A monthly indicator of the business climate in the French service industry based on series of different frequencies

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A Monthly Indicator of the Business Climate in the French Service Industry

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Plan

- Confidence indicator
- Business climate indicator based on static factor model
- Need to developp a dynamic business climate indicator in the services sector
- Dynamic factor model
- Some results

Confidence indicator

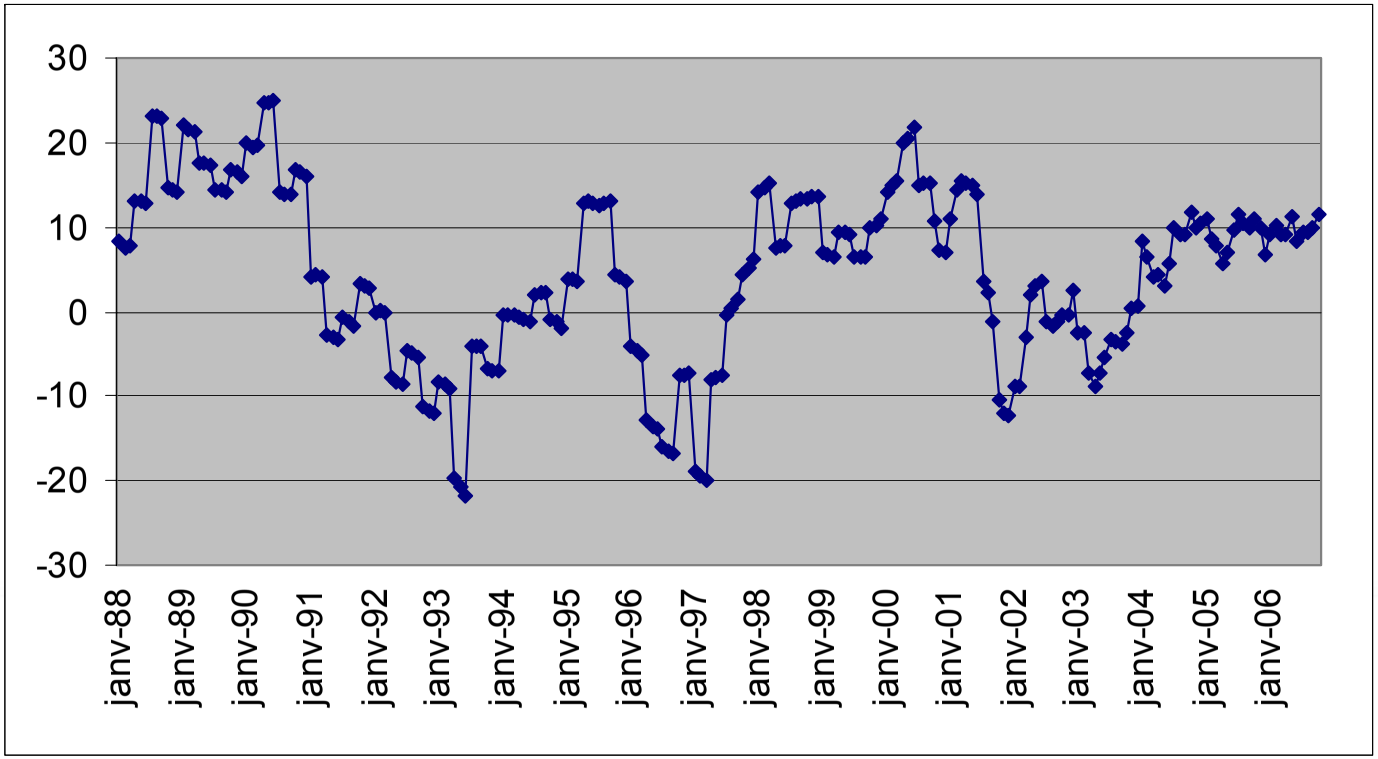
- Confidence indicator calculated by European Commission is a simple arithmetic mean of balances:

$$\overline{F_t} = \sum_{i=1}^{n} y_{i,t}$$

with $y_{i,t}$ value at time t of balance i.

- For example, the services confidence indicator published by EC is a simple arithmetic mean of the balances (%) for the questions on:
  - Business situation,
  - Recent evolution of demand,
  - Expected evolution of demand.

Services confidence indicator for France



Source : DG-ECFIN

Business climate indicator …

- Can go further and calculate a weighted arithmetic mean of n balances:

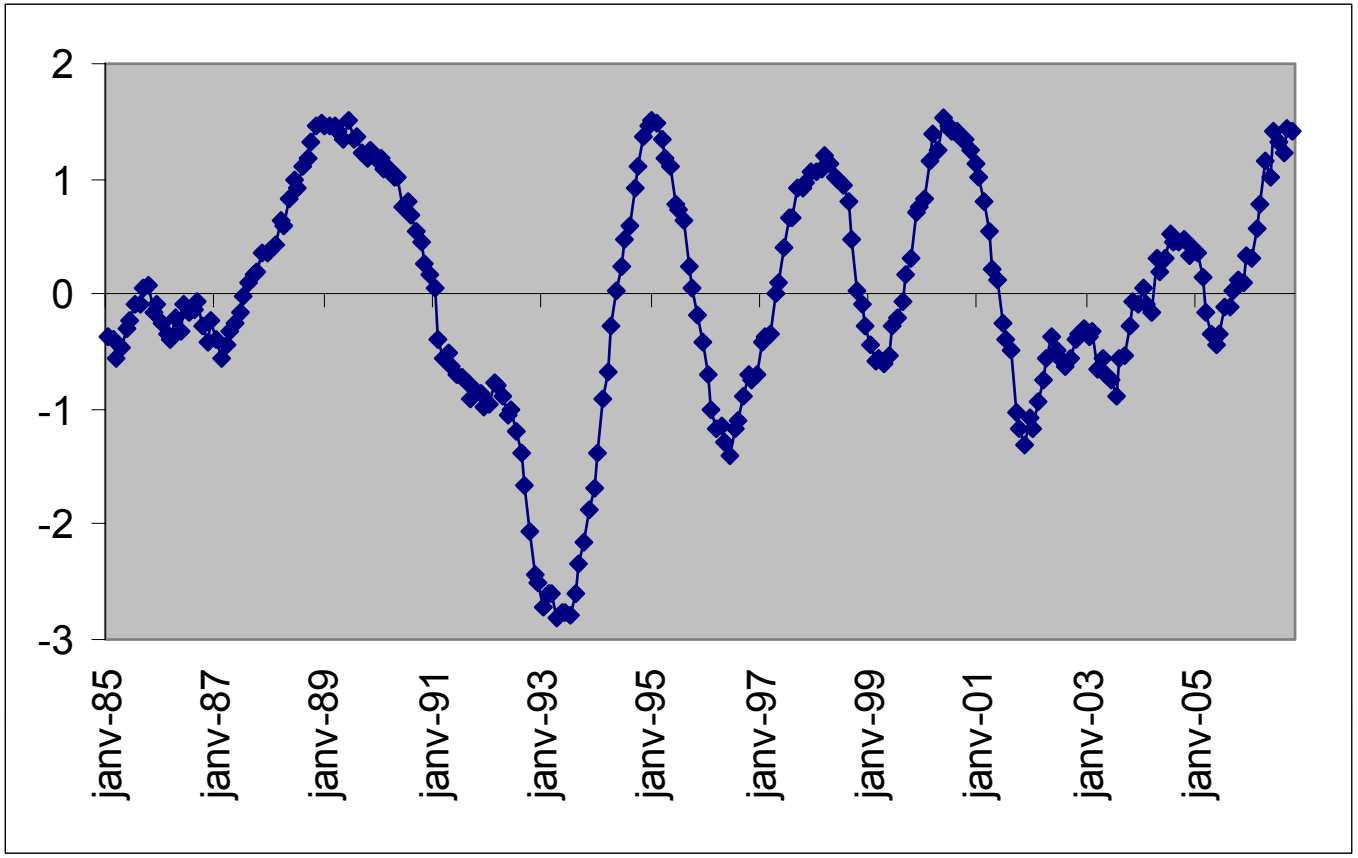
$$\overline{F}_t = \sum_{i=1}^{n} \alpha_i y_{i,t}$$

with $y_{i,t}$ value at time t of balance i,

and α_i weight of balance i.

- For example industrial business climate indicator published by EC is a weighted arithmetic mean of the balances (%) for the questions on:
  - Recent production trends,
  - Stocks,
  - Order books
  - Export order books,
  - Production expectation.

Industry business climate indicator



Source : DG-ECFIN

… based on static factor model

› Business climate indicator is based on a factorial analysis, which is a statistical method used to summarise a set of variables by constructing a few "common factors" F_i' related to all of the variables y_i and "specific factors" related to each individual variable only.

Each balance of opinion is seen as the sum of two terms : a factor common to all the balances of opinion and a second component specific to each series

$$y_{i,t} = \underbrace{\lambda_i F_t}_{\text{common factor}} + \underbrace{u_{i,t}}_{\text{residual}}$$

with $y_i, 1 \leq i \leq I$ the balances of opinion, t the month, and λ_i the loadings.

… based on static factor model

- The model is written in matric form: $y_t = \Lambda F_t + u_t$

- With standards assumptions one obtains estimate of the common factors, linear combinations of the observed variables:

$$\hat{F}_t = \hat{A} y_t$$

- For example, the industry business climate indicator calculated by INSEE is as follow:

F = 0,25 Past production
+ 0,16 Production expectation (CI)
+ 0,35 Order books (CI)
+ 0,16 Export order books
- 0,07 Stocks (CI)
+0,08 General industrial expectation (specific question in France)

(computed with SAS proc factor)

Need to develop a dynamic business climate indicator …

› Need sometimes to go further and to calculate a time depending weighted arithmetic mean of n balances:

$$\overline{F}_t = \sum_{i=1}^{n} \alpha_{i,t} y_{i,t}$$

with $y_{i,t}$ value at time t of balance i,
and $\alpha_{i,t}$' weight at time t of balance i.

Why ?

› Point 1: To raise some assumptions of the static model
  – Are the "static" residuals white noises?
  – Does the common factor present autocorrelation?

Need to develop a dynamic business climate indicator …

- Point 2: To be able to use series of different frequencies or presenting frequency changes.
- Is the case of french services survey.

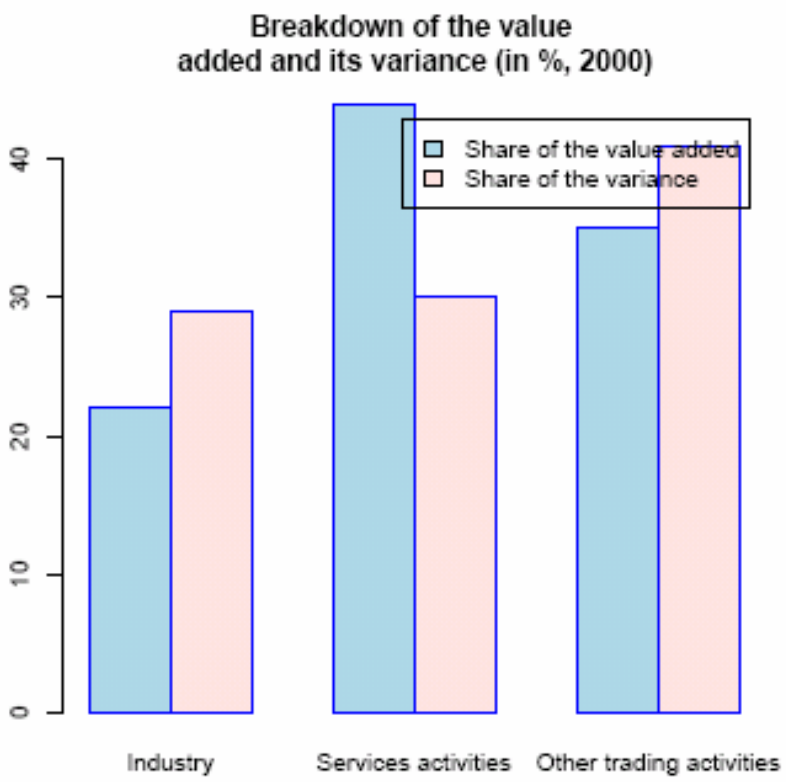
Series	Description	Frequency	Available
OOR	Observed operating result	Quarterly	1988Q1
EOP	Expected operating result	Quarterly	1988Q1
ED	Expected demand	Quarterly	1988Q1
OT	Observed turnover	Quarterly / monthly	1988 Q1 /June 2000
ET	Expected turnover	Quarterly / monthly	1988 Q1 /June 2000
GP	Global prospects	Monthly	June 2000

- As : - services sector is crucial for the short term economic analysis,

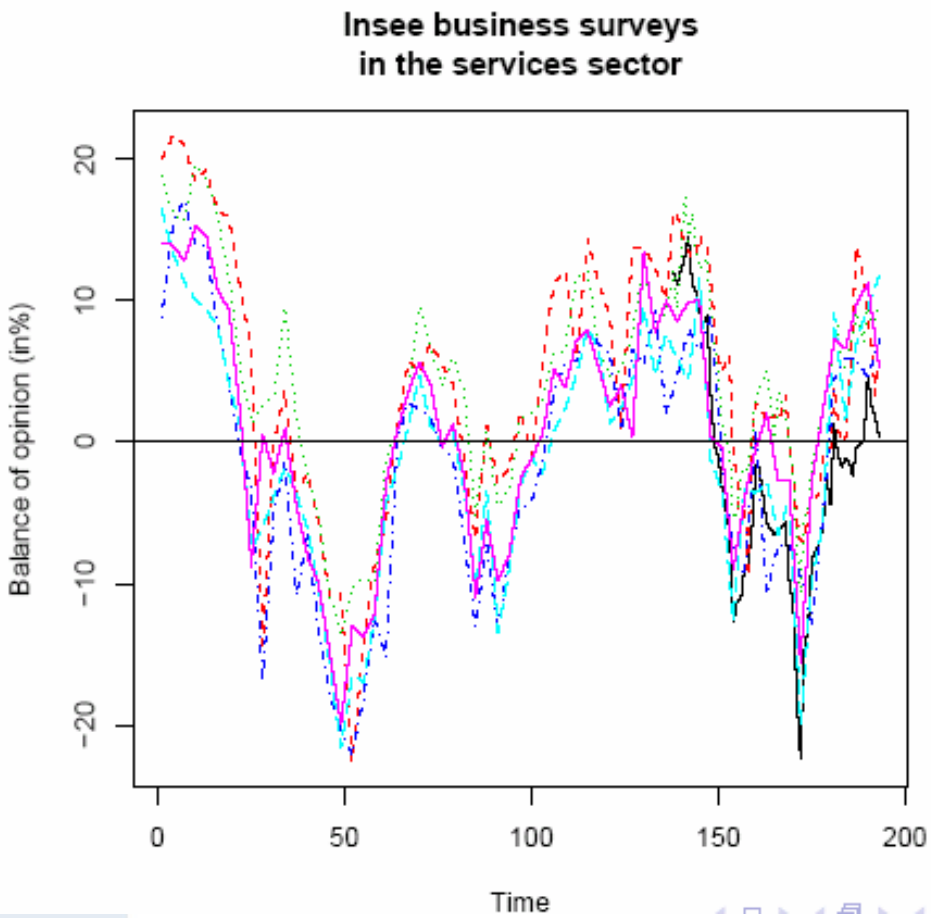
  - services business survey conducted by INSEE plays a key role,

  a monthly synthetic indicator, using quaterly and monthly balances of opinion, has been built in order to get a better understanding of the business climate in the services sector.

Need to develop a dynamic business climate indicator …



Need to develop a dynamic business climate indicator …



	CAPA	CAPRE	PGSEC	DEM	REPA	REPRE
CAPA	1.00	0.85	0.87	0.81	0.93	0.84
CAPRE	**0.85**	1.00	0.90	0.92	0.87	0.91
PGSEC	**0.87**	**0.90**	1.00	0.82	0.82	0.83
DEM	**0.81**	**0.92**	**0.82**	1.00	0.85	0.94
REPA	**0.93**	**0.87**	**0.82**	**0.85**	1.00	0.84
REPRE	**0.84**	**0.91**	**0.83**	**0.94**	**0.84**	1.00

Dynamic factor model

› Therefore, some additional assumptions (point 1):

Following [Doz et Lenglart, 95], we chose an ARMA(2,1) for the common factor and an AR(1) for the residuals.

$$\begin{aligned} F_t &= \phi_1 F_{t-1} + \phi_1 F_{t-2} + \epsilon_t - \theta \epsilon_{t-1} \\ u_{i,t} &= \rho u_{i,t-1} + \epsilon_{i,t-1} \end{aligned}$$

with $\mathrm{Var}(\epsilon_t) = Id$, and $(\epsilon_{i,t}) \sim \mathcal{N}(0, \sigma_i)$, $\epsilon_t \sim \mathcal{N}(0,1)$ independent gaussian white noise.

› The model can then be rewriten in the following matric form (called state-space representation):

$$\begin{aligned} Y_t &= Z_t \alpha_t && \text{Measurement equation} \\ \alpha_t &= A\alpha_{t-1} + R\eta_t && \text{State equation} \\ \alpha_1 &\sim \mathcal{N}(0, \Sigma) && \text{Initial conditions} \end{aligned}$$

Dynamic factor model

› Dynamic factorial analysis is sufficiently flexible to take into account (point2):

– series of different frequencies:

The length of Y_t and Z_t vary over time,

$$Y_t = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{pmatrix}_t \text{ quaterly} \quad \text{or} \quad Y_t = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix}_t \text{ monthly}$$

– changes of frequency: from January 1988 with April 2000, quarterly series, need just to modify the model as following:

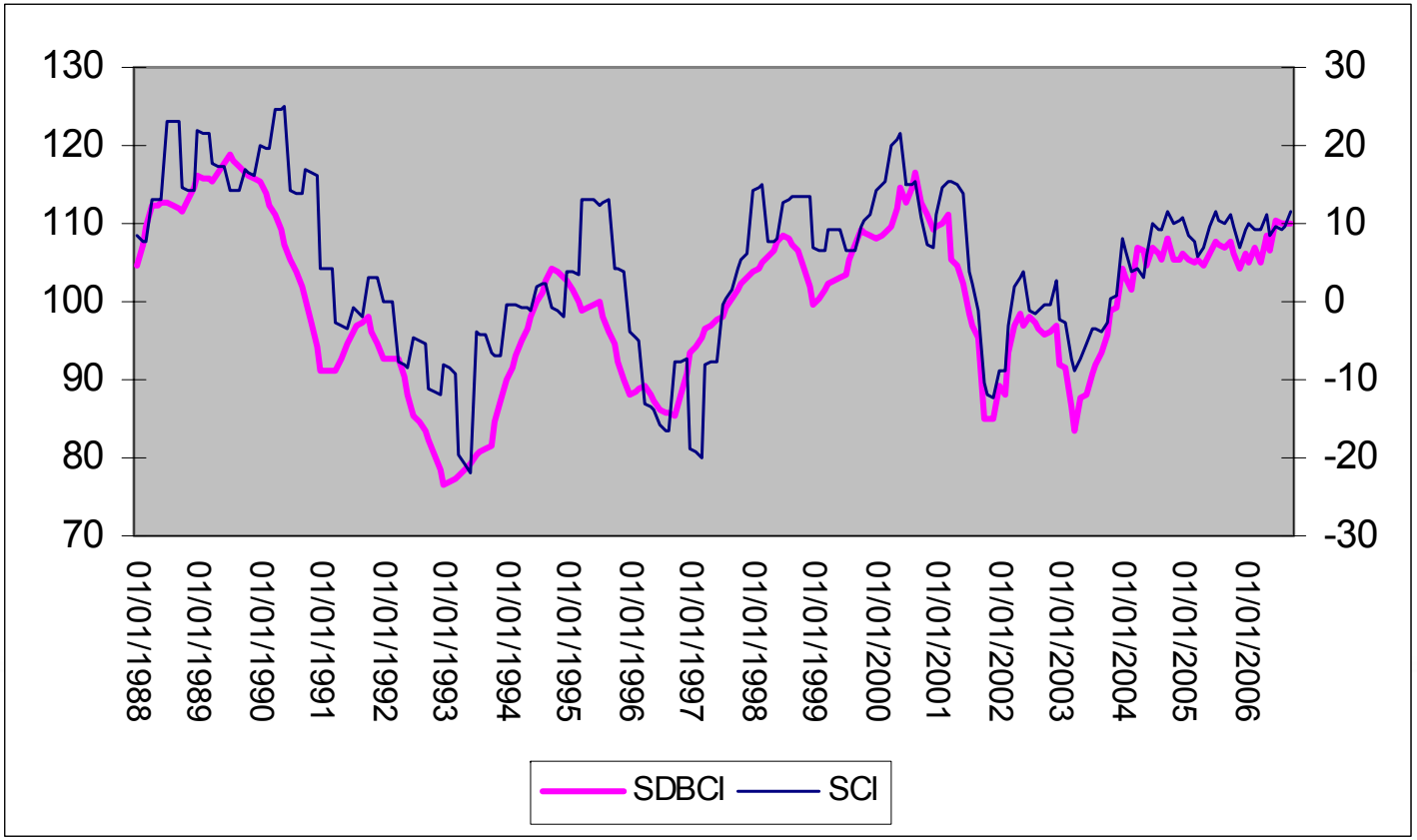
$$\begin{aligned} Y_{t'} &= Z_{t'}\alpha_{t'} \\ \alpha_{t'} &= A_{t'}\alpha_{t'-1} + R_{t'}\eta_{t'} \\ \alpha_1 &\sim \mathcal{N}(0, \Sigma) \end{aligned}$$

with $A_{t'} = A^3$, $R_{t'} = I + R + R^2$ if $t' \leq$ June 2000. t' represents the dates when we have at least one observation.

Estimation

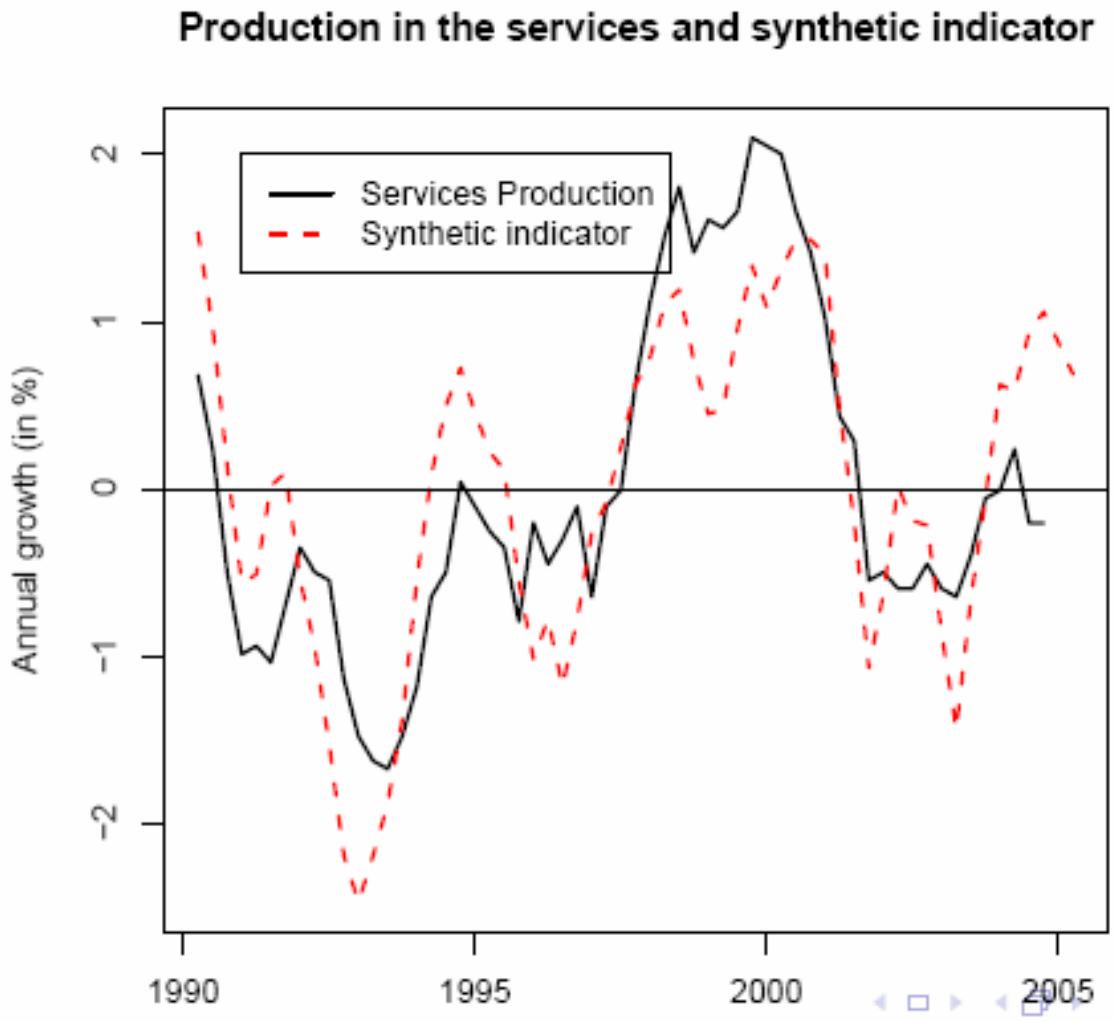
- the likelihood is computed by Kalman filtering.
- the paramaters are estimated by maximum likelihood.
- common factor up to time t : $\hat{F}_t = \mathbb{E}(F_t | I_t)$.

Services dynamic business climate indicator versus services confidence indicator

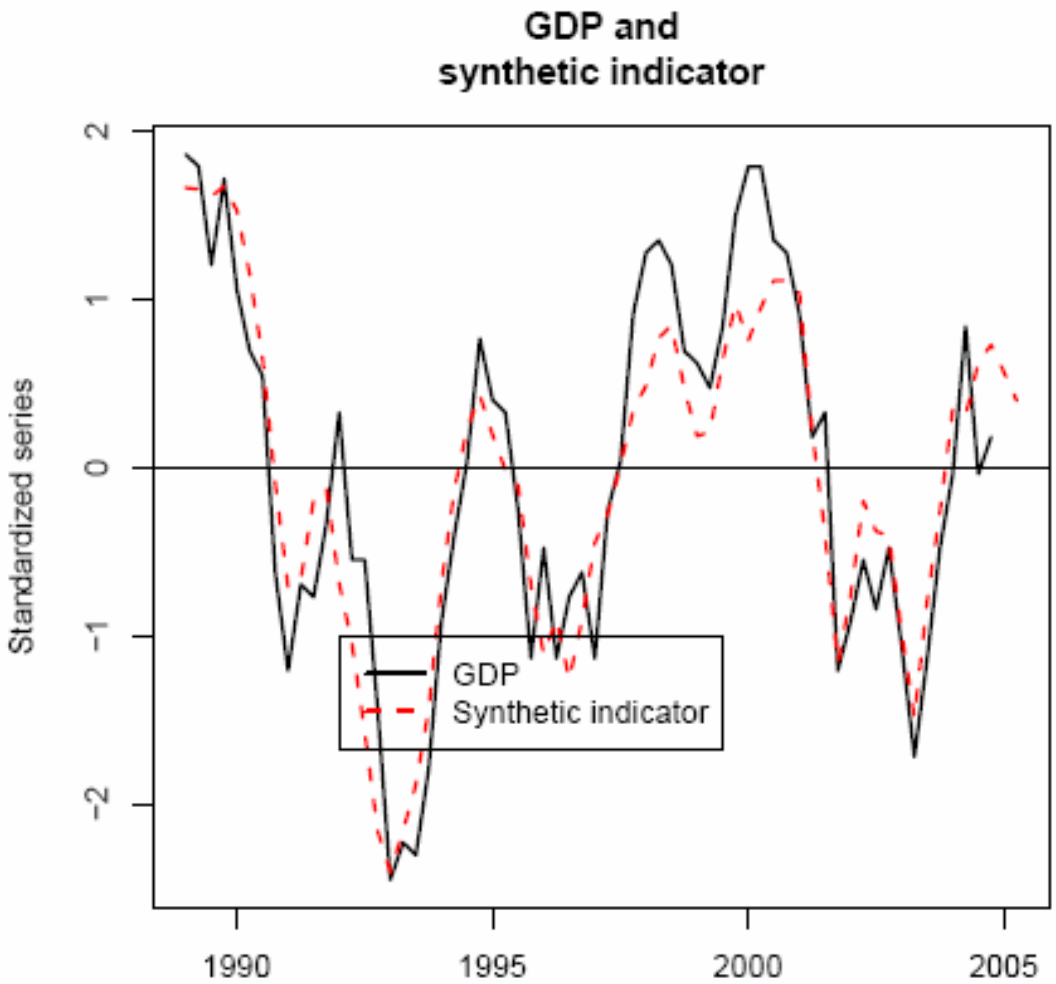


Source :
INSEE : Services dynamic business climate indicator (SDBCI)
DG-ECFIN : Services confidence indicator (SCI)

Some results



Some results



Conclusion

› Services dynamic business climate indicator is a relatively new synthetic indicator for economic outlook:

- adaptative framework with different frequencies date,
- forecasting services production and GDP,
- additional information and complementarity with industry indicator for GDP forecast
- shortcoming and perspectives.

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