International business cycle indicators, measurement and forecasting

Seminar at Sveriges Riksbank

May 17, 2005

By

Ard den Reijer

Research Division

De Nederlandsche Bank

Amsterdam

Outline of presentation

- Measuring business cycles
- Filtering techniques
- Descriptive statistics
- Leading indicators of the business cycle
- Further research

Measuring the business cycle

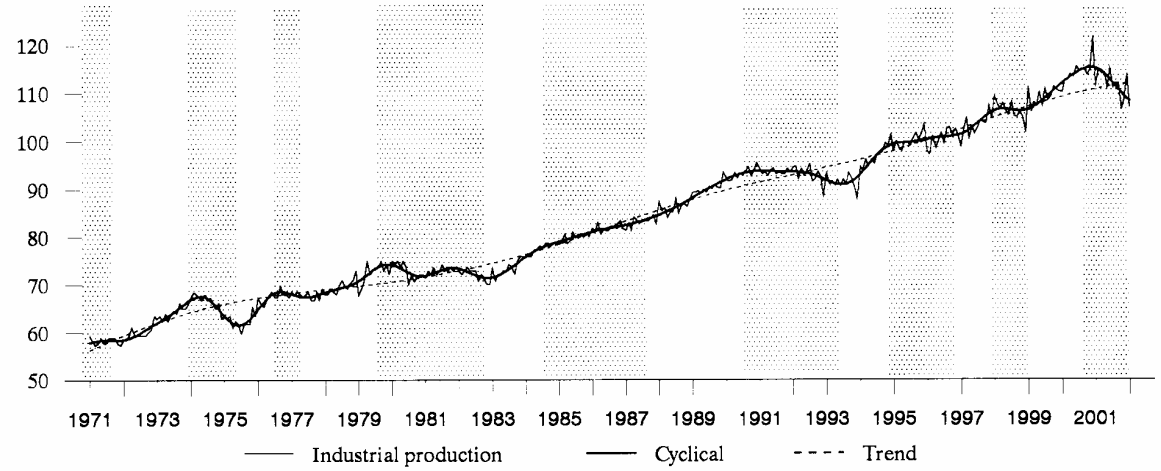
- Classical decomposition of time series into trend, cyclical, season and irregular

- Business cycle frequencies:
  - Stock&Watson (2000) 1.5-8 years
  - Agresti&Mojon (2001) 1.5-10 years

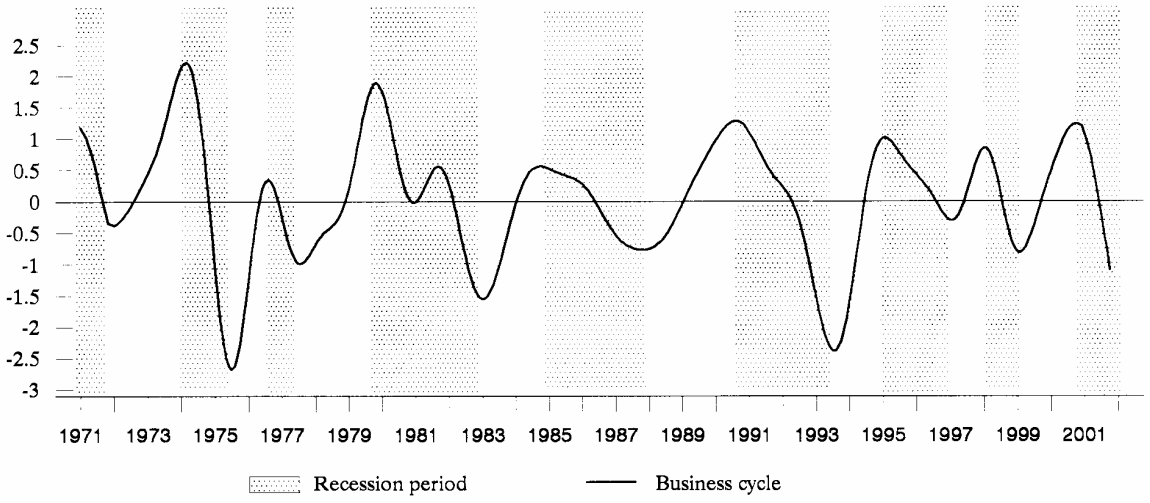
- Reference series: manufacturing output:
  - Close correspondence between cyclicality manufacturing output and gdp-growth (figure 1)
  - Theoretical: some expenditure components of GDP typically not necessarily contemporaneously procyclical
  - Practical: timely and monthly availability of production data (forecasting purpose)

Figure 1 Business Cycle Indicators and GDP-growth for the Netherlands

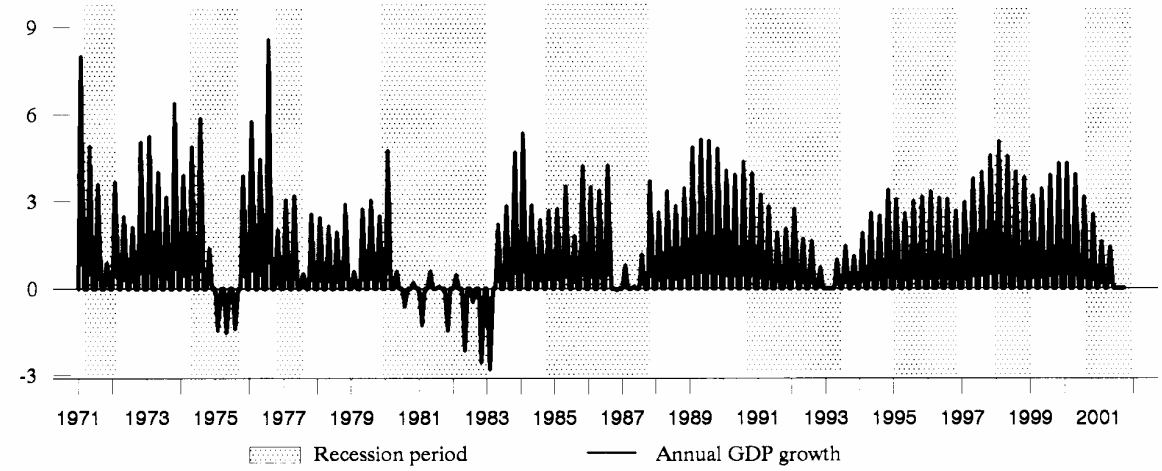
Industrial production, trend and cycle



Business cycle indicator Netherlands



GDP growth rates and cycle dating



Filtering techniques

- HP-filter:
  - spurious cycles Cogley&Nason (1995)
  - trend frequencies: above on average 4-6 years
- Baxter&King (1999) –filter
  - renders (trending) series stationary
  - induces no phase shifts
  - however: trade-off between estimation efficiency and losing data
- Christiano&Fitzgerald (2003) –filter
  - more efficient estimation strategy by using weighting scheme, namely the typical spectral shape of macroeconomic time series.
  - More efficient estimation by using all available data at a negligible cost of phase shift and non-stationarity

Bandpass Filtering

$$\min_{\hat{B}_j^{p,f}\ j=-f,\ldots,p} \int_{-\pi}^{\pi} f_x(\omega)\left|B\left(e^{-i\omega}\right)-\hat{B}^{p,f}\left(e^{-i\omega}\right)\right|^2 d\omega,$$

$$\hat{B}^{p,f}(L)=\sum_{j=-f}^{p}\hat{B}_j^{p,f}L^j,$$

$$B\left(e^{-i\omega}\right)=\begin{cases}1 & \text{for } \omega\in(a,b)\\ 0 & \text{otherwise}\end{cases}$$

With $f_x(\omega)$ is the spectral density of x_t.

Granger (1966), the 'typical spectral shape' of macroeconomic time series is one in which there is substantial power in a significant range of low frequencies

Differences Christiano-Fitzgerald vs Baxter-King

- Stationarity condition $\hat{B}\left(e^{i0}\right)=\hat{B}(1)=0$
- No phase shift in case of symmetry $p=f$
- Weighting scheme: BK $f_x(\omega)=1\forall\omega$

Empirical results: descriptive statistics

- Business cycle dating (Bry-Boschan algorithm): discrete analogue of *dBCI/dt*=0 with rules (alternating top/trough, *BCI* must change sign and local optimum)
- Descriptive statistics: Standard deviation, skewness, kurtosis, duration, amplitude, steepness, sharpness
- Results:
  - Netherlands and Belgium, stability without moderateness, Japan opposite case.
  - US: pattern of smooth rounded peaks and pointed deep troughs
  - Germany: saw tooth; slow expansion phases combined with fast, deep recession phases

Empirical results: international comovement

- Two measures:
  - Contemporaneous cross-correlation
  - Index of concordance: fraction of time two BCI are in the same phase.

$$IC_{ij} = \frac{1}{T}\sum_{t=1}^{T}\left\{S_t^i S_t^j + \left(1 - S_t^i\right)\left(1 - S_t^j\right)\right\}$$

- Result (sample of 25 years):
  - BCI United Kingdom more synchronised with BCI United States than with euro area (countries)

Leading indicators

- Cross-correlation maximization with shifting

- Construct composite leading indicator which replicates and predicts the BCI:
  - selection on economic criteria
  - cross-correlation > 0.5
  - leading with a minimum of 5 months

- Composite leading indicator one dimensional by standardising, synchronising and weighted averaging of selected basic leading indicators

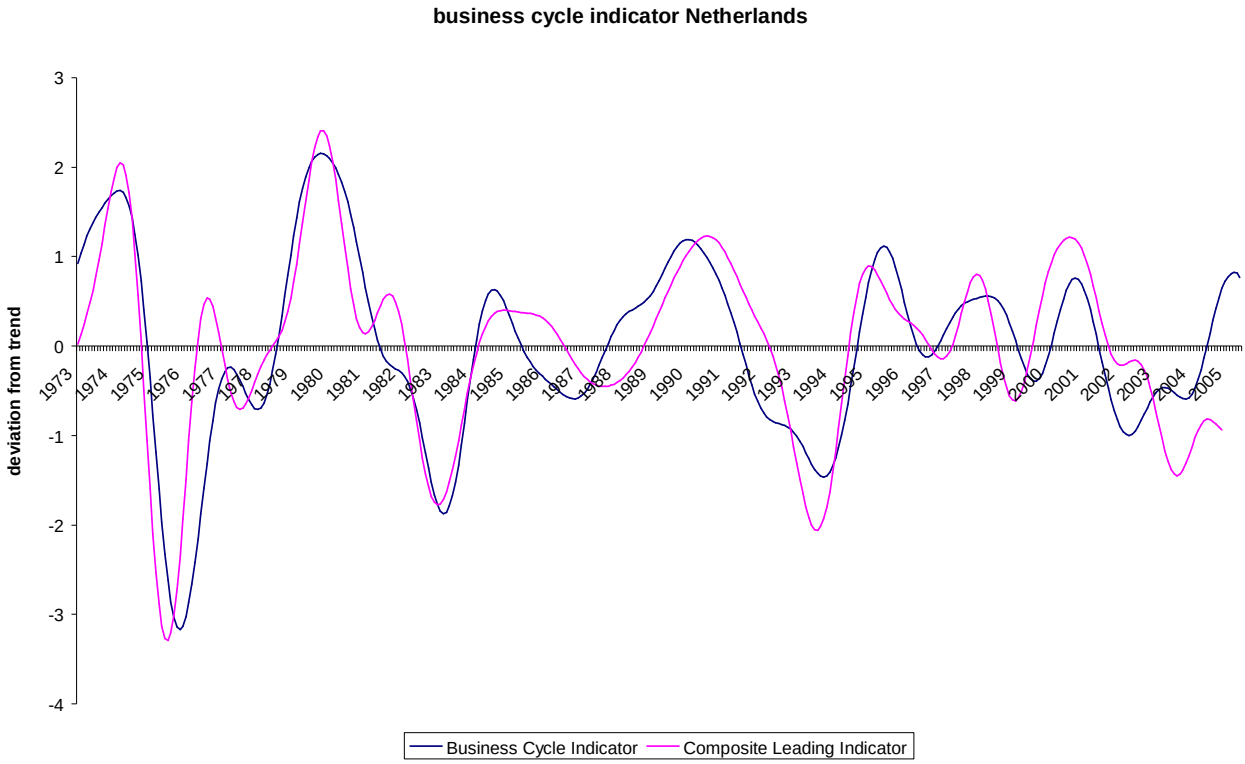
Results leading indicators

- Monetary/financial indicators: short and long term interest rates, equity price and monetary aggregate

- Inventories: non-matching economic flows: storage final products, level order position

- Prices&Wages: world market prices commodities, consumer price index, hourly wage industry, producer price, unit labour costs

- Expectations&confidence: IFO, several surveys, judgement order arrivals, consumer and producer confidence.


business cycle indicator Netherlands
deviation from trend
3
2
1
0
-1
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1973
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1980
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2005
Business Cycle Indicator
Composite Leading Indicator

Current research: real time accuracy

- Real-time accuracy of business cycle measurement:
  - In terms of revisions: MARE

$$MARE_n = \frac{1}{(T-120-n)} \sum_{t=61}^{T-60-n} \left| BCI_{t|t+n} - BCI_{t|T} \right|$$

  - In terms of real-time turning points: