# The IW Business Cycle Traffic Lights
## The State of the Economy at a Glance

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2. Februar 2016

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# Abstract

There is no lack of information for diagnosing the development of an economy. The problem is more one of obtaining a concise summary. The IW Business Cycle Traffic Light captures at a glance the changes in important economic indicators for Germany, the Eurozone, the USA and China. This can only be achieved by establishing which improvements and deteriorations in the short-term development of the economy can be defined as relevant. Like its individual underlying indicators, the IW Business Cycle Traffic Light represents the status of information a varying number of months ago, thus partly reflecting the inevitable recognition lags in business cycle diagnosis.

# 1. Variety of information on business cycles

A wealth of different information is available for describing and diagnosing the short-term development of an advanced economy like Germany's. The relevant sources are national accounts and both official and unofficial business statistics. Commodity and financial indicators can also be important, depending on the country and its economic structure. If the economy in question is an open one, information on the world economy is also required. To obtain a broad description of the overall economic situation, it can be helpful to use a combination of information from sources which are not only diverse but also open to different interpretations.

One way to compile an overall picture from a variety of data is to construct a composite indicator such as the OECD's Composite Leading Indicator (CLI) (Giovanni, 2009; OECD, 2012). Using data on commodities and industrial production, construction, trade, labour markets, prices, interest rates, exchange rates and the like, the CLI aims at predicting the changing dynamics and turning points of Gross Domestic Product (GDP). To illustrate overall trends, information about the dynamics of the current business cycle is weighted and aggregated. However, this aggregation can limit the indicator's explanatory power (Brümmerhoff/Grömling, 2015, 323ff) since it conceals the individual information provided by the indicators used, which can point in diverging directions. Furthermore, there is a general problem with how the data is aggregated and weighted. Often equal weightings are used, sometimes only for reasons of practicality. Even if an econometric analysis of the significance of the individual data achieves a more realistic weighting, such weighting only contains information about the past. Assuming that the business cycle does not depict mechanical regularities but is the outcome of various supply and demand shocks, the weightings can vary over time.

To avoid these problems of aggregation and to keep the amount of information on the business cycle manageable, the Cologne Institute for Economic Research (Institut der deutschen Wirtschaft Köln) has developed what we call the IW Business Cycle Traffic Light (Cholewa/Goecke/Grömling, 2015). It is not a forecasting tool but an instrument for diagnosing the state of the economy. The IW Business Cycle Traffic Light has been regularly updated on a monthly basis since June 2015 and is published online at www.konjunktur-in-deutschland.de.

The IW Business Cycle Traffic Light contains ten indicators that can be divided into three sections: production, employment and demand. This makes it possible to analyse the economic situation from different perspectives. The IW Business Cycle Traffic Light is differently structured than similarly-named tools and a clear distinction needs to be made. The DekaBank's Branchenampel (Bahr/Scheuerle, 2003) depicted the development of several economic sectors on the basis of income, cost

and economic climate. The ifo Business Cycle Traffic Light (Nierhaus/Abberger, 2015) evaluates the current business situation and the business outlook for German companies on the basis of the ifo Business Climate Index, a monthly survey of companies.

## 2. The situation in January 2016

Before we explain the IW Business Cycle Traffic Light in detail, it is presented in its January 2016 version (see Figure 1). In the case of Germany, only two out of the ten variables observed show a positive change and three variables a negative change. On the production side the Purchasing Manager Index (PMI) signalled 3 positive dynamics while production and new orders signal a negative change (red). None of the three employment indicators exhibited any relevant change in the last three months compared to the preceding three months (yellow). The demand side indicators reveal indistinct dynamics with one positive change (private consumption) and one negative change (consumer confidence).

**Figure 1: The IW Business Cycle Traffic Light in January 2016**

| | | Germany | Euro Area | USA | China |
|---|---|---|---|---|---|
| Production | Production | red | yellow | yellow | green |
| | New Orders | red | red | red | grey |
| | Purchasing Managers Index | green | green | red | red |
| Employment | Employment | yellow | yellow | green | yellow |
| | Unemployment | yellow | yellow | yellow | grey |
| | Unemployment Rate | yellow | yellow | yellow | red |
| Demand | Private Consumption | green | green | green | green |
| | Consumer Confidence | red | red | yellow | red |
| | Investment | yellow | yellow | yellow | grey |
| | Exports | yellow | yellow | red | yellow |

Changes of values in the last three months compared to the preceding three months in percent
Green: improvement; red: deterioration; yellow: no relevant change; grey: no data available
1) Manufacturing
Source: Cologne Institute for Economic Research

In the Eurozone, there are two green (positive) and one red (negative) area. Positive changes can be seen in survey data (PMI and consumer confidence). The only negative change is in new orders. There is no relevant change in the employment section. Overall this can be interpreted as an economy that moves more or less sideward.

The US data depict unclear dynamics with two indicators suggesting a relevant positive change and three indicators a relevant negative change. The employment section shows slight improvements with two indicators showing no relevant change and one positive signal. The PMI and new orders have deteriorated in the relevant period revealing major obstacles in the production sector. The demand side indicators show one positive (private consumption) and one negative change (exports).

The seven available indicators covering China reveal different trends. While industrial production and private consumption indicate positive changes, the unemployment rate, consumer confidence and the PMI, which has the strongest leading characteristics, is down. This matches recent signs of a slowdown in the Chinese economy.

## 3. Indicators and data sources

Table 1 provides an overview of the individual indicators, their units, periodicity and their valuation in business cycles. The indicators for the three countries and the Eurozone stem from different sources. Most of the indicators used are updated on a monthly basis, though the published data from national accounts on consumption and investment and the data on employed population for the Euro Area and China and the unemployment rate for China are quarterly.

A seasonally adjusted volume index published by Deutsche Bundesbank using data provided by Germany's Federal Statistical Office (destatis) is used for manufacturing production in Germany. This index measures the output of all companies with at least 50 employees. The Euro Area production is taken from an OECD index that captures the aggregate of the respective indices of the member states. The OECD's data are adjusted by season and working days. The USA is covered by an index compiled by the Federal Reserve Board that measures seasonally adjusted industrial output. China's index is calculated from growth rates of seasonally adjusted volumes of manufacturing production published by the National Bureau of Statistics of China.

Data on new orders for Germany also come from Deutsche Bundesbank, which publishes seasonally adjusted data originating from destatis. This data contains the value of all orders for the delivery of self-made products confirmed by industrial enterprises with 50 or more employees. New orders in the Euro Area are aggregated by the European Central Bank (ECB) from data supplied by member states. Missing data is added by the ECB using model calculations. In the USA, the United States Census Bureau determines the value of all new orders for companies with a yearly trade volume of at least US$ 500 million. There is no data on new orders for China. With the PMI the IW Business Cycle Traffic Light uses a trend indicator that reflects how purchasing managers in manufacturing, services and construction assess the current economic situation. The index for Germany is provided by Markit/BME, for the Euro Area by Markit Economics, for the US by the Institute for Supply Management Michigan and for China by the China Federation of Logistics and Purchasing. Taken together, the indices on industrial production and new orders and the PMI constitute the production section of the IW Business Cycle Traffic Light. While manufacturing and GDP tend to be synchronous, new orders and the PMI are regarded as leading indicators.

**Table 1: Indicators oft he IW Business Cycle Traffic Light**
Sections and Units

| Section | Indicator | Unit | Periodicity | Improvement in Business Cycles |
|---------|-----------|------|-------------|-------------------------------|
| **Production** | Production [1] | Index | Monthly | Increase |
| | New Orders [1] [2] | Index | Monthly | Increase |
| | Purchasing Managers Index | Index | Monthly | Increase |
| **Employment** | Employment | Persons | Monthly (Germany, USA), Quarterly (Euro Area, China) | Increase |
| | Unemployment [2] | Persons | Monthly | Decrease |
| | Unemployment Rate | Percent | Monthly, Quarterly (China) | Decrease |
| **Demand** | Private Consumption | Index | Quarterly | Increase |
| | Consumer Confidence | Index | Monthly | Increase |
| | Investment [2] | Index | Quarterly | Increase |
| | Exports | Index | Monthly | Increase |

1) Manufacturing
2) No data on China available
Source: Cologne Institute for Economic Research

The indices on employment, unemployment and the unemployment rate can be interpreted as variables lagging behind GDP. The absolute number of employed persons in Germany is taken from data gathered by destatis, data for the Euro Area is published by the OECD while the US data comes from the US Bureau of Labor Statistics. These sources capture all people that were at least temporarily employed

within the given period. Data on the number of unemployed in Germany, the Euro Area and the US are taken from OECD figures. There is no data available on the total number of unemployed people in China. The German, Euro Area and US unemployment rates are a harmonised unemployment rate based on the ILO concept. For Germany and the Euro Area these unemployment rates are taken from Eurostat. The US data is provided by the OECD. Chinese figures on the employed population and the unemployment rate are provided by the National Bureau of Statistics of China. The unemployment rate covers only urban areas. Consumption, consumer confidence, investment and exports represent the demand side. Consumption, investment and exports are components of GDP. The index on private consumption for the Euro Area and the US is calculated from growth rates published by the OECD on the basis of national accounts. Germany is covered by an index compiled by Deutsche Bundesbank based on the national accounts. There is no data available for China.

An indicator on consumer confidence for each country and the Eurozone is published by the OECD. It is surveyed monthly and covers expectations for the financial situation, the general economic trend, savings and the future occupational status of private households. The data is gathered by national institutes: in Germany by Gesellschaft für Konsumforschung, in the US by the University of Michigan, in the Euro Area by the European Commission and in China by the National Bureau of Statistics China.

Data on investment in Germany is taken from the national accounts. It is an index of gross fixed capital formation adjusted for price, season and working days. Eurostat publishes figures on investment in the Euro Area which is a seasonally adjusted chain volume index based on national accounts. Data on investment in the US is also provided as a chain index on gross fixed capital formation taken from the national accounts. No data is available for China.

Eurostat provides export data for the Euro Area based on a price- and seasonally-adjusted volume index. The IW Business Cycle Traffic Light includes data on the Euro Area's external trade. German exports are captured by Deutsche Bundesbank as a seasonally adjusted index on the basis of data provided by destatis of Germany. For the US and China the OECD provides growth rates based on price- and seasonally-adjusted values taken from national accounts. These data are used to calculate an index to ensure comparability.

Table 1 also shows how a change in the individual variables is regarded as affecting the state of the economy. For all variables in the production section an increase in an index is deemed positive for the economy. The PMI is the only variable whose

valuation is extended by one dimension, as the index level of 50 is an expansionary threshold. Values above 50 indicate growth, whereas values below 50 point to a reduction of future economic output. To account not only for the recent trend, but also for this threshold, an improvement to the economic situation is indicated by an increasing index and a level that is above 50. A deterioration is indicated by a decreasing index and a level that is below 50. All other possible events are regarded as neutral. This is to prevent index levels above 50 being interpreted as negative just because they have declined within the reference period. A similar argument applies to values which have increased below the threshold. In the employment section rising values for the employed and falling values for the unemployed population and the unemployment rate are regarded as positive. All variables in the demand section are regarded as positive for the economic situation when they are increasing.

## 4. Thresholds

All variables are converted to values on a three-month basis. For all variables which are updated monthly this means that the average of the last three-month period is compared to the preceding three-month period. These three-month periods do not necessarily correspond to quarters. All the months are given the same weighting to ensure comparability with the quarterly data for other variables. Variables updated quarterly are compared to the preceding quarter. It should be borne in mind that values presented in the IW Business Cycle Traffic Light in January 2016, for example, do not mirror the actual situation in January 2016 but the information available in that month. The release date usually deviates from the reporting period by one to three months.

All changes are subsequently compared to the standard deviation of the same variable over the last ten years, a period chosen because it would normally include two whole business cycles. When new data for a later period is added, the length of this standard deviation period remains at a constant ten years, thus moving forward in lockstep with the observation period.

To ensure that slight changes in any of these variables in either direction are not overvalued, the IW Business Cycle Traffic Light defines a range, in which changes are regarded as "neutral" and marked in yellow (see Figure 1). An improvement beyond this range is shown in green, a deterioration in red. For the IW Business Cycle Traffic Light a seventh of the standard deviation has been chosen as a threshold for all variables. This applies to both positive and negative changes. How

the outcome changes with different thresholds is shown in a sensitivity analysis below.

# 5. Sensitivity

Our choice of threshold for the sensitivity analysis – the share of the standard deviation – is to a certain degree arbitrary and subjective. Table 2 shows how the IW Business Cycle Traffic Light changes with different thresholds and depicts the resulting sensitivity. The chosen share of the standard deviation influences the thresholds at which the signal does indicate an improvement/deterioration. An improvement (a green signal) can never change into a deterioration (a red signal) due to the chosen threshold and vice-versa. The sensitivity analysis shows the effect of choosing a fifth, a seventh and a ninth of the standard deviation as a threshold and the outcome for the IW Business Cycle Traffic Light.

**Table 2: Thresholds of the IW Business Cycle Traffic Light**
Thresholds of the indicators for Germany in January 2016 on the basis of different values oft he standard deviation

| Section | Indicator | 1/7 | 1/5 | 1/9 |
|---|---|---|---|---|
| Production | Production[1] | ± 0.95 | ± 1.34 | ± 0.74 |
| | New Orders | ± 1.30 | ± 1. 82 | ± 1.01 |
| | Purchasing Managers Index | - | - | - |
| Employment | Employment | ± 149 068 | ± 208 695 | ± 115 941 |
| | Unemployment | ± 73 770 | ± 103 278 | ± 57 376 |
| | Unemployment Rate | ± 0.25 | ± 0.35 | ± 0.20 |
| Demand | Private Consumption | ± 0.32 | ± 0.45 | ± 0.25 |
| | Consumer Confidence | ± 0.20 | ± 0.28 | ± 0.16 |
| | Investment | ± 0.72 | ± 1.01 | ± 0.56 |
| | Exports | ± 1.39 | ± 1.95 | ± 1.08 |

1) Manufacturing
2) No data on China available
Source: Cologne Institute for Economic Research

Table 2 shows the respective thresholds obtained from the different shares of the standard deviation corresponding to the data available for Germany in early January 2016. As the overview shows, the range where a change is rated as neutral becomes smaller with a smaller share of the standard deviation, leaving fewer areas of the Traffic Light "neutral" and therefore marked in yellow.

The values for manufacturing, new orders, the PMI, consumption, consumer confidence, investment and exports are changes of index values. Employment and unemployment are stated as the number of persons, and the unemployment rate is given in percentage points. Taking the unemployment rate as an example, the different sensitivity measures show that, using a fifth of the standard deviation, the rate has to change by 0.35 percentage points in order to be considered an improvement or deterioration. A seventh of the standard deviation gives a threshold of 0.25 percentage points while with a ninth of the standard deviation a change of above 0.20 percentage points is already regarded as significant.

An analysis of all four territories provides the following results for the IW Business Cycle Traffic Light in January 2016:

- A change from a seventh to a fifth of the standard deviation would have a little effect on the outcome. For Germany there would be two changes (production and new orders would change from red to yellow). The values for the Euro Area would not change. There would be three changes for the US (new orders and exports from yellow to red and employment from yellow to green) and only one for China (industrial production from green to yellow). Overall this means changes in six, or 16 percent, of the 37 variables.
- Using a ninth standard deviation instead of a seventh would bring one change for Germany (employment from yellow to green). For the Euro Area three values would change (employment, unemployment and the unemployment rate from yellow to green). For the US and China there would be no changes. This amounts to 11 percent of the areas changing.

The number of changes shows that the IW Business Cycle Traffic Light does not react overly sensitively to changes in the share of the standard deviation. Choosing lower shares means that fewer areas are marked as neutral.

## 6. Synchronicity

To assess the usefulness of the IW Business Cycle Traffic Light as a tool for describing business cycle dynamics, two specific periods for Germany are evaluated below. Once again it is important to emphasize that the individual variables show data for different reporting months, a phenomenon which can scarcely be avoided in business cycle analysis.

Table 3 shows the correlations of the individual indicators with real GDP. GDP is measured as an index and compared to the corresponding three-month averages. All signs turn out to be exactly as shown in Table 1. Manufacturing exhibits its highest correlation coefficient of 0.89 when no lag is used. The other production indicators exhibit a leading character. New orders have their highest correlation with a lead of one quarter, the PMI with a lead of two. The variables in the employment section all lag behind GDP using the highest correlation as a reference point. While the unemployment rate lags by one quarter, the other two variables lag by two. All three variables have their highest correlation coefficients close to a positive/negative correlation of 0.9. Consumption always shows a high correlation close to 0.9 regardless of the lag/lead used. This may be due to its rather sticky dynamics. Consumer confidence has its highest correlation with a lead of one quarter. Investment and exports exhibit a very high correlation with GDP as shown by their correlation coefficients of 0.95 and 0.99 when no lag is applied.

**Table 3: Correlation matrix of indicators**
Correlation of indicators with real GDP

|  | lead = 2 | lead = 1 | lag = 0 | lag = 1 | lag = 2 |
|---|---|---|---|---|---|
| Production[1] | 0.76 | 0.85 | 0.89 | 0.81 | 0.68 |
| New Orders[1] | 0.68 | 0.73 | 0.69 | 0.55 | 0.38 |
| Purchasing Managers Index | 0.52 | 0.39 | 0.08 | -0.13 | -0.35 |
| Employment | 0.81 | 0.84 | 0.87 | 0.90 | 0.91 |
| Unemployment | -0.73 | -0.78 | -0.83 | -0.85 | -0.85 |
| Unemployment Rate | -0.81 | -0.84 | -0.88 | -0.89 | -0.89 |
| Private Consumption | 0.86 | 0.86 | 0.87 | 0.86 | 0.87 |
| Consumer Confidence | 0.70 | 0.72 | 0.65 | 0.51 | 0.32 |
| Investment | 0.83 | 0.90 | 0.95 | 0.92 | 0.83 |
| Exports | 0.91 | 0.97 | 0.99 | 0.95 | 0.87 |
| IW Business Cycle Traffic Lights | 0.09 | 0.31 | 0.54 | 0.79 | 0.62 |

1) Manufacturing
Source: Cologne Institute for Economic Research

Table 3 additionally shows the correlation of the IW Business Cycle Traffic Light with real GDP. For this purpose the monthly net values of the indicators were computed and condensed to three-month averages. These were then compared to the quarterly growth rates of real GDP. The low correlation coefficients when used with a lead serve to emphasize that the IW Business Traffic Light is no tool for forecasting. The highest correlation can be seen with a lag of one quarter, when the coefficient has a value of 0.79.

# 7. Evaluation

In the upper part of Figure 2 month-to-month profiles for Germany from January 2008 to December 2009 are presented. The columns show the number of green, yellow and red areas of the IW Business Cycle Traffic Light. For example, in March 2009, at the peak of the financial crisis, six indicators were red (manufacturing, new orders, PMI, consumer confidence, investment and exports) and the other four yellow (unemployed population, unemployment rate, employed population and consumption). The lower part of Figure 2 shows the price-, seasonally- and working-day-adjusted GDP that is used as the reference time series as well as the quarter-to-quarter changes from January 2007 to December 2010.
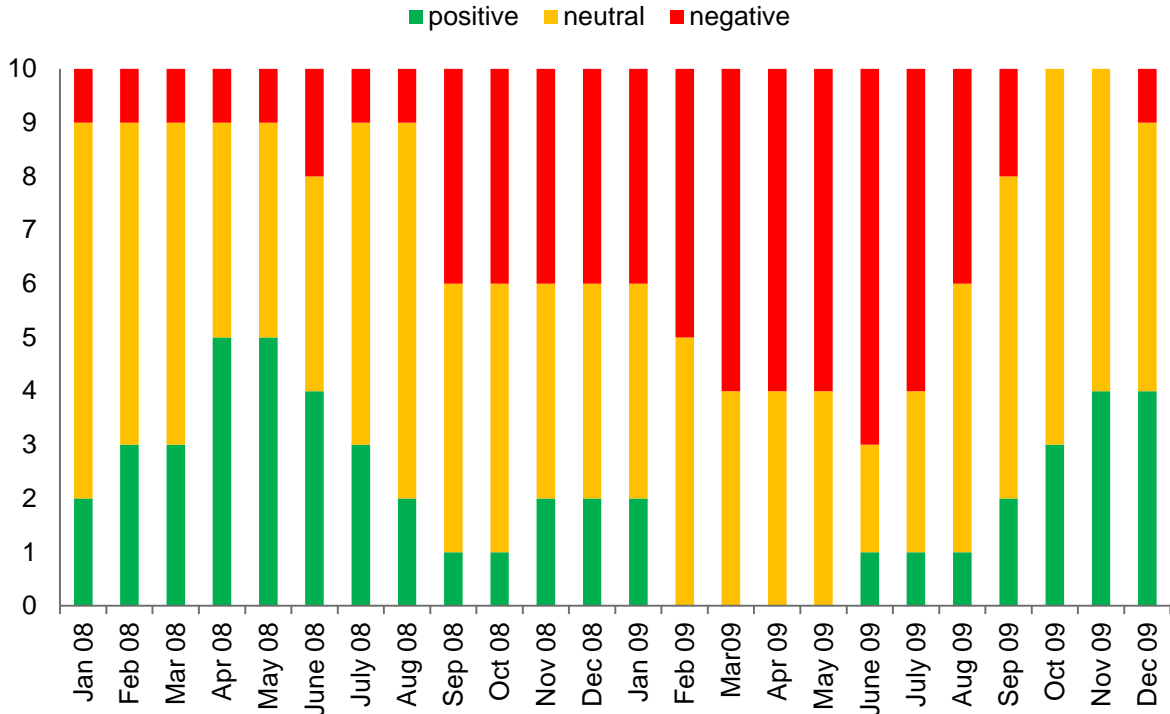
It is apparent from Figure 2 that in the first quarter of 2008 the pre-crisis boom in the German economy had reached its peak. Afterwards, real GDP dropped slowly until the third quarter of 2008. In September 2008, with the intensification of the global financial crisis triggered by the subprime crisis in the US in summer 2007, German economic performance collapsed. Between the third quarter of 2008 and the first quarter of 2009 real GDP fell by 6.3 percentage points. Bottoming out in the first quarter of 2009 it then began a gradual recovery that gained momentum in the third quarter of 2009.

The IW Business Cycle Traffic Light shows that the economic data available in January 2008 were still largely characterised by developments in 2007 and, indeed, GDP continued to rise a little in the first quarter of 2008. In September 2008 the first dramatic reversal of the trend – on the basis of information on economic activity in the previous months – can be recognised. The number of red areas increases significantly at the expense of the green. The full severity of the crisis, however, was not recognised until the early summer of 2009. By this time GDP had already started to grow again. In the IW Business Cycle Traffic Light this positive trend reversal can be seen a little later that same summer. Yet the accelerating recovery in the course of 2009 is well depicted in the IW Business Cycle Traffic Light.

The time span from January 2013 until January 2016 is taken as a second evaluation period. Figure 3 shows the month-to-month profiles and price-, seasonally- and working-day-adjusted GDP and its quarterly growth rates from 2011 to third quarter of 2015. At the beginning of 2013 the IW Business Cycle Traffic Light is characterised by the dragging economic dynamics of 2012 and, indeed, GDP continued to drop in the first quarter 2013. The enduring economic recovery in 2013 is well captured both by the individual indicators and by the resulting overall picture. The stagnation of the economy's dynamics in the first three quarters of 2014 is nicely reflected by the almost constant pattern of yellow and green areas.
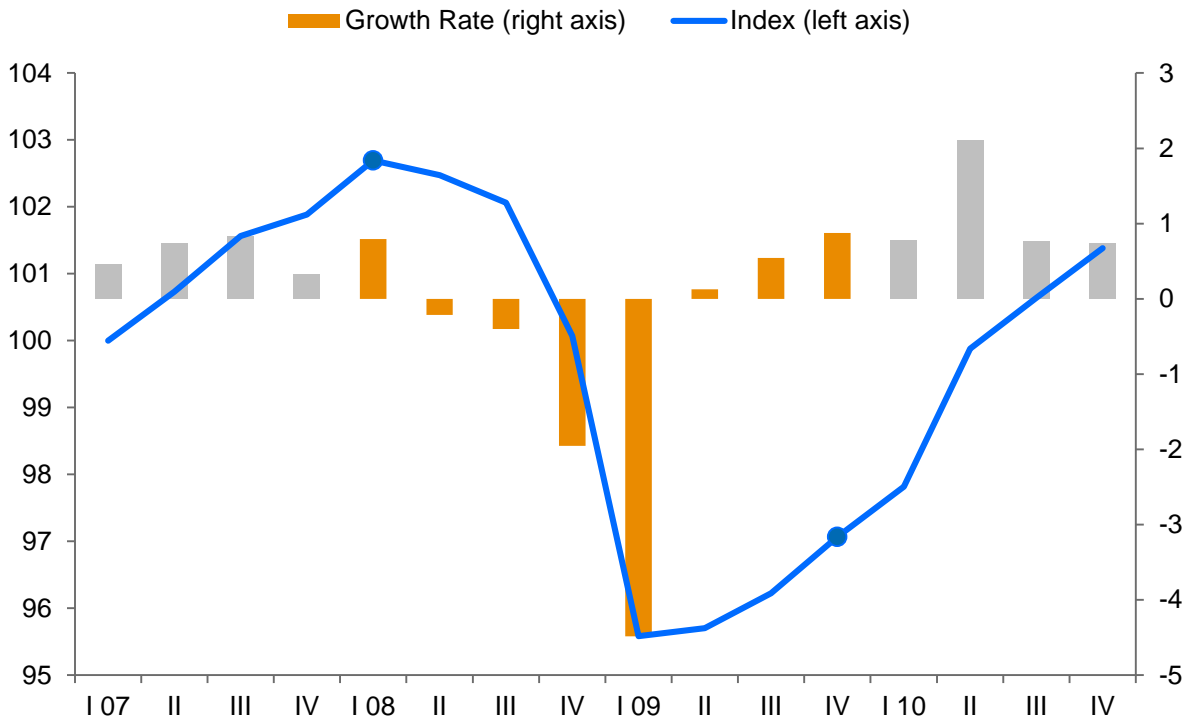
**Figure 2: Month-to-month profiles of the IW Business Cycle Traffic Light and real GDP**

Amount of yellow, green and red signals for Germany[1]



Development of price-, seasonally- and working-day-adjusted real GDP in Germany ;

Index: Q1 2007 = 100 (left axis) and change from the preceding quarter in percent (right axis)
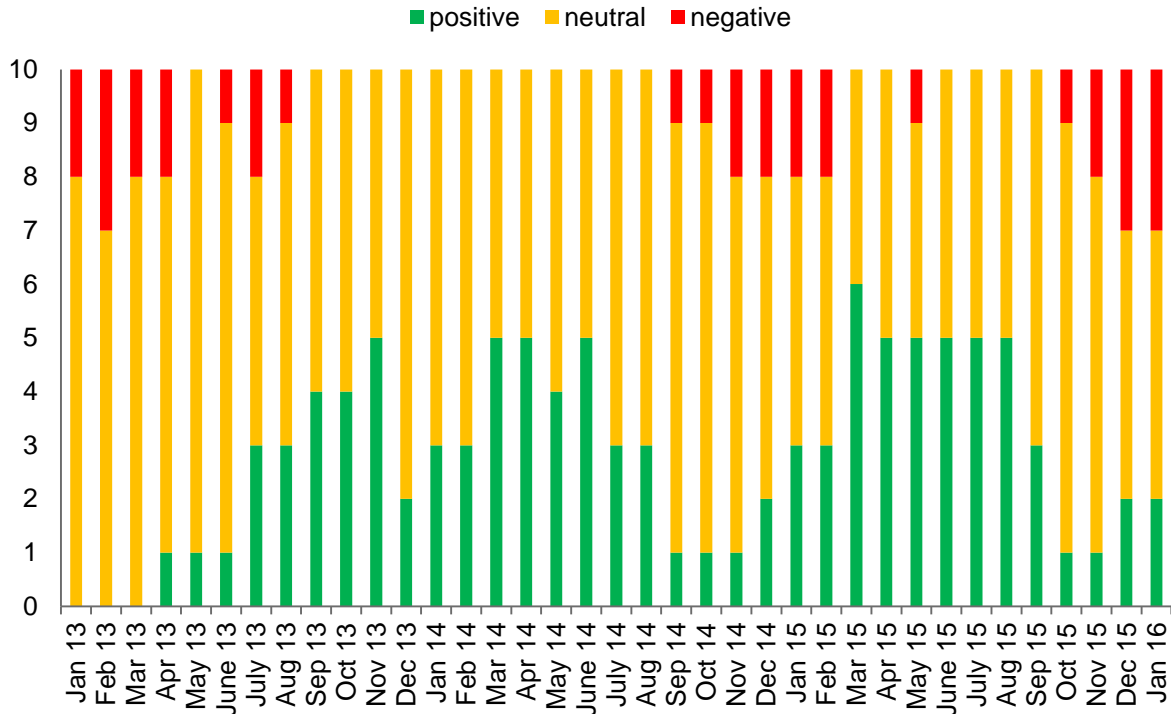


1) Red signals a deterioration, green an improvement of the business cycle situation on the basis of the relevant indicator; yellow indicates no relevant change.
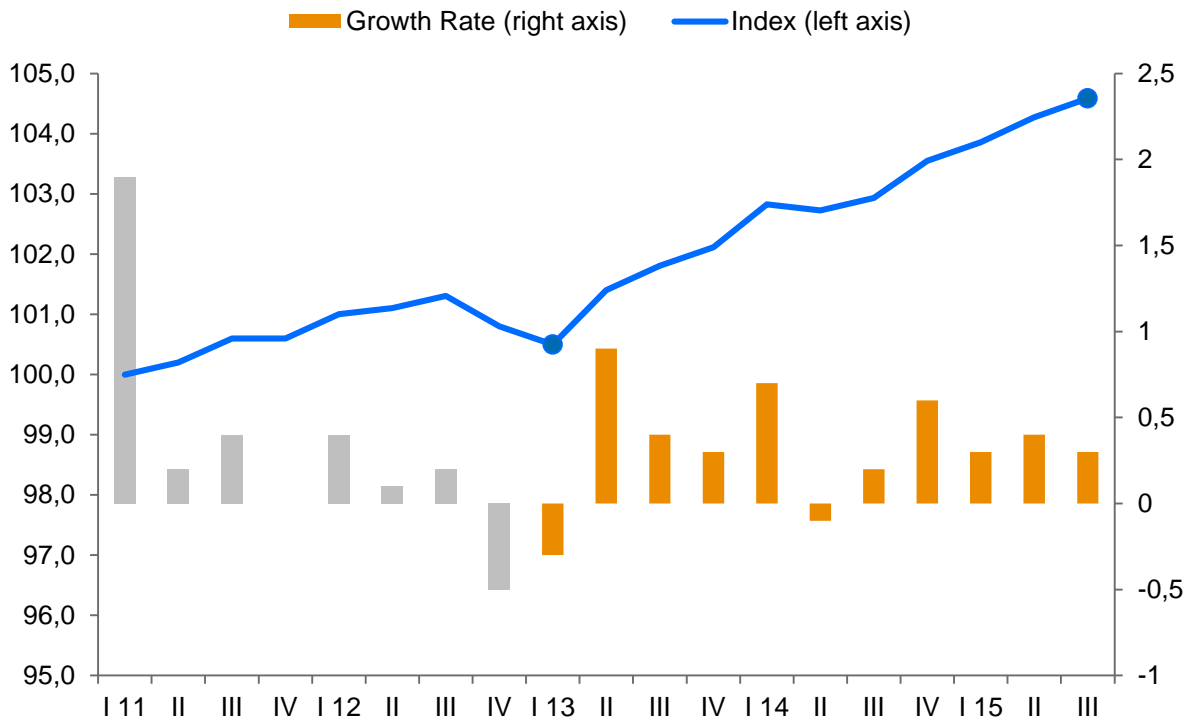Source: Federal Statistical Office of Germany, Cologne Institute for Economic Research

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1) Red signals a deterioration, green an improvement of the business cycle situation on the basis of the relevant indicator; yellow indicates no relevant change.
Source: Federal Statistical Office of Germany, Cologne Institute for Economic Research

The number of red areas increases in the fourth quarter of 2014 (consumer confidence and investment). This time lag again makes clear that the IW Business Cycle Traffic Light, together with its constituent variables, can only show direction and turning points with a delay.

## 8.  Conclusions

The idea of the IW Business Cycle Traffic Light is to provide a tool for analysing the current status of the economy. Its great advantage is that it brings together several important indicators without merging them into a single composite, thus retaining the individual information each provides. The statistical method used provides a lean framework for analysing specific information on business cycles. Moreover, the overall picture can be extended or adjusted to individual needs by including other countries, indicators and thresholds.

As the sensitivity analysis reveals, the indicators used in the Traffic Light correlate strongly with real GDP. While the IW Business Cycle Traffic Light itself also exhibits a strong correlation with real GDP, this involves a time lag which makes it unsuitable for forecasting.

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