

SPEECHES, STUDIES AND STATEMENTS

1. Unabridged Translations

Potential Output Growth, the Economy's Position in the Cycle and Inflationary Pressures

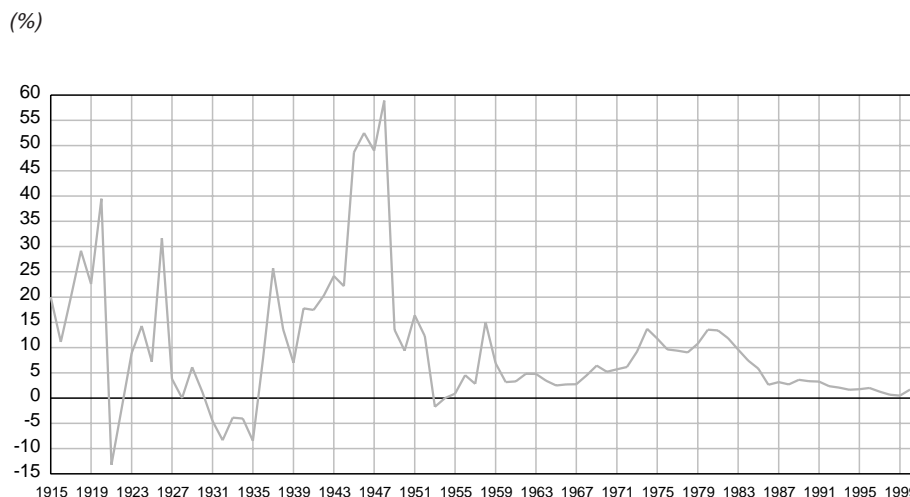
Changes in the French consumer price index reveal a strong long-run trend towards a lower magnitude of price changes. These fluctuations were particularly pronounced in the years following both World Wars and in the inter-war period (see Chart 1). Since 1960, changes in inflation have been smaller, ranging from a maximum annual average of approximately 13.5% in 1974, 1980 and 1981 to a low of 0.5% in 1999. Over the past ten years (1992-2001), inflation has oscillated between a low of around 0.5% in 1999 and a high of 2.4% in 1992. A similar trend has been seen in other euro area countries. Furthermore, inflation in countries experiencing relatively high levels of inflation, such as Italy, has progressively converged towards that of countries with relatively low inflation, such as Germany and France (see Chart 2). Thus, since the creation of the euro area in January 1999, the differential in the year-on-year increase in the harmonised index of consumer prices between the three largest countries in the area has not exceeded 1.3 percentage points. This contrasts with the last decade, where the differential peaked at around 5 points, in 1995.

In comparison with the previous century, then, the recent period has featured greater price stability, both in France and the euro area. This stability promotes economic growth by reducing costs, such as menu costs, inflationary costs and uncertainty in expectations. The role of the monetary authorities is to maintain this price stability¹. Accordingly, assessing inflationary risks is of the utmost importance to them. To do this, they may either assess existing pressures on the goods and labour markets, or, by taking a more global approach, measure the pressures present on both markets simultaneously. Estimates of potential output, potential output growth and the difference between actual and potential output are used in this assessment process.

This study was carried out by a working group led by G. Cette, and including, in addition to the authors of the following articles, S. Avouyi-Dovi, H. Le Bihan, L. Bilke, C. Bouthevillain, P. Dedryver, X. Denis, B. Fougier, D. Irac, I. Kühlen, P. Rousseaux and A. Sylvain. The views expressed are those of the authors and do not necessarily reflect the position of the Banque de France.

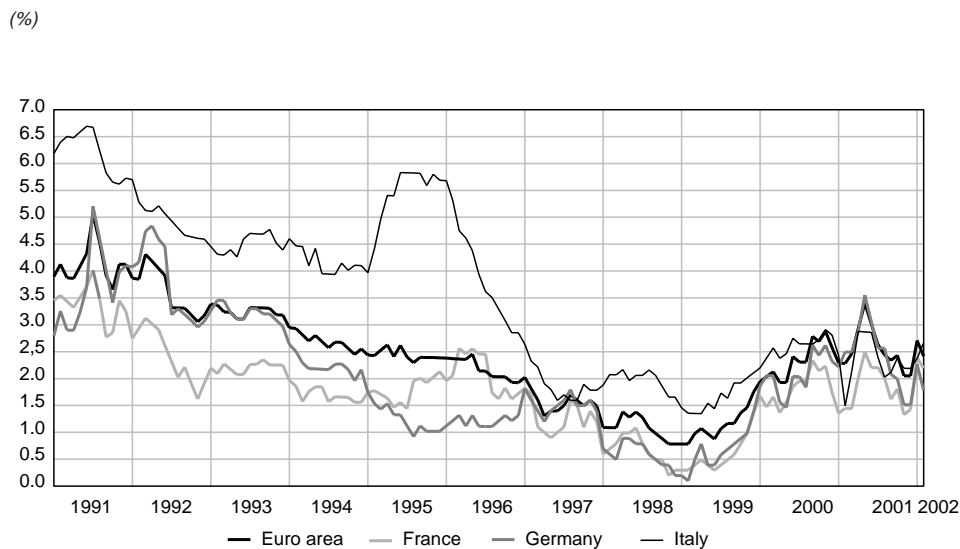
¹ Article 105 of the Maastricht Treaty assigns the European System of Central Banks (ESCB) and the European Central Bank (ECB) the primary objective of maintaining price stability.

Chart 1
Long-run inflation in France
 Average annual growth rate of the consumer price index



Source: INSEE (calculated using the franc purchasing power series)

Chart 2
Inflation in major euro area countries over the last decade
 Year-on-year increase in the harmonised index of consumer prices



Source: Eurostat

Potential output growth is often defined as the level of real GDP growth compatible with an absence of pressures on the goods and labour markets, which is a condition for price stability. Estimates of potential output growth are used to calculate the output gap, which is a composite and simple indicator of the economy's position in the cycle. These estimates are useful for analysing inflationary pressures: output gap indicators supply information on existing domestic pressures that could lead to higher inflation in the short to medium term. Indicators of medium to long-term potential output growth also provide useful information. They give an indication of the output growth rate that could be sustained on this horizon without causing a rise in inflation, thereby enabling monetary policymakers to determine a reference value for the growth of monetary aggregates.

This study aims to propose several angles from which to analyse inflationary pressures on the basis of an estimate of potential output growth and the output gap. Part one consists of a brief presentation of the factors of inflation and the different indicators used to estimate potential output growth and the output gap. This is followed by a description of the main analytical findings of these indicators concerning the cyclical pattern of France's economy and of other industrialised countries or areas. We then discuss empirical evidence confirming the influence of these cyclical patterns on actual inflation. We conclude by showing how estimates of potential output growth and the output gap can be used not just to assess the stance of monetary policy, but also to refine economic analyses in other areas, such as current account developments.

1. Analysing inflationary pressures

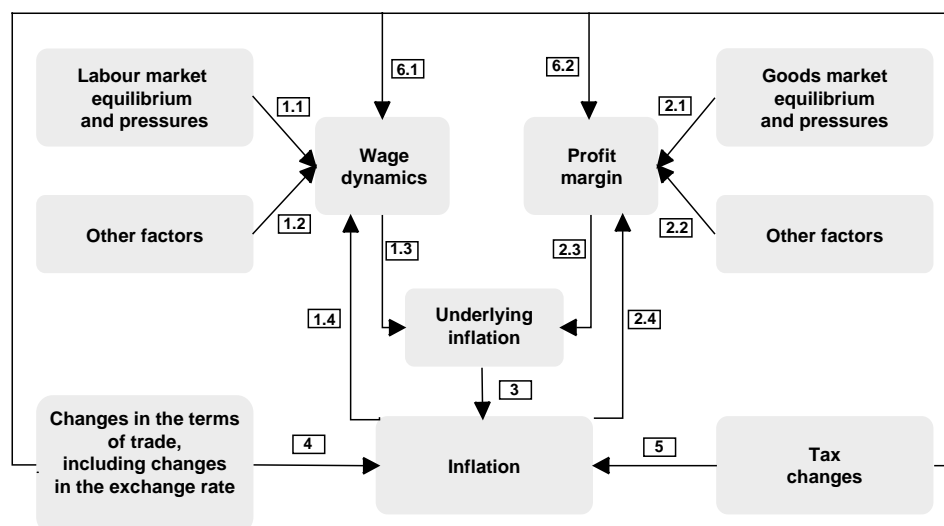
Inflation has many sources. By estimating the level of potential output growth and the difference between potential output growth and actual output growth (which is influenced by monetary policy), it is possible to assess these inflationary pressures.

1.1. Inflation has many sources

Chart 3 gives a highly simplified picture of the potential sources of inflationary pressure. Without dwelling on all the different relationships here, let us stress simply that the two sources of underlying inflation are wage growth (relationship 1.3) and the business profit margin (relationship 2.3). Inflation, in terms of effective consumer prices, is determined by underlying inflation² (relationship 3) together with the direct impact (i.e. excluding second-round effects that are absorbed in the short term by wages or margins) of changes in the terms of trade (relationship 4) and in taxes (relationship 5). Inflation itself influences wage dynamics (relationship 1.4) via indexing mechanisms, thus affecting the business profit margin at the same time (relationship 2.4).

² There is no single consensus-backed definition for underlying inflation. In this study, we define it as inflation excluding the direct impact(s) of changes in the terms of trade or in taxes.

Chart 3
Sources of inflationary pressure
(highly simplified diagram)



For a given stock of productive capital and labour force, potential output growth can be defined as the level at which supply and demand are balanced on the goods and labour markets, enabling inflation to stabilise. The balance between supply and demand on these two markets is usually captured by composite indicators: the capacity utilisation rate and the business profit margin are used for the goods market, and the unemployment rate for the labour market. Potential output growth thus corresponds to a situation of equilibrium on the goods market (equilibrium profit margin) and the labour market (the non-accelerating inflation rate of unemployment, or NAIRU). These equilibrium levels on the goods and labour markets may be affected by a wide range of shocks. Such shocks may be specific to the goods market (relationship 2.2; a cost of capital shock, for example) or to the labour market (relationship 1.2; an exogenous change in working time, for example). Others may affect both markets if they involve a change in the terms of trade (relationship 4; a change in the exchange rate or energy prices, for example) or tax changes (relationship 5; modifications to the tax base, for example). Any analysis of potential output growth thus appears to be closely linked to the conditions for equilibrium on the goods and labour markets.

1.2. Estimating potential output growth using a battery of indicators³

A host of different techniques can be used to estimate potential output growth and the output gap. However, results may differ depending on the method employed. The variety of available methods illustrates how genuinely difficult it is to select one reliable and indisputable technique. Given the many different uses to which potential output growth and output gap indicators can be put, and taking into account the difficulties and uncertainties surrounding their estimation, we provide a large battery of indicators rather than one single indicator. By doing this, we can assess the robustness of the analysis of the economy's position in the cycle. The analysis is more robust when the different indicators converge at similar levels and vary in the same direction. If this is not the case, the analysis may be taken further. Furthermore, it must be emphasised that these estimates are sensitive not just to the method used, but also to the parameters selected and the assumptions made when applying each method. Thus, it is not merely by implementing a given method that a specific estimate of potential output growth and the output gap will be arrived at. The assumptions used also play an important, even determining, role. Accordingly, these assumptions, and their economic content, must be clearly explained. Lastly, any empirical estimates of potential output growth and the output gap are particularly non-robust over the most recent period. There are a number of reasons for this, one of which is that most of the available data are provisional and so may be subject to accounting revisions.

The selection process for the indicators was based on four criteria: first, indicators had to be economically relevant; second, they had to be used by other institutions (so that comparisons could be made); third, they could not be prohibitively expensive to construct and, more importantly, to regularly re-estimate and update; fourth, other economists had to be able to replicate the indicators in order to open up the possibility of scientific debate and thereby cement the indicators' credibility. In view of these four criteria, a set of indicators was selected, some based on univariate or multivariate statistical techniques, others on structural methods⁴.

The first two methods used to estimate potential output growth are statistical, univariate approaches. The first is a smoothing technique (using the Hodrick-Prescott filter method), while the second is a trend estimation, potentially including trend breaks. The next two methods are also statistical, but multivariate. They are based on estimates from structural VAR models or from unobserved component models. The fifth method is structural and is based on an explicit production function. This method concerns the business sector, with the non-business sector as an exogenous variable. For this last method, the NAIRU has to be calculated before estimating the short to medium-term level of potential output growth.

³ This section is a summary of an article by G. Clette that will appear in a future edition of the *Digest*.

⁴ A method is said to be structural when a structural relationship is used to explain (e.g. *via* a production function) the linkages between the level of supply (here, GDP) and the level of the factors of production generating this supply. It is said to be statistical when no such relationship is *a priori* explicitly imposed. A method is said to be univariate if the output series alone is used to estimate potential output growth, or multivariate if other variables are also used.

All the above indicators concern the short to medium term and are useful for characterising existing inflationary pressures at a given time. Potential output growth may vary from year to year. The origins of such changes may be more or less explicit depending on whether the estimation method is strictly statistical or more structural. Thus, in the case of the structural approach with a production function, potential output growth could vary as a result of changes over the short to medium term in the NAIRU, for example, or in the pace of technical progress. The smaller the variability of potential output growth, the greater the magnitude of changes in the output gap, i.e. the difference between actual output, whose growth is extremely variable, and potential output growth. Thus, estimating potential output growth “simply” by estimating a trend on the basis of actual GDP assumes that potential output growth does not vary, which means that output gap estimates will show the largest magnitude of change.

In the medium to long term, the variables that could generate short to medium-term fluctuations in potential output growth are generally assumed to be stable at a structural level. On this medium to long-term horizon, which is relevant when assessing the outlook for sustainable growth, potential output growth is thus assumed to be constant. One estimate of potential output growth adapted to the medium/long term was computed by using a production function to characterise the combination of inputs, assuming that potential employment follows the same trend as the working-age population and that the capital coefficient is stable in value terms.

In the battery of indicators that we propose for short to medium-term estimates, the criterion of economic relevance leads us to prioritise the structural method with a production function, given that it enables a more explicit characterisation of the formation of actual and potential productive supply. The other three criteria require the focus to be placed more on smoothing or trend estimation approaches.

2. A few results in estimating potential output growth and the position of the economy in the cycle

The above indicators can be used to estimate potential output growth and the position in the economic cycle of France and other industrialised areas or countries.

2.1. Potential output growth and the French economy's position in the cycle⁵ ...

In qualitative terms, the different estimates come to similar conclusions as to the position of the French economy in the cycle over the entire period (cf. Chart 4). They find that the economy was in a cyclical trough (i.e. a negative output gap was

⁵ This section summarises some of the results of estimates discussed in detail in an article by O. De Bandt and J-P. Villetelle that will appear in a future edition of the *Digest*.

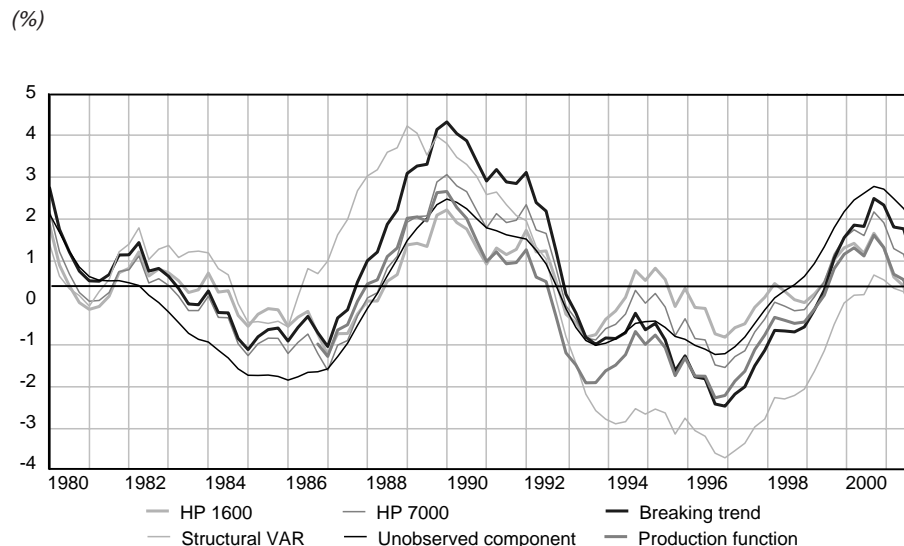
registered) from 1982-1983 to 1987, followed by a cyclical peak (positive output gap) until 1992, then another trough until 1999 (with lags of up to a year depending on the estimate) and finally another peak. The 1992-1999 trough featured a rebound in 1994 that was broken off in 1995. The size of this rebound varied according to the indicator. In 2001, the slowdown was reflected in a downturn of the output gap. Quantitatively, however, the output gap estimates yielded by the different indicators differ fairly widely according to the assumed flexibility of potential output growth.

For the period 1991-2000, the different estimates all put short to medium-term average potential output growth within a fairly tight range of 1.8% to 2.2%. For 2001 alone, the interval is markedly larger, ranging from 1.9% to 3.0%, which illustrates the uncertainties surrounding estimation. In the case of indicators using a smoothing (Hodrick-Prescott filter or breaking trend) or a structural approach, which are prioritised in our analysis for the reasons given above, there is a smaller difference between the estimates of potential output growth: 1.9% to 2.1% for 1991-2000 and 2.1% to 3.0% for 2001.

For the last quarter of 2001, the difference in the output gaps calculated by the prioritised smoothing or structural indicators was fairly close (-0.25% to -1.25%), which supports the analysis that the French economy is close to its short to medium-term level of potential output.

Furthermore, medium to long-term potential output growth has slowed steadily since the beginning of the 1990s. The reasons for this slowdown are the downward trend in working time and the slower decline in the price of investment relative to the value added deflator. However, on the horizon for such indicators (a decade), gradual factors are capable of countering this downturn. Such factors would include the increase in participation rates, the decline in structural unemployment, and a return to a steeper downtrend in the price of investment relative to the value added deflator, linked, for example, to ICT investment effects.

Chart 4
Estimates of the French output gap



Guide to chart: HP: Filtering using the Hodrick-Prescott method, with $\lambda = 1\ 600$ or $7\ 000$; Breaking trend: no break appears in the trend over the period covered here; Structural VAR: VAR model with four variables – GDP, inflation, 3-month real interest rate, fiscal balance; Unobserved component: inflation is determined by its previous levels, changes in the real minimum wage and the output gap, which itself is determined by its own previous values and the 3-month real interest rate; Production function: modelling of the combination of inputs using a calibrated Cobb-Douglas function that explicitly takes into account the impact of technical progress via average equipment age.

Source: Results of estimates discussed in detail in an article by O. De Bandt and J-P. Villetelle that is to appear in a future edition of the *Digest*.

2.2. ...and the position of several other industrialised areas and countries⁶

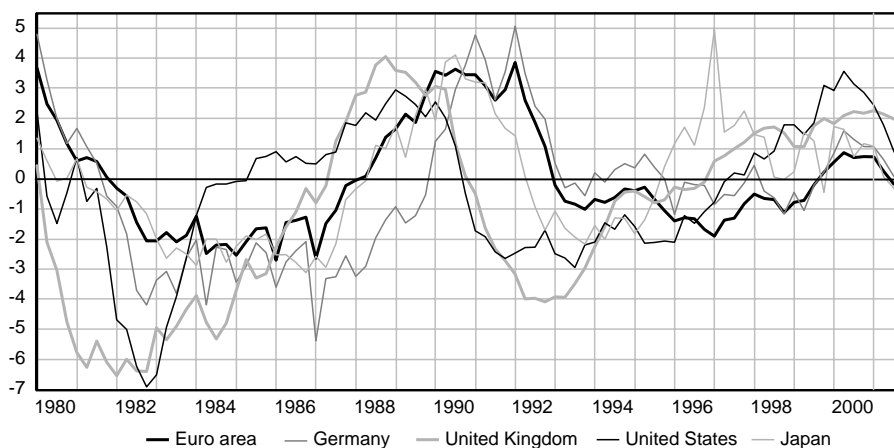
The industrialised areas and economies described below appear to be in different phases in the cycle (cf. Chart 5). The German economic cycle often seems to lag behind the euro area cycle by two to six quarters, while the euro area follows a similar cyclical pattern to that of the French economy (see above). The lag in the German economic cycle is chiefly to be seen in the 1987-1993 sub-period, during which reunification took place. By contrast, the UK cycle appears to lie two to six quarters ahead, and the US four to eight quarters. The Japanese cycle seemed to be in phase with that of the United States until the 1990s, at which point Japan's position in the cycle became blurred.

⁶ This section summarises some of the estimate results discussed in detail in an article by A-M. Rieu that will appear in a future edition of the *Digest*. For simplicity's sake, only the results obtained using the breaking trend method are supplied in Chart 5 and then commented on. The other methods yield qualitatively close results.

Chart 5

Estimate of the output gap in several industrialised areas and countries
Breaking trend method

(%)



Guide to chart: According to this method, which consists of an econometric estimation of a breaking trend, no break is shown for the euro area (whose potential output growth appears to be 2.2% per year), the UK (2.2%) and the US (3%) over the period covered here. A break appears for Germany in 1991, where potential output fell from 2.2% to 1.5%, and in Japan in 1993, where it fell from 3.8% to 0.9%.

Source: Results of estimates discussed in detail in an article by A-M. Rieu that will appear in a future edition of the *Digest*.

The rate of potential output growth has varied across countries and areas since the early 1990s. It seems to be lower in Japan, at around 0.9%, which offers a good illustration of the structural problems affecting the country. In the United States, which enjoyed especially robust growth throughout the decade, the potential output growth rate appears to be higher, at about 3%⁷. In Germany, which has doubtlessly suffered from a counter-shock following reunification, potential output growth appears to come between these two “extremes”, at 1.5%, compared with 2.2% in the UK. The euro area’s potential output growth rate also appears to average 2.2%, not substantially different from the rate estimated for the French economy using the same method (2.1%).

On average in 2001, the output gap seems to be close to zero in the euro area, Germany and Japan. This would mean, as we saw earlier for France, that output growth in these areas is likely to be close to its short to medium-term potential. The output gap appears to be around 2% in the UK and 1.5% in the US, suggesting the presence of potentially inflationary pressures.

⁷ Although greater uncertainty is attached to the results for the United States given the divergences in the estimates provided by the different methods.

3. Position in the cycle and inflation

Since one of the reasons for estimating the output gap is to identify domestic inflationary pressures within an economy, it is important to assess whether these estimates can be used to explain some of the variations observed in inflation rates.

This analysis was carried out on quarterly estimates for France over the period 1985-2001, on the basis of a simple relationship in which inflation is determined by its past rates and by current and past values of the output gap⁸. By taking into account lags in the output gap, it is possible to introduce speed limit effects, assuming that inflation is influenced not just by the output gap attained over the period under consideration, but also by present and past changes in the output gap⁹. As a result, depending on whether the output gap has previously experienced strong or weak variations, a given output gap will not necessarily reflect the same domestic inflationary pressures in all estimates. The results obtained appear to be both significant and original. They show clearly, for all indicators, the impact of past and current values of the output gap on inflation. Furthermore, this influence appears to be more important than that of an indicator of pressure on the goods market alone, such as, for example, the capacity utilisation rate. Thus, an increase of one point in the output gap for four quarters in a row will raise the rate of inflation by between 0.1 and 0.3 points in two years, with the effect gradually dissipating afterwards. In addition, a certain degree of asymmetry appears: the same increase in the output gap will be more inflationary when it is positive than when it is negative.

4. Putting these indicators to use

Estimates of potential output growth and the output gap provide two useful indicators for the conduct of monetary policy. Moreover, they can also be used in the decomposition of certain economic variables, as illustrated below in the example of the current account balance¹⁰.

⁸ See the article by M. Baghli and H. Fraisse, which will appear in a future edition of *Digest*.

⁹ D. Turner (1995) has, for example, already sought to detect such speed limit effects: *Speed limit and asymmetric inflation effects from the output gap in the major seven economies*, *OECD Economic Studies*, no. 24, 1995/1.

¹⁰ Such decompositions can also be carried out for gross financial flows or the fiscal balance, as shown by the recent analysis of C. Bouthevillain, P. Cour-Thimann, G. van der Dool, P. Hernandez de Cos, G. Langenus, M. Mohr, S. Momigliano and M. Tujula (2001): *Cyclically adjusted budget balances: an alternative approach*, September, *ECB Working Paper*, no. 77.

4.1. Inclusion in the conduct of monetary policy¹¹

Monetary policy has a transitory impact on the macroeconomic equilibrium and so does not influence potential output growth, but does affect actual output growth and, hence, the output gap. Central banks, mindful of their objective of price stability, endeavour to avoid overly large output gaps, whether positive or negative. Various monetary policy rules geared to reflect the central bank reaction function are often used to assess the stance of monetary policy. The best known of these is the rule put forward by J. B. Taylor in 1993¹² which states that the central bank's theoretical intervention rate should be determined according to the output gap, the neutral interest rate and the difference in inflation with the central bank's target.

Potential output growth and output gap indicators are included in the indicators used under the second pillar of the European Central Bank's (ECB) monetary policy, but are also used in the analysis of the first pillar.

At the very foundation of the first pillar lies the monetary approach to inflation, according to which monetary policymakers must ensure that the money supply expands in the medium term at a rate consistent with non-inflationary growth, adjusting for any changes in the velocity of circulation of the benchmark aggregate.

The output gap and potential output growth are not directly observable. Inevitably, conventional assumptions have to be used to estimate them. For this reason, the second pillar of the ECB's monetary strategy is designed to rely upon a broad set of economic and financial indicators that are likely to contain information on current and future inflationary pressures. Available estimates of output gaps obviously form part of this set of indicators

4.2. Distinguishing between structural and cyclical components in current account developments

The gross external trade flows of a country are determined by structural aspects such as the country's competitiveness with respect to its trading partners, the potential output growth of the country and its partners, or the position of the country and its partners in the cycle. Thus, all other things being equal, an increase (reduction) in the output gap of an economy will result automatically in higher (lower) imports and hence in a deterioration (improvement) in the trade balance. Symmetrically, and all other things being equal once more, an increase (reduction) in the output gaps of partner countries will cause an increase (reduction) in the exports of the country in question and hence an improvement (deterioration) in its

¹¹ We summarise here a few aspects of an article by L. Clerc that will appear in a future edition of the *Digest*.

¹² J. B. Taylor (1993): *Discretion Versus Policy Rules in Practice*, *Carnegie-Rochester Series on Public Policy*, no. 39.

trade balance. The proposed decomposition¹³, which is based on simple but realistic assumptions, shows that observed trends in France's trade balance have been largely structural over the last 20 years, given that the French economy has followed an extremely similar cyclical pattern to that of its main trading partners. This notwithstanding, the French economy has secured competitive gains over the last ten years, enabling it to enjoy higher potential output growth¹⁴ than its main trading partners, such as Germany, as well as improved trade and current account balances.

¹³ This is a brief summary of an article by D. Nivat and J-P. Villetelle that will appear in a future edition of the *Digest*.

¹⁴ Potential output growth was estimated using a Hodrick-Prescott filter.