

# The Dutch Business Cycle: Which Indicators Should We Monitor?

With the credit crunch in the banking system and the stock market crash, it is just a matter of time until the unravelling financial turmoil is going to push the real economy into recession. What does that actually mean, being in a recession? And how can you measure and reasonably predict such a thing as a business cycle and its corresponding turning points? The business cycle indicator of the Dutch central bank, De Nederlandsche Bank (DNB) extracts fluctuations from selected macroeconomic variables and represents them in a single index that describes the current stance of the business cycle. This article explains how the DNB business cycle indicator is constructed.

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is currently employed at the central bank of Sweden, Sveriges Riksbank. He constructed the business cycle indicator while he was employed at the Dutch central bank, De Nederlandsche Bank<sup>1</sup>. The analysis is part of his PhD-thesis under supervision of prof. dr. L.H. Hoogduin (University of Amsterdam) and prof. dr. F.C. Palm (Maastricht University). See also his personal website; <http://www.reijer.info>

Various commercial, academic and government institutions use a business cycle indicator as an instrument to measure and predict business cycle developments and its turning points. An accurate assessment of the current and future state of the business cycle is valuable information in the decision process of policy makers and businesses. Most institutions, who regularly publish business cycle indicators, follow the approach of using leading and coincident indicators as developed at the National Bureau of Economic Research (NBER) in the US in the 1930s. Some institutions construct uniform business cycle indicators for several countries. Most notably, the American Conference Board and the Paris based Organisation of Economic Co-operation and Development (OECD) regularly publish their updated indicators for various countries. The OECD also runs an indicator that is specifically calibrated for the Dutch economy, as do the Netherlands Bureau for Economic Policy Analysis (CPB), Rabobank, Statistics Netherlands (CBS) and the universities of Groningen and Rotterdam. This article focuses on the business cycle indicator that is used by DNB and published on their website<sup>2</sup>.

The definition of a business cycle as formulated in the seminal contribution of Burns and Mitchell (1946) reads as follows: *"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent, but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible."* So, business cycles can broadly be defined as oscillating motions of economic activity, which are visible as patterns of fluctuations within macroeconomic variables such as output, production, interest rates, financial markets, consumption, unemployment and prices. The term 'cycle' is misleading in the sense that it suggests a regular periodicity. Each single business cycle is unique and can be characterized by its depth, duration and diffusion. The depth of the cycle represents the cumulative rise (fall) of economic activity during the expansion (recession) phase. The duration of the cycle is the elapsed time between two peaks or troughs and varies from more than one year to ten or twelve years. The diffusion of the cycle represents the extent to which the business cycle is visible across different economic sectors and geographical areas.

The DNB business cycle indicator presents the cyclical outlook in two single indices, as shown in figure 1. The coincident index of the DNB business cycle indicator summarizes the factual stance of the business cycle. The leading indi-

<sup>1</sup> Views expressed are those of the individual author and do not necessarily reflect official positions of De Nederlandsche Bank.

<sup>2</sup> See for the most recent update <http://www.dnb.nl/en/z-onderzoek/auto88154.jsp>

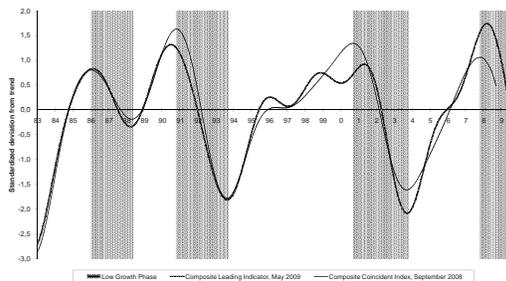


Figure 1: DNB Business Cycle Indicator

icator aims to replicate the coincident index and moreover, aims to project it up to six months ahead into the future. The indicator describes the business cycle as the deviation of economic activity from its trend level. The x-axis of the figure corresponds to the trend level and so, a positive (negative) index means that the level of economic activity lies above (below) its trend level. A downward (upward) sloping index means that the level of economic activity is growing slower (faster) than its potential growth, which is shown in figure 1 by the shaded areas. Following the peak in the business cycle, four subsequent phases can be distinguished as: i) slow-down; the cycle is positive, but downward sloping; ii) recession: the cycle is negative and downward sloping, which ends in a business cycle trough; iii) recovery: the cycle is negative, but upward sloping; iv) boom: the cycle is positive and upward sloping. The DNB business cycle indicator shows in Figure 1 that the Dutch economy is currently in the slow-down phase and will be entering the recession phase on short notice.

**Measuring the business cycle**

The DNB business cycle indicator is based on the notion of a business cycle as all the intrinsic cyclical motion visible in macroeconomic data consisting of waves within a specified frequency interval. This interval of business cycle frequencies corresponds with Burns and Mitchell's (1946) taxonomy of business cycles as waves lasting longer than a pre-specified minimum duration and shorter than a pre-specified maximum duration. Business cycles at certain frequencies can be isolated by so called band-pass filters. This type of filters originates from electrical engineering and operates on a time series of observations for an economic variable like tuning a radio: some frequency ranges are eliminated and other frequency ranges, i.e. the business cycles, get passed through. In an ideal world in which we have an infinite amount of observations  $\{x_t\}_{t=-\infty}^{\infty}$  for an econo-

mic time series variable, we can precisely extract the pre-specified business cycle fluctuations using the ideal band-pass filter defined as follows:

$$\text{Let } 2 \leq p_l < p_u < \infty$$

$$B_j = \frac{\sin(jb) - \sin(ja)}{jn}, j \geq 1$$

$$B_j = \frac{b-a}{n}, a = \frac{2n}{p_u}, b = \frac{2n}{p_l}$$

$$\text{Then } cycle_t = \sum_{j=-\infty}^{\infty} B_j x_{t-j}$$

So, the cyclical fluctuation labelled  $cycle_t$  consists of all the cyclical fluctuations incorporated in the time series variable  $x_t$  whose waves are characterized by a duration longer than  $p_l$  periods and shorter than  $p_u$  periods. The DNB business cycle indicator, which is based on monthly observations, operationalizes 36 months, i.e. 3 years, as a lower bound and 132 months, i.e. 11 years, as an upper bound.

Since we are not living in an ideal world, but in a real one with a limited amount of available observations, the econometric question is how to approximate the ideal band pass filter? Approximate band pass filters suffer from leakage, i.e. some frequency ranges that are supposed to be filtered out get passed through to some extent and compression, i.e. some frequency ranges that are supposed to pass through get dampened to some extent. Christiano and Fitzgerald (2003) (CF) propose an approximate band pass filter that is optimal in a weighted mean squared error sense conditional on a special characteristic that is typical for macroeconomic time series<sup>3</sup>. In the real world, we have a finite amount of  $T$  observations  $\{x_t\}_{t=1}^T$ . Then  $t, t=1, \dots, T$  with  $f=T-t+1, p=t-1$  the coefficients of the CF-filter look like:

$$\hat{B}_j^{p,f} = B_j, j = -p+1, \dots, f-1$$

$$\hat{B}_{-p}^{p,f} = \frac{B_0}{2} - \sum_0^{p-1} B_j, \hat{B}_f^{p,f} = \frac{B_0}{2} - \sum_0^{f-1} B_j$$

$$\text{Then } cycle\_CF_t = \sum_{j=-p}^f \hat{B}_j^{p,f} x_{t-j}$$

Note that the filter coefficients converge to their ideal band pass filter equivalents in case we have a lot of observations at our disposal. So,  $\hat{B}_j \rightarrow B_j$  as  $p, f \rightarrow \infty$

**Which indicators should we monitor?**

Real gross domestic product (GDP) as the aggregate of all economic activity constitutes an important statistic for business cycle measurement, the American and European business cycle dating committees<sup>4</sup>, however, monitor se-

<sup>3</sup> More precisely, Christiano and Fitzgerald (2003) assume that the underlying economic time series variable follows a random walk process, i.e. that it is integrated to the first order: a so-called I(1) process. This type of process captures the trending behaviour that is typically observed in macroeconomic data.

<sup>4</sup> See the websites of the American National Bureau of Economic Research (NBER) and the European Centre for Economic Policy Research (CEPR).

veral macroeconomic variables as the cyclical fluctuations of GDP do not always move synchronously with the ones of its underlying components. It is in general infeasible to identify one single variable, which covers a broad range of economic activity, represents the current stage of the business cycle and is available on a monthly basis. The coincident reference index is therefore constructed as a composite index of several synchronous indicators. The index constitutes a more robust standard of business cycle measurement since the idiosyncrasies of the individual series are averaged out. In addition to reflecting the cyclical properties of GDP, other important practical criteria for selecting the variables are a limited publication delay and minor data revisions. This means that new data releases are published shortly after the corresponding period has ended and that the initially published values are subject to only minor revisions during subsequent publications regarding the same period. As a result, the coincident index of the DNB business cycle indicator is based

relative to the share of services production. Despite this small share, the OECD's indices are solely based on industrial production as its cyclical motion is considered a representative statistic for the business cycle. The staffing employment market is the segment of the labour market that is most sensitive to business cycle motions, because companies can adjust their use of staffing services immediately to changing market conditions.

Cyclical motion in the economy is reflected in various macroeconomic time series in a dynamic sense as well. Depending on the timing behaviour of their cyclicity vis-à-vis the coincident index, variables can be classified as leading, coincident or lagging. Leading variables give by nature an early signal on the cyclical position. Economic plausibility requires that the leading indicators should be supported by economic theory either as possible causes of business cycles or as quickly reacting to positive or negative shocks. Since economic fluctuations originate from different sources, we combine a

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on industrial production, household consumption and staffing employment. The volume index of consumption by households is closely related to retail sales, since it consists only of those expenditures for which households pay themselves. Industrial production constitutes approximately 25% of GDP and its share is declining

Leading indicator variable	Lead time (in months)
IFO-indicator Germany	9
Expected business activity	9
Three month interest rate	26
Term structure of interest rates	30
Stock finished products	10
Order arrivals	15
Consumer Confidence	11
Stock Price Index (AEX)	7
Registered motor vehicles	9
Real house price	7
OECD leading indicator for the U.S.	18

Table 1 Composition of the leading index

number of relevant leading indicators into a single composite index. The main selection criteria for the leading indicators are the lead time and the statistical conformity with the business cycle as represented by the composite coincident index. The leading indicator should show consistent timing by systematically anticipating peaks and troughs with a rather constant lead time and avoiding missed turning points or false signals. A missed turning point is a turning point in the coincident index, which the leading indicator fails to signal. A false signal occurs when the leading indicator shows a turning point that eventually does not materialize in the coincident index.

The leading index of the DNB business cycle indicator consists of eleven selected leading indicator variables that together make up a balanced representation of near future cyclical developments. As shown in table 1, the composite leading indicator consists of three financial series, four business and consumer survey results and four real activity variables, of which two supply and two demand related.

The three financial variables are the short term interest rate, the yield curve and the stock price index. Low short term interest rates reduce financing costs and will spur investment

demand. The AEX stock price index consists of the 25 most actively traded shares in the Netherlands and indicates the expected future corporate profitability and the underlying growth potential. An inverse yield curve is usually observed at the start of a recession period and acts therefore as a predictor. The four business and consumer survey results are expected business activity, the IFO-indicator of future expectations, domestic consumer confidence and the OECD's leading indicator for the United States. The IFO-indicator represents the economic expectations of producers in Germany, the largest trading partner of the Netherlands. The OECD's leading indicator for the U.S. reflects the short term outlook of the world's largest economy, whose business cycle is known to be leading for the G7 countries. Finally, two supply related real activity variables are the order arrivals and the stock of finished products and two consumption related real activity variables are the real house price and the registrations of new cars. Housing wealth, and therefore real house price changes, are an important factor in the total wealth of consumers. The registration of new cars is a variable that quickly reacts to alterations in the business cycle.

### Summary

Every month the composite coincident index shows the current state of the economy on the basis of industrial production, household consumption and employment. These three variables are important reference points for dating economic turning points. The composite leading index provides an estimate of the state of the economy in the near future. The leading index is based on three financial series, four business and consumer survey results and four real activity variables, of which two supply and two demand related. Referring to the four quadrant characterisation of business cycle phases, i.e. slow-down, recession, recovery and boom, the DNB business cycle indicator shows that the Dutch economy is currently in the slow-down phase and will be entering the recession phase on short notice.

### References

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