A monthly indicator of the business climate in the French service industry based on series of different frequencies
A Monthly Indicator of the Business Climate in the French Service Industry
28th CIRET conference

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Plan

› Confidence indicator

› Business climate indicator based on static factor model

› Need to develop 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
Business climate indicator ...

› Can go further and calculate a weighted arithmetic mean of \( n \) balances:

\[
F_t = \sum_{i=1}^{n} \alpha_i y_{i,t}
\]

with \( y_{i,t} \) value at time \( t \) of balance \( i \),
and \( \alpha_i \) 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 $\gamma_i$ 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

$$y_{i,t} = \lambda_i F_t + u_{i,t}$$

common factor residual

with $y_i, 1 \leq i \leq l$ the balances of opinion, $t$ the month, and $\lambda_i$ 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:

\[
F = 0.25 \text{ Past production} \\
+ 0.16 \text{ Production expectation} \quad \text{(CI)} \\
+ 0.35 \text{ Order books} \quad \text{(CI)} \\
+ 0.16 \text{ Export order books} \\
- 0.07 \text{ Stocks} \quad \text{(CI)} \\
+0.08 \text{ General industrial expectation (specific question in France)}
\]

(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:

\[
\bar{F}_t = \sum_{i=1}^{n} \alpha_{i,t} y_{i,t}
\]

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.

<table>
<thead>
<tr>
<th>Series</th>
<th>Description</th>
<th>Frequency</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>OOR</td>
<td>Observed operating result</td>
<td>Quarterly</td>
<td>1988Q1</td>
</tr>
<tr>
<td>EOP</td>
<td>Expected operating result</td>
<td>Quarterly</td>
<td>1988Q1</td>
</tr>
<tr>
<td>ED</td>
<td>Expected demand</td>
<td>Quarterly</td>
<td>1988Q1</td>
</tr>
<tr>
<td>OT</td>
<td>Observed turnover</td>
<td>Quarterly / monthly</td>
<td>1988Q1 / June 2000</td>
</tr>
<tr>
<td>ET</td>
<td>Expected turnover</td>
<td>Quarterly / monthly</td>
<td>1988Q1 / June 2000</td>
</tr>
<tr>
<td>GP</td>
<td>Global prospects</td>
<td>Monthly</td>
<td>June 2000</td>
</tr>
</tbody>
</table>

› 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 quarterly 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 …

Insee business surveys in the services sector

<table>
<thead>
<tr>
<th>Time</th>
<th>Balance of opinion (in%)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>-20</td>
</tr>
<tr>
<td>50</td>
<td>-10</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
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<tr>
<td>150</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>20</td>
</tr>
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</table>

**Table: Correlation Matrix**

<table>
<thead>
<tr>
<th></th>
<th>CAPA</th>
<th>CAPRE</th>
<th>PGSEC</th>
<th>DEM</th>
<th>REPA</th>
<th>REPRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPA</td>
<td>1.00</td>
<td>0.85</td>
<td>0.87</td>
<td>0.81</td>
<td>0.93</td>
<td>0.84</td>
</tr>
<tr>
<td>CAPRE</td>
<td>0.85</td>
<td>1.00</td>
<td>0.90</td>
<td>0.92</td>
<td>0.87</td>
<td>0.91</td>
</tr>
<tr>
<td>PGSEC</td>
<td>0.87</td>
<td>0.90</td>
<td>1.00</td>
<td>0.82</td>
<td>0.82</td>
<td>0.83</td>
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<tr>
<td>DEM</td>
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<td>0.92</td>
<td>0.82</td>
<td>1.00</td>
<td>0.85</td>
<td>0.94</td>
</tr>
<tr>
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<td>1.00</td>
</tr>
</tbody>
</table>
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.

\[
F_t = \phi_1 F_{t-1} + \phi_1 F_{t-2} + \epsilon_t - \theta \epsilon_{t-1}
\]
\[
u_{i,t} = \rho \nu_{i,t-1} + \epsilon_{i,t-1}
\]

with \( \text{Var}(\epsilon_t) = I d \), 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 rewritten in the following matric form (called state-space representation):

\[
Y_t = Z_t \alpha_t \quad \text{Measurement equation}
\]
\[
\alpha_t = A \alpha_{t-1} + R \eta_t \quad \text{State equation}
\]
\[
\alpha_1 \sim \mathcal{N}(0, \Sigma) \quad \text{Initial conditions}
\]
Dynamic factor model

- Dynamic factorial analysis is sufficiently flexible to take into account (point2):
  
  - series of different frequencies:

    \[ Y_t = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{pmatrix} \quad \text{quarterly} \quad \text{or} \quad Y_t = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix} \quad \text{monthly} \]

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

    \[
    Y_{t'} = Z_{t'} \alpha_{t'} \\
    \alpha_{t'} = A_{t'} \alpha_{t'-1} + R_{t'} \eta_{t'} \\
    \alpha_1 \sim \mathcal{N}(0, \Sigma)
    \]

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

- the likelihood is computed by Kalman filtering.
- the parameters 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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