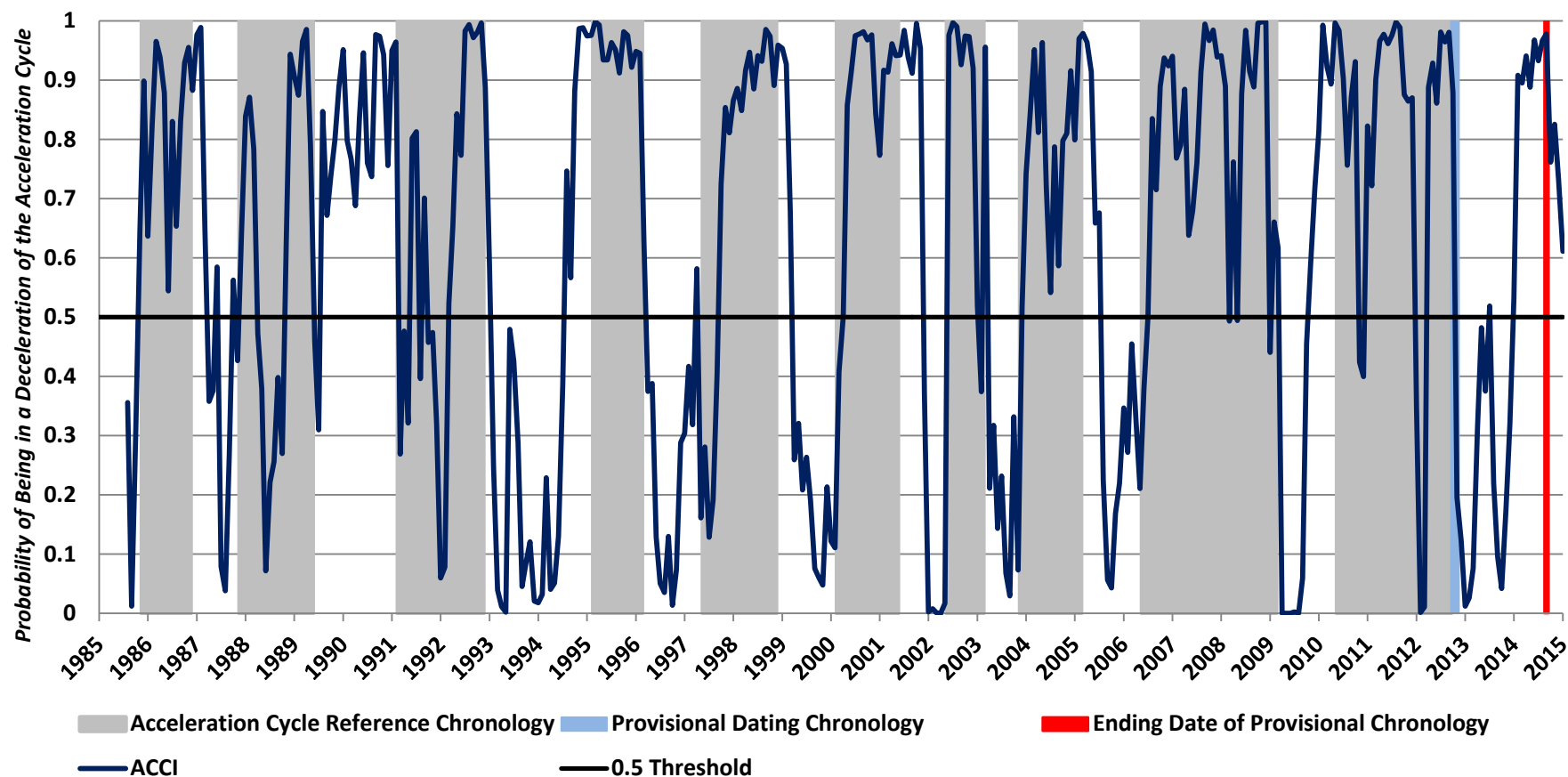
Multivariate coincident indicators for turning points detection (XIII)

Business cycle outcome summary

Country	Recessions missed	False recessions	Average delay in locating peaks (in months)	Accuracy in signalling recessions	
				Brier's Score (QPS)	Concordance Index
Belgium	2 (1998 - 2000)	0	6	0.15	0.84
France	1 (2012)	0	2.5	0.06	0.94
Germany	0	1 (2001 - 2002)	3.4	0.08	0.92
Italy	1 (2001)	0	2.8	0.12	0.87
Netherlands	0	0	3.5	0.12	0.88
Portugal	0	0	4.3	0.17	0.82
Spain	0	0	1.3	0.05	0.94
EA direct	0	0	2.3	0.06	0.94
EA indirect	1 (2011-2013)	0	2.5	0.06	0.90

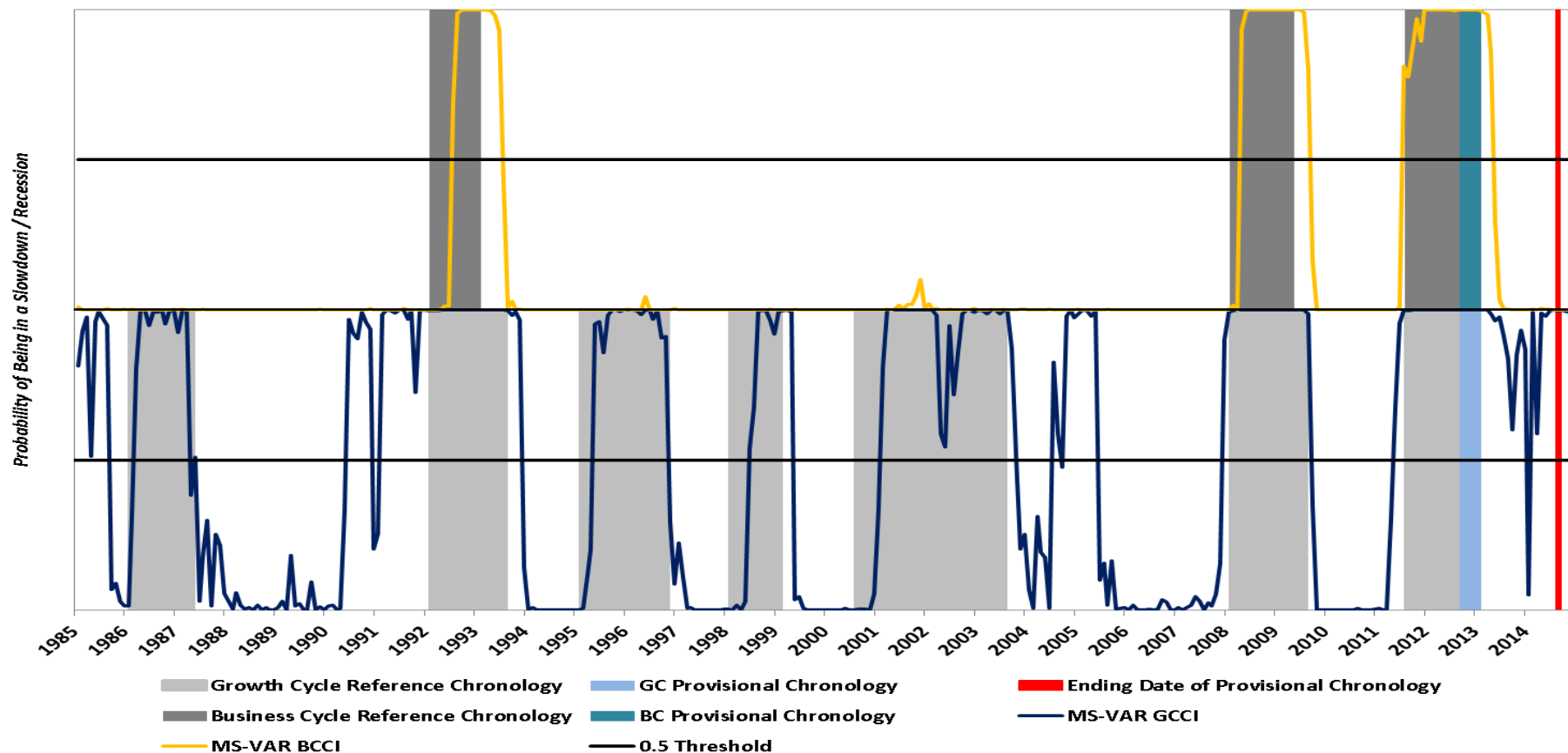
Multivariate coincident indicators for turning points detection (XIV)

Euro Area ACCI univariate



Multivariate coincident indicators for turning points detection (XV)

Euro Area MS-VAR BCCI and GCCI multivariate



Multivariate coincident indicators for turning points detection (XVI)

- Complex reading of the indicators presented above, especially for non-expert audience
- Complex detection of a synthetic cyclical message from the simultaneous analysis of the three indicators
- Problematic country comparison
 - **Synchronisation**
 - **Turning point diffusion**
- Need for a graphical friendly tool to display the cyclical situation in a clear and understandable way
 - **Allowing for multi-country comparison**

Business cycle clock (I)

- The new business cycle clock: providing a clear and understandable picture of the cyclical situation based on the $\alpha\text{AB}\beta\text{CD}$ approach
- Turning points and coincident turning point indicators as the engine of the tool
- Cyclical turning points located in a clock delimitating well defined cyclical phases
- Dynamic application
 - **Evolution over the time**
 - **Cross-country comparison**

Business cycle clock (II)

The web page

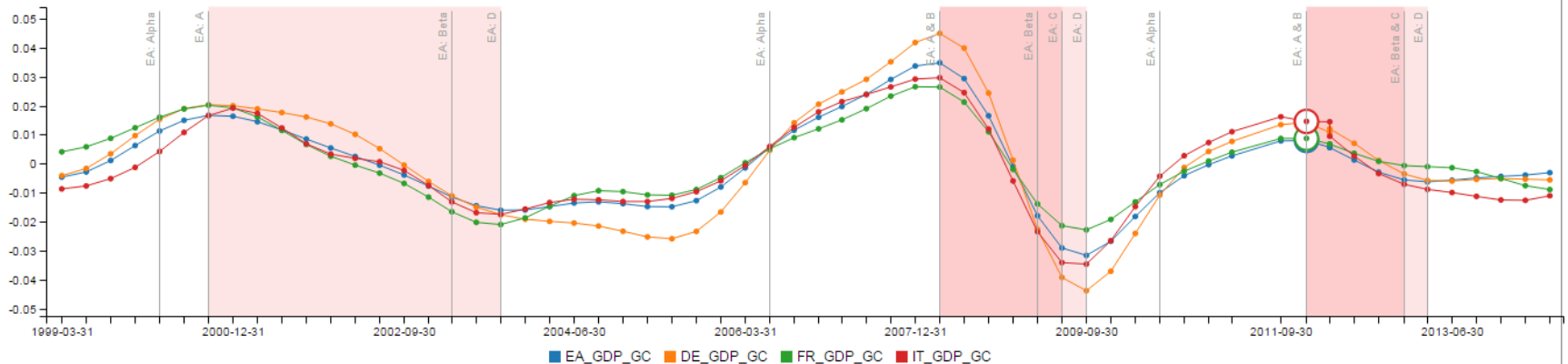
- The web application is composed of 3 elements:
 - the upper part of the window is dedicated to the graph representation
 - the lower left corner of the window is dedicated to the business cycle clock
 - the lower right corner is used to present cycle statistics

Business cycle clock (III)

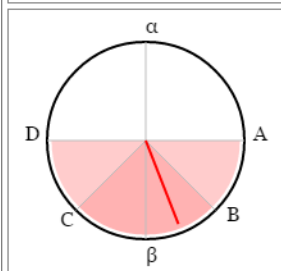
Illustration of the website

Business Cycle Clock

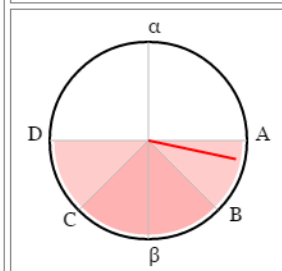
BC#1 BC#2 BC#3 BC#4



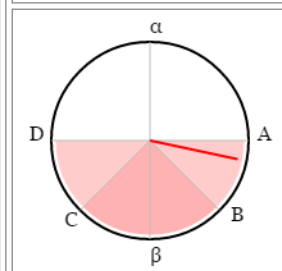
EA => 01/12/2011



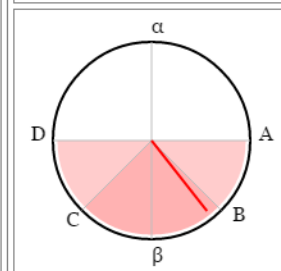
DE => 01/12/2011



FR => 01/12/2011



IT => 01/12/2011



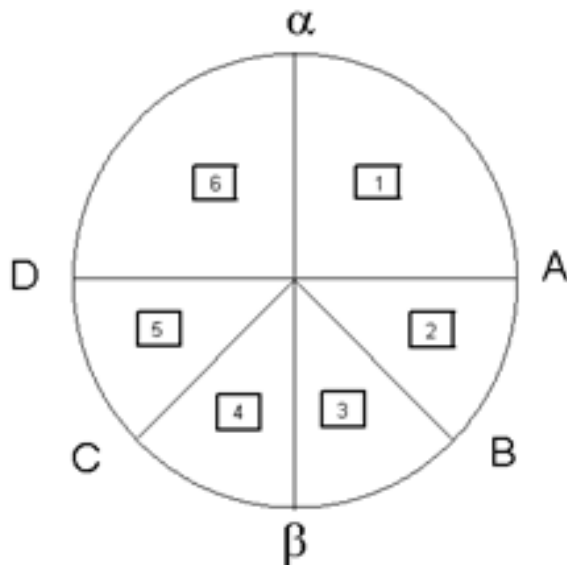
Current Cycle Durations

EA
Slowdown = 13 quarters
Recession = 0 quarters

FR
Slowdown = 13 quarters
Recession = 0 quarters

Business cycle clock (IV)

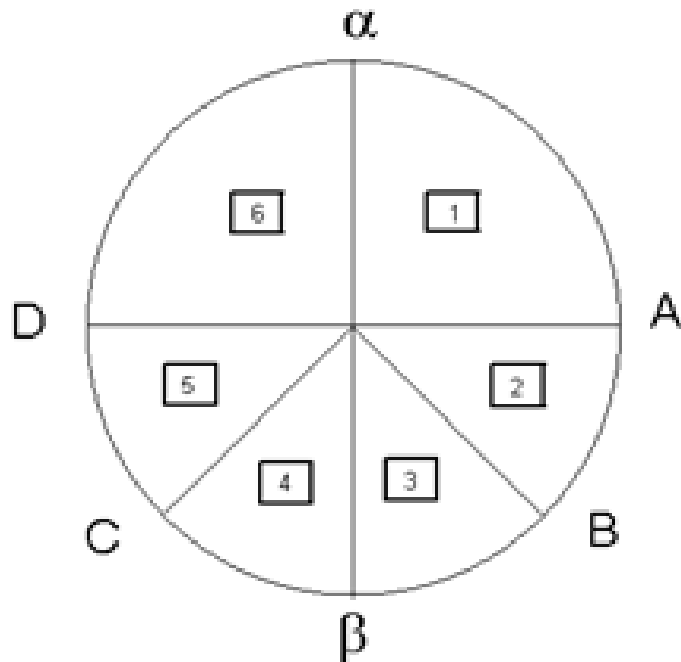
The clock framework



- Noon is α , peak of the growth rate cycle
- 3 pm is A, peak of the growth cycle
- 4.30 pm is B, peak of the business cycle
- 6 pm is β , trough of the growth rate cycle
- 7.30 pm is C, trough of the business cycle
- 9 pm is D, trough of the growth cycle

Business cycle clock (V)

Relationship with cyclical indicators

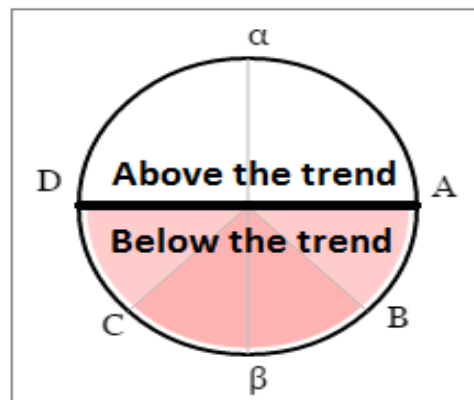


Using the Growth, Business and Acceleration cycles indicators, we compute the location of the hand, associating each clock sector to values of the indicators.

ACCI					
<0.5			>0.5		
BCCI			BCCI		
<0.5		>0.5		<0.5	
>0.5		<0.5		>0.5	
GCCl	<0.5	6		1	
	>0.5	5	4	2	3

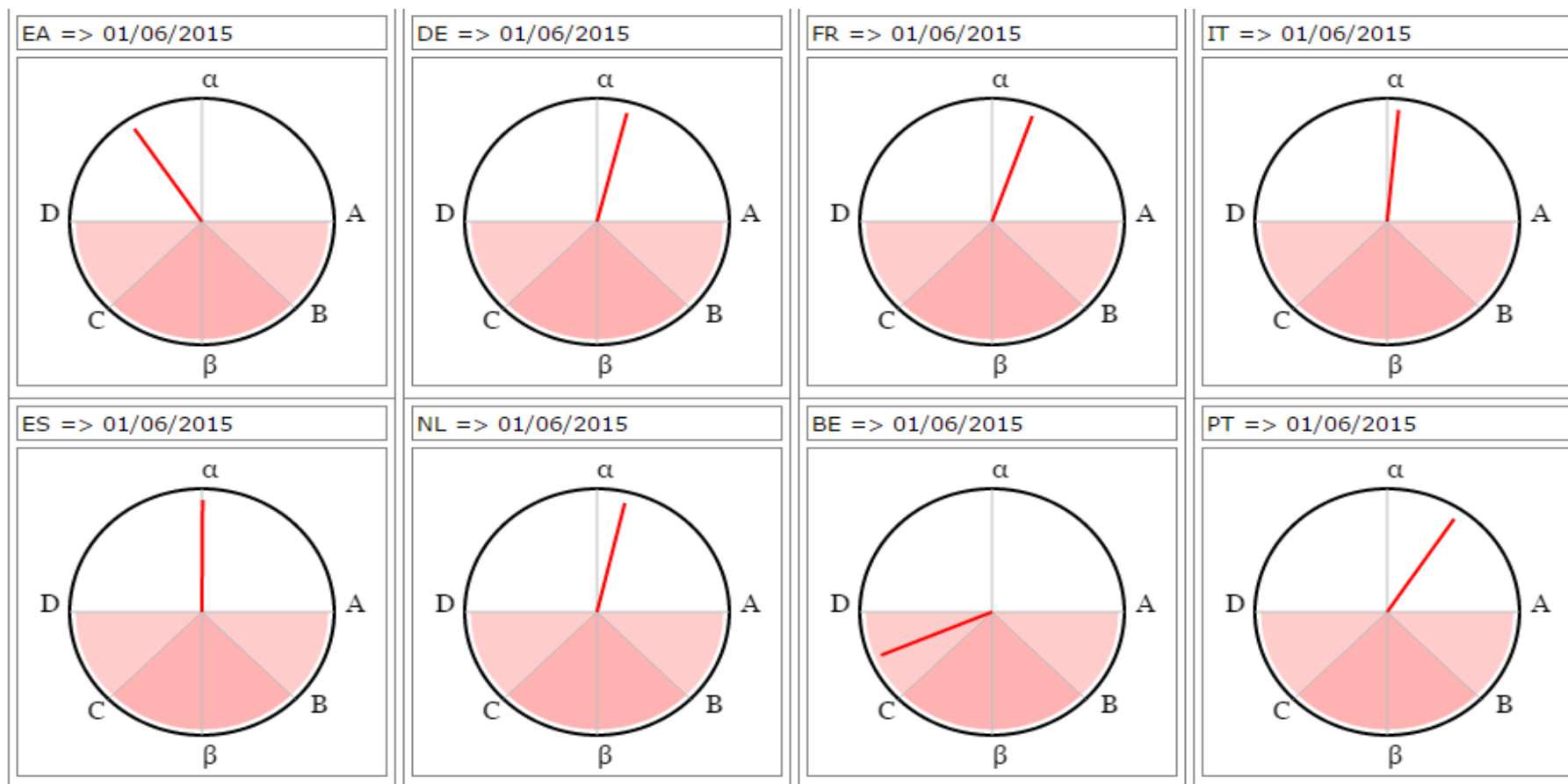
Business cycle clock (VI)

- Useful information on economic growth delivered by the business cycle clock
- Is the economy growing above or below the trend?
- Is the economic growth accelerating or decelerating?



Business cycle clock (VII)

Cyclical situation of the euro area and some member countries in June 2015



Business cycle clock (VIII)

- Using the clock for a comparative study of the exit from the slowdown and the recession started in 2011
- Useful information in terms of synchronisation and diffusion of turning points across euro area member countries
- Possibility of deriving synchronisation and diffusion measures based on the clock outcomes

Business cycle clock (IX)

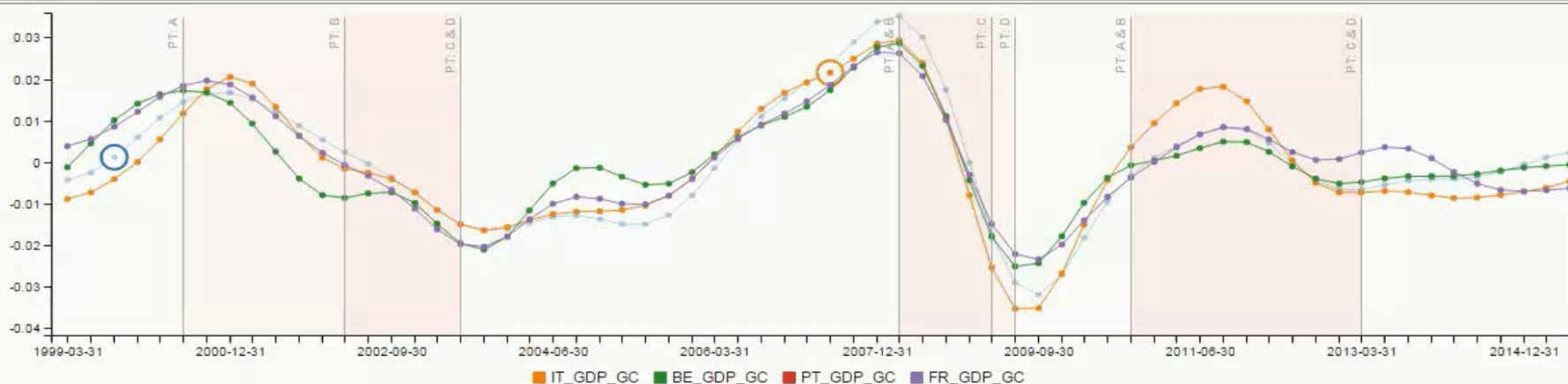
Analysis of the 2012/2013 recession at euro area and member countries level



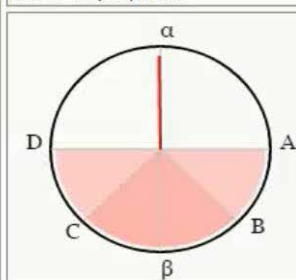
Business cycle clock (X)

Business Cycle Clock

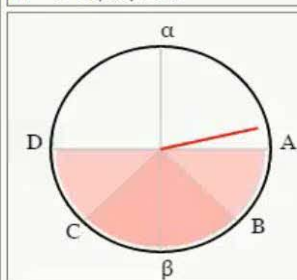
BC#1 France BC#2 Portugal BC#3 Belgium BC#4 Italy



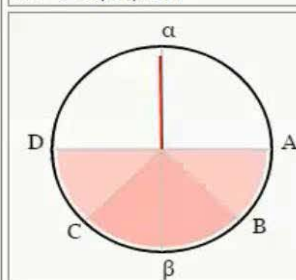
FR => 01/06/2007



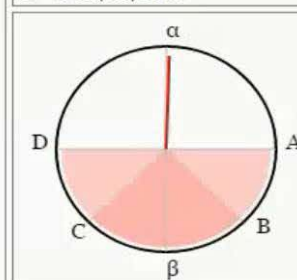
PT => 01/06/2007



BE => 01/06/2007



IT => 01/06/2007



Current Cycle Durations

EA
Slowdown = 13 quarters
Recession = 0 quarters

FR
Slowdown = 13 quarters
Recession = 0 quarters

Conclusions

- Official statistics complemented by financial and survey indicators as the core of a monitoring system of macroeconomic evolution
- Providing data in a dashboard form helping users in having an overall picture of the macroeconomic evolution
- Complementing dashboards with advanced statistical and econometric techniques as well as dissemination techniques
 - **Nowcasting business cycle indicators**
 - **Friendly tool for cyclical monitoring**
- Real-time monitoring of the macroeconomic evolution with clear messages on cyclical position