Box 3

BASE EFFECTS AND THEIR IMPACT ON HICP INFLATION IN EARLY 2005

The measure of inflation that is given prominence by the ECB is the year-on-year rate of change in the HICP. When the change in this rate between two consecutive months is described, base effects are often mentioned. This box clarifies what is meant by a base effect – from both a technical as well as a conceptual viewpoint. It also highlights two particular base effects, relating to the impact of fiscal measures implemented in early 2004, which will have a downward impact on HICP inflation in early 2005.

Calculation of annual inflation rates

The annual inflation rate (π_t) is calculated as the percentage difference between the consumer price index in a given month (p_t) and the index value 12 months earlier (p_{t-12}). This can be approximated by:

$$\pi_t = \left[\ln(p_t) - \ln(p_{t-12})\right] \times 100 ,$$

where ln stands for the natural logarithm. Thus, the difference between the annual inflation rates in two subsequent months is approximately the same as the difference between the month-on-month rate in the current month and the month-on-month rate twelve months previously:

$$\pi_t - \pi_{t-1} = \left[\left(\ln(p_t) - \ln(p_{t-1})\right) - \left(\ln(p_{t-12}) - \ln(p_{t-13})\right)\right] \times 100 .$$

This illustrates the fact that the change in the year-on-year inflation rate from one month to the next reflects the impact of both recent price changes and price movements in the base month, i.e. 12 months earlier. For example, if the price index jumps in the period from *t-13* to *t-12*, this will reduce the change in annual inflation between *t-1* and *t*. Note that the logic behind these definitions is the same if the annual rate of change is calculated (more precisely) as:
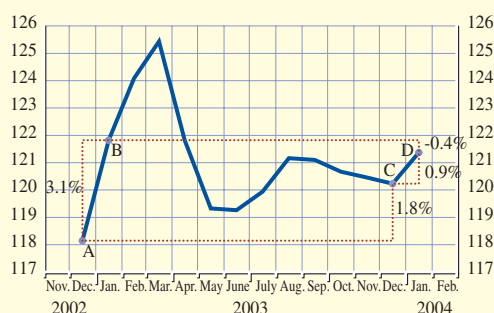
$$\pi_t = \left[(p_t - p_{t-12}) / p_{t-12}\right] \times 100 .$$

Technical definition of a base effect

In a purely technical sense, the contribution to the change in the annual inflation rate from the month-on-month rate of change one year earlier (i.e. $\ln(p_{t-12}) - \ln(p_{t-13})$) could be referred to as a base effect. One illustrative example is the annual rate of change in the HICP energy component, which declined to -0.4% (from B to D in the chart) in January 2004 from 1.8% (from A to C) in December 2003, despite a month-on-month increase of 0.9% (from C to D) in January 2004. The decline in the year-on-year rate of change, of 2.2 percentage points, was fully explained by

Chart HICP energy

(index: 1996 = 100)

Source: Eurostat.

the month-on-month rate of increase of 3.1% (from A to B) in January 2003 – which is the base effect – as it dropped out of the year-on-year rate of change in January 2004.

Economic definition of a base effect

From an economic point of view, however, it may sometimes be useful to consider a base effect as the contribution to changes in the annual rate of inflation from unusual or extreme changes in the price index (or sub-index) during the base period, i.e. the period that is used as the basis for the calculation of annual rates. While such a definition would seem to make economic sense, it nonetheless leaves open a number of issues and therefore does not, on its own, help to precisely identify and quantify the size of a base effect. For example, judgement is always required in assessing whether a price movement is unusual or extreme. This economic definition would imply that base effects are identified only with exogenous factors which influence the general inflationary pattern and can be traced to movements in specific HICP components (e.g. a tax effect on tobacco prices or a sharp increase in food prices due to an outbreak of disease among livestock).

In addition, base effects will arise when there are unusual seasonal fluctuations. Clothing prices, for instance, typically show sharp month-on-month declines in January and July at the time of the winter and summer sales. It could be the case that the month-on-month rate of change that drops out of the year-on-year rate (i.e. the technical definition of a base effect) is large, but normal for the season, while the current month-on-month rate is smaller than the average increase for that month. From a technical viewpoint the change in the annual inflation rate is driven by a base effect. However, from an economic perspective the change in inflation is driven by developments in the current month, i.e. a smaller than normal seasonal change.

Another issue in the context of base effects is that most price series normally show an upward trend (although this may not be the case for certain items of technical equipment such as PCs) because the rate of change in the HICP is generally positive (in line with the ECB's definition of price stability, which allows a positive annual change in the HICP below but close to 2%). To calculate a base effect in a meaningful way that isolates unusual or extreme developments, one has to take account of this upward trend. This can be done by comparing the historical averages of the respective HICP series with the actual developments.

However, when assessing seasonality or calculating the average price change for an HICP item in a particular month, one has to bear in mind that the seasonal pattern of the index may change over time. For example, prices of package holidays (which are part of the services component) have a very strong seasonality which has a tendency to change somewhat from one year to another in response to, for instance, the timing of the Easter weekend. The result is that the annual rate of change is also volatile. In addition, seasonal sales for Italy and Spain were introduced in the HICP in January 2001, as a result of which there is a statistical break in the index. For this reason, caution is warranted when judging whether a price change is unusual for a particular month.

Base effects in early 2005

Base effects are expected to have a downward effect on annual euro area HICP inflation at the beginning of 2005. In particular, the fact that price increases due to the German health care reform and tobacco tax increases in various countries will drop out of the year-on-year rate of

change should have a downward impact on inflation. For instance, the health component of the HICP rose by 5.7% month on month in January 2004. The average increase in January since 1996 is 0.9%, which means that the difference, i.e. 4.8 percentage points, could be seen as the base effect. The mechanical impact on HICP inflation from this would be around 0.2 percentage point (taking into account that health-related goods and services had a weight of 4.0% in the overall HICP in 2004). In addition, tobacco prices rose by 5.3% month on month in March 2004, which is 4.9 percentage points higher than the average increase for this component over the period 1996 to 2003. The mechanical impact on HICP inflation from this base effect is approximately 0.1 percentage point (with tobacco products having a weight of 2.4% in the HICP). Importantly, it cannot be ruled out that pressure on public finances might result in additional but as yet unplanned increases in administered prices and indirect taxes. This would offset the downward effect on inflation from these base effects.