TRENDS IN POTENTIAL OUTPUT

Measures of potential output are useful for distinguishing between longer-term trends and shorter-term cyclical movements in the economy. According to a variety of estimates, the potential output of the euro area economy fell significantly in the wake of the financial crisis. It is likely that the financial crisis has led to a one-off permanent loss in the level of potential output, owing to the economic effects of the downsizing of some sectors, such as the financial and construction sectors, following their disproportionate expansion during the boom. However, it is yet to be seen whether this will also affect the longer-term growth rate of potential output. The longer-term effects of the financial crisis on potential growth will depend very much on the flexibility of the economy in adjusting to this shock.

Irrespective of the long-run effects of the financial crisis on potential growth, the ageing population in the euro area will have a dampening effect on future potential output growth. Without far-reaching structural reforms supporting long-term economic growth, it appears unlikely that the euro area will achieve the previously measured potential growth rates of 2% or above in the coming decade. Such reforms are also important to help ensure that the financial crisis does not have a longer-term downward impact on the potential growth rate of the economy.

The output gap, which is defined as the difference between actual and potential output, can be regarded as an indicator of over or under-utilisation of the productive capacity of the economy over the business cycle. During the recent economic downturn, actual output has fallen below the level of potential output, which has led to a significant negative euro area output gap. This is likely to have contributed to the current lower inflationary pressures. However, recent evidence seems to confirm that the link between the output gap and inflation is rather weak in the euro area.

1 INTRODUCTION

The concept of potential output is generally understood to measure the medium-to-long-term level of sustainable real output in the economy. While measures of potential output growth abstract from short-term cyclical movements, they can still fluctuate from year to year, reflecting supply conditions, such as changes in the key production inputs of capital and labour and their productivity, as well as variations in investment and the degree of unemployment persistence. Therefore, variations in annual measures of potential output growth should be distinguished from the long-run trend rate of potential output growth, which is primarily determined by the rate of technical progress and population growth.

Measures of potential output are also used to derive additional indicators, such as cyclically adjusted government budget balances, which are used to assess the fiscal policy stance. However, it must be noted that potential output cannot be observed directly, but has to be inferred from existing data using statistical and econometric methods. There is considerable uncertainty in the measurement of potential output, which translates across to the derived indicators.[1]

The latest economic downturn in the context of the financial crisis had a sizeable adverse short-term impact on output. It is a widely held view that potential output may have been affected as well. The effect of the financial crisis on potential output has implications not only for economic activity, but also for the assessment of possible short-run downward price pressures emanating from excess capacity. Looking further forward, an ageing population in the

1 For a more detailed discussion of the role of potential output measures in macroeconomic analysis and the uncertainty surrounding its measurement, see "Potential output and output gaps: concept, uses and estimates", *Monthly Bulletin*, ECB, October 2000. See also "Potential output in the euro area", *Monthly Bulletin*, ECB, July 2009.

euro area will also have a dampening effect on future potential output.

This article is organised as follows. First, the various concepts and measures of potential output are described. Second, the article reviews the evolution of and current developments in estimates of potential growth, considers how they may have been affected by the latest economic downturn and discusses the longer-term outlook for potential growth. Third, the evolution of and current developments in estimates of the output gap and its link to inflation are examined. The article concludes with implications and suggestions for economic policy.

2 THE CONCEPT OF POTENTIAL OUTPUT AND ITS MEASUREMENT

Potential output is generally understood to provide an indication of the medium-to-long-term level of sustainable real output in the economy and its rate of growth. It is also referred to as the level of output which can be achieved using available production factors without creating inflationary pressures. The level of potential output and its rate of growth are affected by many factors, among which the institutional framework in which the economy operates as well as structural economic policies play a major role. The output gap, defined as the percentage deviation of the actual level of output from the potential level, measures the degree of utilisation of production factors in the economy and is often regarded as an indicator of the state of the business cycle and, among others, as an indicator of possible inflationary pressures.

The evolution of potential output depends on developments in a number of underlying factors, foremost among them supply conditions such as the endowments of the economy relating to the key production inputs of capital and labour and their productivity. Hence, potential output growth reflects developments in these supply-side elements which, in turn, are linked to various factors such as demographic and labour market trends, variations in investment and technological innovations.

The capacity of an economy to produce is shaped by the legal and economic framework. Prominent features of this framework which influence potential output are: the tax system; the definition of property laws; the efficiency of the legal and educational systems; regulations in product, labour and financial markets; and the existence of a stable, credible and efficient monetary system. In general, changes in these framework conditions can have a sizeable impact on the growth capacity of the economy. Thus, economic reforms aimed at increasing competition and minimising disincentives to invest in capital and human resources are key to raising the medium- and long-term productive capacity of the economy. Furthermore, technological innovation is an additional crucial source of variation in an economy's productive capacity (namely product and process innovations), which, by definition, is difficult to predict, but which can be seen as the main driver of economic growth in the long run. Finally, it is evident that major economic crises can affect potential growth, as part of the stock of real and human capital may depreciate more rapidly or become obsolete during severe downturns, while institutional rigidities may prevent a quick re-employment of the productive resources that become idle or under-utilised in such crises.

All in all, this suggests that the rate of potential growth can change substantially over time. Furthermore, as the impact of these factors on economic growth cannot be measured with certainty, and because the level of potential output or its rate of growth cannot be observed directly but has to be inferred from existing data using statistical and econometric methods,[2] estimates of potential output are surrounded by considerable uncertainty. This is particularly the case in the current environment, as the long-term economic implications of the financial crisis are still unclear.

2 See footnote 1.

3 RECENT DEVELOPMENTS AND OUTLOOK FOR POTENTIAL OUTPUT

In the context of the recent sharp global downturn, the uncertainty regarding the medium-term outlook for the growth of euro area GDP as well as that of the rest of the world is particularly high. In the following, estimates by international institutions of potential growth for the euro area at the current juncture are presented and the main drivers behind the recent developments in potential output are analysed. In addition, the outlook for potential output growth is discussed.

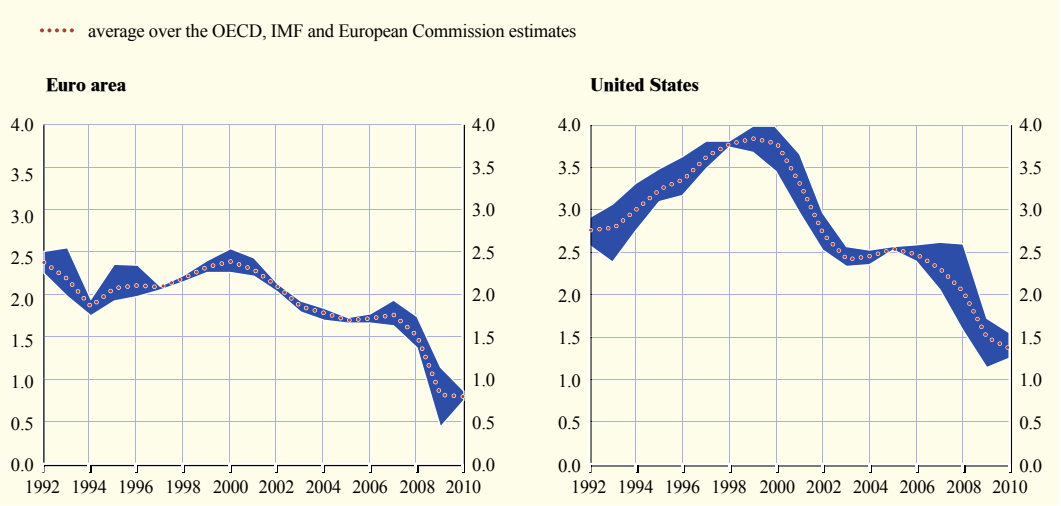
RECENT DEVELOPMENTS IN POTENTIAL OUTPUT GROWTH

Recent estimates of potential output provided by the OECD, the IMF and the European Commission indicate that potential growth in the euro area is estimated to have fallen significantly during the recent economic downturn. The average rate of annual potential growth was estimated to be around 1.9% in the period 2000-07, with a relatively narrow range of estimates over this period (see Chart 1). This compares with an average estimate of the annual rate of potential growth of 0.9% in the years 2008-10. In this latter period, the range between the estimates provided by the institutions also increased.

The sizeable fall in estimates of potential growth is not unique to the euro area: the rate of potential growth in the United States, although estimated to be at a higher level than in the euro area, was on average estimated to decline by a similar amount, from 2.5% in the period 2000-07 to 1.8% over the years 2008-10.

The approaches of international institutions to the estimation of potential output are based on the concept of a macroeconomic production function which relates output to technology levels and to the key inputs of labour and capital. Under some simplifying assumptions, such an approach allows for a decomposition of potential growth into contributions from changes in the usage of capital and labour in the economy, as well as from changes in the productivity of these factors. The latter effect is also called "total factor productivity" (TFP) and its contribution to potential GDP growth can be understood as a rough measure of the rate of technical progress of

Chart 1 Range of estimates of potential output growth for the euro area and the United States

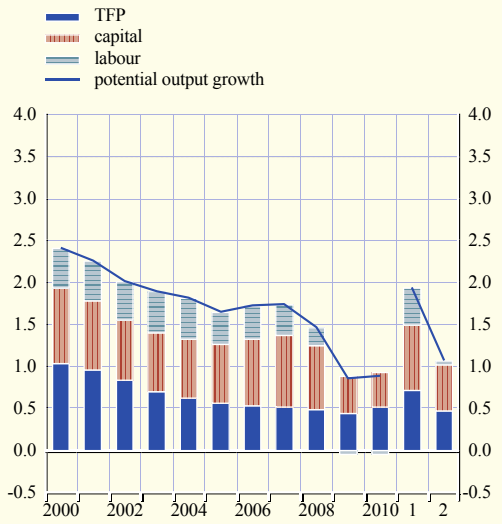


Sources: *Economic Outlook*, OECD, December 2010; *World Economic Outlook*, IMF, October 2010; and European Commission, AMECO database, autumn 2010.

the economy. In the long run, technical progress is the only source of increases in economic wealth measured by GDP per capita.

The breakdown of potential output growth estimates according to the contributions of labour, capital and productivity for the euro area is provided in Chart 2, on the basis of estimates made by the European Commission.[3] The chart reveals, first, a remarkable trend in the period 2000-07 before the financial crisis: the contributions from total factor productivity halved from about 1% in 2000 to ½% in 2007, whereas the contributions of the accumulation of the capital stock and the labour input remained relatively stable. Second, the potential growth factors have been affected by the latest economic downturn to different degrees: while the estimates of the contribution from TFP changed only marginally, the decline in potential growth in the context of the financial crisis is generally explained by lower contributions from the labour and capital inputs. The fall in the labour contribution to growth is due to an increase in estimates of the structural rate of unemployment (the NAIRU – non-accelerating inflation rate of unemployment), lower labour market participation rates, and estimates of a steeper trend decline in hours worked. Furthermore, the lower contribution from the capital stock reflects the decline in investment in the context of the recent economic downturn. This is in line with the general finding that capital and employment tend to be depressed for an extended period of time after financial crises, while TFP seems to suffer less and recover more quickly.[4]

Chart 2 Contributions to potential growth for the euro area over the period 2000-10



1 Average 2000-07
2 Average 2008-10

Sources: European Commission, AMECO database, autumn 2010.

The longer-term impact of the crisis on potential output is uncertain. There are indeed several reasons why the financial crisis may be associated with structural shocks which can lead to a longer-lasting downward shift in the level of potential output or even persistently lower growth rates of potential output.[5]

First, a lasting decline in the level of potential output can originate from the adjustment of the excess capacity which accumulated during the period preceding the crisis. Such an adjustment process would give rise to a fall in investment levels combined with an acceleration in the depreciation or obsolescence of some vintages of the capital stock. Indeed, the latest economic downturn might in some countries result in a significant downsizing of some sectors, such as the financial and construction sectors, following their disproportionate expansion during the boom.

Second, a fall in the level of potential output can originate from a reduction in the trend level of labour input as a consequence of the depreciation of labour skills due to long-term unemployment. As the downturn was particularly pronounced, and as specific sectors were disproportionately affected, this may also exacerbate the labour market "mismatch",

3 A comparable breakdown is not available for estimates by the IMF and the OECD.
4 See *World Economic Outlook*, IMF, Chapter 4, October 2009.
5 See "Potential output in the euro area", *Monthly Bulletin*, ECB, July 2009.

i.e. the matching of unemployed workers to vacancies may be disrupted as sectoral reallocation may change the range of skills required. Such frictions in the labour market can bring about a temporary but persistent increase in structural unemployment.

Longer-term effects of the financial crisis on the rate of growth of potential output are more uncertain. Such effects may emerge where the financial crisis has depressed current and expected profits over a protracted period and led to increases in risk premia, and where the supply of credit has become constrained resulting in tighter lending standards and higher effective borrowing costs.[6] Such developments can slow down investment, and consequently the accumulation of capital, over a longer period of time. Furthermore, real and nominal rigidities in labour markets may hinder the reallocation of labour resources and limit the adjustment of wages, leading to weak labour demand and a persistent pattern of lower employment growth. A deep recession may also cut potential labour force growth by discouraging groups in the labour force from participating in the labour market and by reducing immigration flows.

The factors mentioned above, together with a possible longer-lasting subsidisation of unprofitable sectors, may impede the process of restructuring and adversely affect innovation activities, thereby bringing about a lasting downward shift in productivity and hence in potential output growth. However, when less efficient firms and activities are removed from the market and substituted by more efficient ones, efficiency and productivity growth may improve in the medium and long term, thereby contributing to an increase in potential output growth. Box 1 presents empirical evidence showing that such a restructuring process is crucial for economies to maintain high productivity growth and that it would also be a key factor in ensuring that an economy grows out of an economic downturn.

Experiences with past financial crises can give an impression of how crucial economic policy responses are for the long-run impact of a financial crisis on potential output.[7] For instance, the recessions which started in 1991 in Sweden and Finland were relatively short-lived and did not result in a long-lasting reduction of potential output growth. This was largely due to the quick resolution of the banking crises in those countries, as well as comprehensive economic restructuring processes triggering an increased contribution of TFP to potential growth. By contrast, an insufficiently resolute policy reaction to a financial crisis may have contributed to the slowdown in long-run potential growth in Japan in the course of the 1990s.

All in all, the financial crisis is likely to have led to a downward shift in the level of potential output. The extent to which potential output growth has also been affected is highly uncertain, not least since the impact on growth depends to a large extent on policy responses to the recent economic downturn.

6 See the box entitled "Developments in potential output in the light of changes in oil prices and credit risk premia", *Monthly Bulletin,* ECB, December 2008.

7 "Impact of the current economic and financial crisis on potential output", *European Economy Occasional Papers*, No 49, European Commission, June 2009.

Box 1

TOTAL FACTOR PRODUCTIVITY AND STRUCTURAL PATTERNS IN FIRMS' DYNAMICS FOR SELECTED EURO AREA COUNTRIES

The link between firms' dynamics, economic activity and total factor productivity (TFP) has been widely discussed in the economic literature. The shedding of unproductive firms and the entry of more productive ones is a process that has been identified as an important driver of changes in aggregate productivity growth.[1]

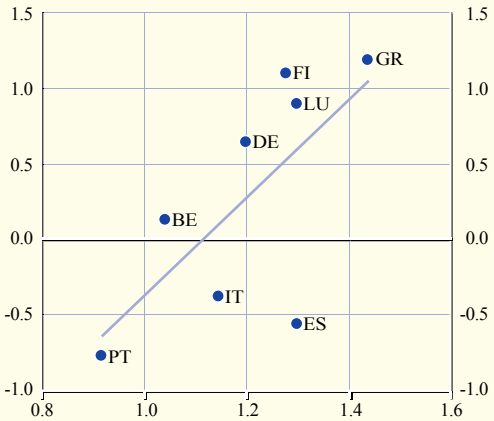
Structural features of firms' entry-exit processes seem to be a particularly relevant economic issue for TFP and potential output, particularly during large recessions such as the recent economic and financial crisis. Therefore, a better understanding of firms' exit and entry dynamics is key to the design of policies that will enhance productivity and long-term growth and provide the right conditions for a durable recovery from the crisis. This box sheds light on firms' dynamics in selected euro area countries based on data on firms' births and deaths.

The available data seem to support the view that a Schumpeterian type of creative destruction is a key feature of euro area firms' dynamics. As can be observed in Chart A, a higher level of firm births relative to deaths is broadly in line with a higher growth rate of TFP.[2] A possible interpretation of this finding is that new firms entering the market are more innovative in comparison to surviving firms and those which are exiting. An intensification of competition due

1 See Bartelsman and Doms (2000).
2 However, it should be noted that a significant correlation does not necessarily suggest the existence of a causal relationship among the variables.

Chart A Substitution ratio and TFP growth

Horizontal axis: substitution ratio – average 1999-2008
Vertical axis: TFP growth – average 1999-2008[1)]

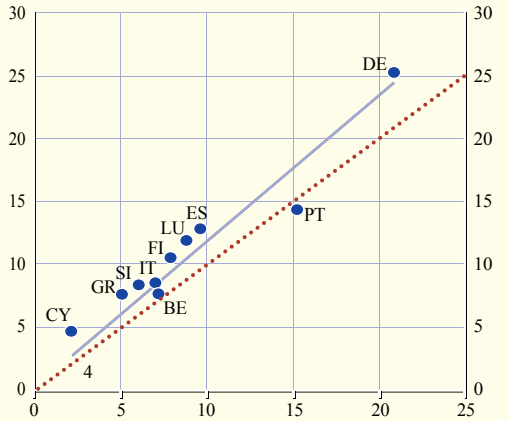


Sources: Conference Board Total Economy Database, and ECB calculations.
Note: The substitution ratio relates firm birth rates to firm death rates.
1) Percentage changes.

Chart B Average firm birth and death rates

(percentages)

Horizontal axis: average of firm death rates 1999-2009
Vertical axis: average of firm birth rates 1999-2009



Source: ECB calculations.
Note: The dotted line is a 45-degree line.
Birth and death rates are defined as the ratio between the number of firms entering or exiting in a given year and the total number of firms that existed the year before.

to a greater number of firms in the market – a result of the entry of newcomers – may also be a driver of this innovation-enhancing process.[3]

Chart B suggests a strong relationship between firm birth and death rates within the individual euro area countries. However, birth and death rates differ widely across countries, with the majority of these rates falling within the range of 5-10% of the total stock of firms.[4] In most of the euro area countries, the birth rates exceed the death rates on average over time, implying a positive net growth in the number of firms.

In summary, the "churning" of firms in terms of faster birth rates than death rates seems to be positively correlated with TFP growth. Accordingly, structural reforms which enhance the setting-up of firms, such as reducing red tape and regulations for new firm start-ups, as well as measures which foster competition and innovation and reduce product and labour market rigidities, should be seen as means to enhance TFP growth and boost the growth rate of potential output in the euro area.

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López-García, P., Puente, S. and Gómez, A., "Firm productivity dynamics in Spain", *Banco de España Working Papers*, No 0739, 2007.

3 Additionally, the contribution of entries and exits to aggregate productivity growth may vary across sectors. As Lopez and Puente (2007) show for Spain, new firms in the service sector tend to be less productive than entries in the industry sector.

4 The degree of heterogeneity/homogeneity may hide asymmetries, such as regulatory factors affecting the likelihood of opening a new firm or sunk costs related to the foreclosure of existing firms and the consequential opening of renewed businesses.

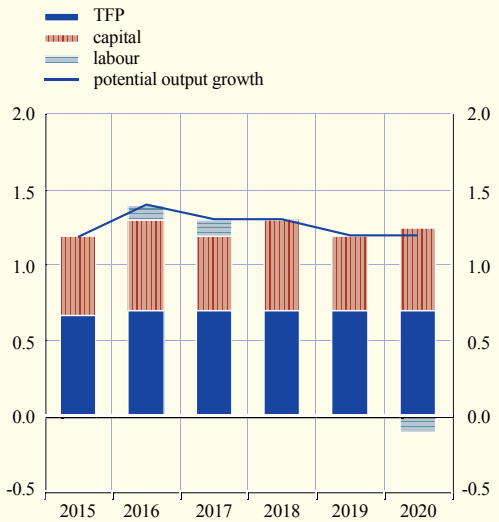
LONGER-TERM OUTLOOK FOR POTENTIAL GROWTH

Looking further ahead, future potential output in the euro area is also likely to be affected by the ageing of the population. Population ageing dampens the rate of growth of the labour force, giving rise to a lower supply of labour and thereby attenuating the growth rate of potential output in the medium and longer term.

The recent European Commission medium-term projection of potential growth for the euro area[8] – as shown in Chart 3 – points to a notable long-run decline in future potential growth rates in the euro area if there are no major changes in economic policies which would contribute to increasing the potential rate of growth. This is due to the reduction in the size of its working age population: the annual rate of change in the population aged 15-64 years in the euro area is projected to decline and therefore the overall contribution of the labour input – as measured by total hours worked in the economy – to annual potential growth is estimated to fall and become negative by 2020. The projections carry forward the 2007 pre-crisis growth contributions of about ½ percentage point by the rate of technical change and of ¾ percentage point by capital accumulation, reflecting the assumption of an unchanged stance in structural economic policies in the euro area. Together with an assumed negative contribution by the labour input reflecting the projected impact of ageing, this yields an estimated rate of growth as low as 1¼% for the euro area in 2020. Thus, even without incorporating any lasting negative impact of the latest economic downturn on potential output growth rates, the impact of an ageing population will significantly reduce potential output growth in the euro area in the long run if no economic reforms take place.

Chart 3 Medium-term scenario for potential growth of the euro area

(annual percentage changes; percentage points)



Source: *European Economy*, European Commission, 7, December 2010, pp. 48-66.

4 THE OUTPUT GAP AND INFLATION

The latest economic downturn had a large downward cyclical impact on activity. Such impacts are reflected in measures of the output gap, which is defined as the percentage difference between the actual and potential level of real GDP. Like measures of potential output, measures of the output gap are subject to uncertainties as well.

The output gap can be regarded as an indicator of the degree of usage of the economy's production capacities, reflecting short-term variations in demand. As productive capacities such as capital stock or human skills can be fully adjusted only in the medium term and cannot be immediately aligned with fluctuations in demand, the utilisation of existing production resources will change over the business cycle. Thus, a positive output gap indicates a high utilisation of capacity in times of strong demand, while a negative output gap indicates that demand falls short of the production volume that can potentially be provided with existing production capacities.

8 See European Commission, *European Economy*, 7, December 2010, pp. 48-66. The population growth assumptions underlying these projections are broadly in line with the 2009 Ageing Report (see " The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies for the EU-27 Member States (2007-2060)", *European Economy*, No 7/2008, p. 209, table entitled "Euro Area – Main Demographic and Macroeconomic Assumptions").

Accordingly, although inflation is ultimately a monetary phenomenon, the output gap is often seen as a key determinant of inflationary pressures in the short run. Put simply, the more actual output exceeds its potential level (i.e. the wider the output gap), the stronger the upward pressure on prices. Conversely, the more production capacities lie idle (and the output gap is in negative territory), the greater the incentive for firms to stimulate demand for their products by cutting prices or reducing price increases.

The latest economic downturn depressed demand to a greater extent than supply, and therefore resulted in a marked decline in the output gap in both the euro area and the United States. As estimates of the output gap shown in Chart 4 suggest, the output gap started shrinking in both economies in 2007. However, when the financial crisis intensified, the decline was amplified, and the output gap is estimated to have eventually reached an exceptionally deep trough in 2009, giving rise to the most severe downturn in peacetime since the Great Depression in the 1930s.[9] Meanwhile, the negative output gap is expected to shrink somewhat in 2010 in both the euro area and the United States.

The marked fall in the output gap in 2008 and 2009 has contributed to a lower annual rate of HICP inflation in the euro area. However, the effect has been contained, and there is a widespread consensus amongst forecasters that inflation in the euro area will remain positive over the medium term. This outlook seems to be broadly in line with historical experience, when movements in economic slack played only a limited role in the inflation process in the euro area. As Chart 5 shows, the relationship between the output gap and price developments has been mixed in the past, and it suggests that, on average, relatively large movements in output gaps are required to affect euro area inflation in a significant way.[10]

There are a number of explanations for the recent trends in inflation. As shown in more

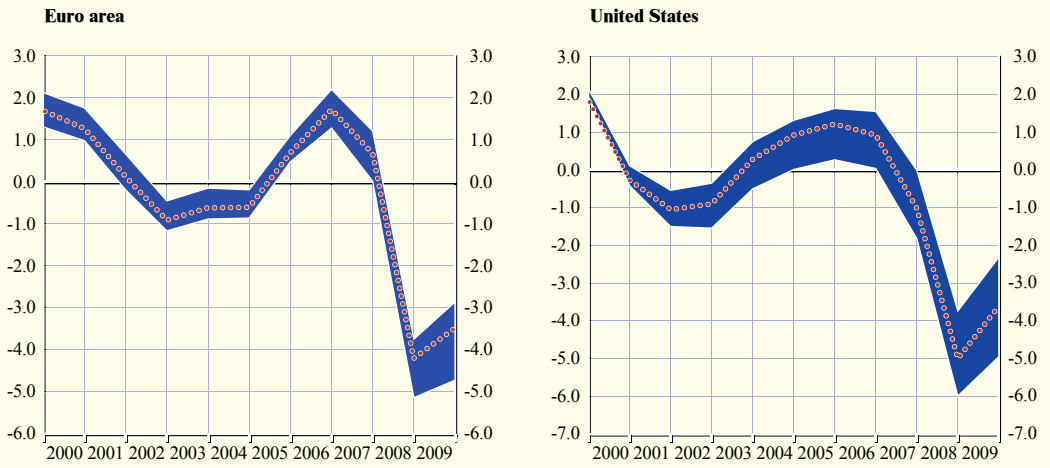
9 The latest recession differs significantly from a typical recession. For a more detailed description of the recent downturn from a historical perspective, see "The latest euro area recession in a historical context", *Monthly Bulletin*, ECB, November 2009.

10 See, for instance, Musso, A., Stracca, L. and von Dijk, D., "Instability and nonlinearity in the euro area Phillips curve", *Working Paper Series*, No 811, ECB, 2007, as well as Fagan, G. and Morgan, J., *Econometric models of the euro area central banks*, Edward Elgar Press, 2005.

Chart 4 Range of estimates of the output gap in the euro area and the United States

(as a percentage of GDP)

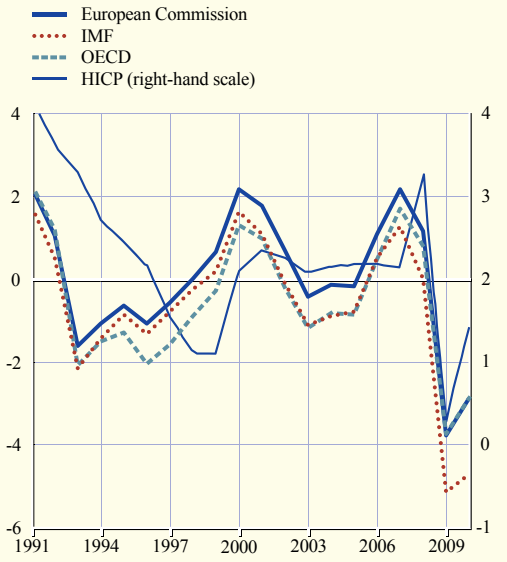
····· average over the OECD, IMF and Commission estimates



Sources: *Economic Outlook*, OECD, December 2010; *World Economic Outlook*, IMF, October 2010; European Commission, AMECO database, autumn 2010.

Chart 5 Selected measures of the euro area output gap and annual overall HICP inflation

(annual percentage changes; percentage of GDP)



Sources: European Commission, IMF, OECD and Eurostat.
Notes: Values of all variables except the annual rate of change of the HICP are shown on the left-hand scale. Estimates of output gaps in 2010 and 2011 are projections. Data for HICP excluding energy and food in 2010 are based on available monthly observations.

detail in Box 2 on the basis of a technical analysis of the link between the output gap and inflation in a Phillips curve framework, a key factor is inflation expectations, which play a strong role in shaping inflation developments. Over the past year, inflation expectations in the euro area have remained well-anchored, with medium-term measures of inflation expectations staying close to 2%, in line with the ECB's mandate of maintaining price stability.[11] At the same time, the euro area has also been characterised by wage and price rigidities, such as stickiness in wages deriving from multi-year contracts, minimum wage arrangements, or the indexation of wage agreements to inflation developments. In general, nominal rigidities can be expected to give rise to significant non-linearities or asymmetries in the response of prices to changes in activity: firms may be more reluctant to move prices down than up, and workers may particularly resist reductions in nominal wages.[12] These types of wage and price rigidities also mute the disinflationary response to a deterioration in economic conditions.

Overall, while a sizeable slack in the economy can exert a mitigating impact on price pressures in the near term, changes in prices and wages in the euro area are characterised by a substantial degree of rigidity, reducing the impact the output gap has on shaping the inflation profile, and well-anchored inflation expectations also play a crucial role. Furthermore, uncertainty in the measurement of potential output translates into the output gap. Thus, if the abrupt slowdown in activity were to reflect a negative impact of supply-side factors to a greater extent than currently assumed, the level of potential output would be lower and the output gap would be less negative. Therefore, the assessment of the impact of the current downturn on inflation is also uncertain.

11 Several studies find an increasing role for inflation expectations in estimated Phillips curves. For example, based on estimated Phillips curves for a panel of OECD economies, Anderton et al. (2010) find that the impact of the output gap on inflation may be becoming weaker over time, possibly due to changes in monetary policy that have contributed to low and well-anchored inflation expectations. See Anderton, R., Galesi, A., Lombardi, M. and di Mauro, F., "Key elements of global inflation", in *Challenges to inflation in an era of relative price shocks*, Reserve Bank of Australia Conference Volume, 2010.

12 More details on price-setting in the euro area are provided in "New survey evidence on wage setting in Europe", *Monthly Bulletin*, ECB, February 2009 and in "Price-setting behaviour in the euro area", *Monthly Bulletin*, ECB, November 2005.

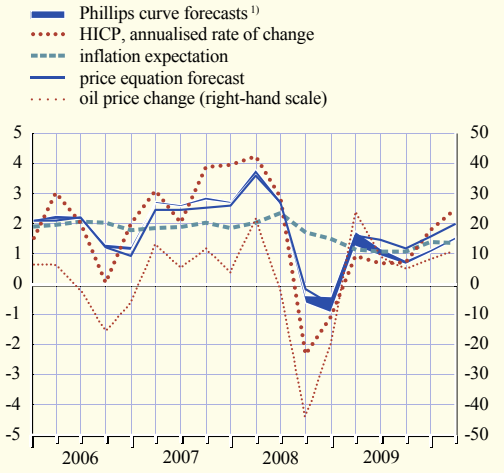
Box 2

THE LINK BETWEEN INFLATION AND THE OUTPUT GAP: AN ILLUSTRATION BASED ON A PHILLIPS CURVE FRAMEWORK

A standard framework for understanding the relationship between the output gap and inflation is the Phillips curve. In its original formulation, the Phillips curve presented a simple short-term relationship between inflation and the unemployment rate.[1] Modern variants acknowledge that potential output can also vary over time and therefore relate inflation to deviations of economic activity from its potential level – the output gap.[2] They also recognise the influence of firms' and workers' expectations on price- and wage-setting behaviour. Empirical estimates of the Phillips curve thus include proxies for inflation expectations – either forward-looking (e.g. expectations based on surveys of economic forecasts) or more backward-looking (i.e. expectations based on past inflation) – reflecting that expectations mechanisms can also be formed adaptively in response to developments in inflation. Finally, Phillips curve models of inflation also attempt to capture the influence of other exogenous supply-side factors such as changes in oil and other commodity prices. Since changes in these prices tend to be passed through to headline HICP inflation, substantial movements in these variables have a significant effect on inflation in the short run.

Actual HICP inflation and model predictions of HICP inflation based on estimated output gaps, oil price changes and inflation expectations

(quarter-on-quarter percentage changes)



Sources: Eurostat, Datastream, Consensus Economics survey, European Commission (AMECO database), OECD, IMF and ECB calculations.
Note: Values of all variables except the oil price change are shown on the left-hand scale.
1) Range implied by the range of output gap estimations by the European Commission, the OECD and the IMF. The European Commission and IMF estimates of annual values of output gaps have been interpolated to obtain quarterly values.

This box illustrates the possible impact of economic slack – as measured by the output gap – on inflation, on the basis of a simple but broadly standard Phillips curve framework. The impact of different variables explaining inflation in such a framework can be estimated by regressing the quarter-on-quarter, annualised rate of change of the overall HICP on the following main explanatory variables:[3] (i) the measure of one-year-ahead inflation expectations from the Consensus Economics survey, (ii) the value of HICP inflation in the preceding quarter (as a means of capturing inertia and rigidity in the adjustment of prices), (iii) the quarterly rate of change of the oil price in euro (as a way of capturing an important exogenous supply-side driver of inflation), and (iv) a measure of the output gap. In order to assess the importance of the output gap as a driver of inflation, an alternative estimation has also been carried out excluding the output gap. In a second step, the impact parameters derived from the model estimations can be used to derive two types of inflation predictions conditioned on the values of the explanatory

1 See Phillips (1958).
2 See Kuttner (1994).
3 The regression models are estimated on the basis of the ordinary least squares method with data from Q1 1991 to Q2 2010.

variables: first, the Phillips curve predictions incorporating the impact of the output gap as measured by different institutions – the European Commission, the IMF and the OECD – and second, a prediction of inflation excluding the output gap impact but still reflecting the impact of the remaining explanatory variables (i.e., price equation forecast).[4]

The chart illustrates the main results of this exercise for the period Q1 2006 – Q2 2010. The two types of predictions are very similar, and they both broadly match the observed inflation. The explanation for this result is that the variation in inflation is primarily captured by factors other than the output gap: first, the overall level of inflation is broadly determined by inflation expectations, which have remained comparatively stable over the recent recession. Second, the quarter-on-quarter variations in overall inflation mainly reflect exogenous impacts such as oil price changes.

Summing up, the results of this analysis suggest that for the euro area over this period, the output gap has played only a limited role in shaping inflation developments, while other determinants, such as inflation expectations and changes in oil prices, have been more important.

References

Kuttner, K.N., "Estimating Potential Output as a Latent Variable", *Journal of Business and Economic Statistics*, 12, 1994, pp. 361-368.

Phillips, A.W., "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom", *Economica,* 25, 1958, pp. 283-299.

4 Standard statistics indicate that the estimated models perform well overall: all explanatory variables are statistically significant at conventional significance levels, with the exception of lagged inflation in the Phillips curve models. The part of the variance in inflation explained by the explanatory variables is in the range of 73-76% for the Phillips curve models, depending on the estimates of output gaps used. Without using the output gap in the regression model, the share of the explained variance amounts to 73%. The component of inflation unexplained by the explanatory variables is captured by the regression residuals. They are assumed to reflect only unsystematic random influences and should be uncorrelated and normally distributed over time. On the basis of standard statistical tests, these assumptions hold broadly for the Phillips curve models, while the respective diagnostic statistics for the regression model without the output gap are weaker. Overall, taking the output gap into account in these models of inflation developments improves their statistical properties, whereas the actual economic impact of the output gap on inflation is limited.

5 CONCLUSIONS

The financial crisis has been accompanied by a slowdown in the potential output growth rate of the euro area, and similar falls in potential output can be observed in other economies, such as the United States. In principle, the financial crisis should only have a temporary effect on the potential growth rate of the economy, i.e. it should only lead to a single downward shift in the level of potential output. However, this will depend on a variety of factors, particularly the flexibility of the economy and the policy reaction to the financial crisis.

Looking further ahead, the ageing of the population will contribute to a lower growth rate of potential output in the euro area in the medium and longer term. On the basis of currently available estimates, it does not seem likely that the euro area will reach the pre-crisis levels of potential growth of 2% or above over the coming decade.

The prospect of a slowdown in potential output growth in the longer term suggests that far-reaching structural economic reform efforts are needed in the euro area to support a lasting increase in production and employment

and to pave the way for a recovery in the long-term sustainable economic growth prospects to become firmly established. Past experiences show that enhancing productivity growth is key to sustaining high levels of long-term growth, particularly in the aftermath of a financial crisis.

The main determinants of gains in productivity in the medium and long term are the rate of technological innovation in the economy, the speed with which less efficient sectors of the economy can restructure, and how flexible the economy is in allowing resources made unemployed or under-utilised during the financial crisis to be re-employed more productively. Therefore, the prospects for potential growth depend very much on the policy framework. A sufficiently flexible institutional framework will help the restructuring process and ensure that the latest economic downturn does not lead to the economy getting locked onto a lower potential output growth path in the medium and longer term. Hence, economic policy needs to aim at strengthening the adjustment capacity and flexibility of labour and product markets. This can best be achieved by facilitating appropriate wage-setting and enhancing labour mobility across sectors and regions. Fostering competition and strengthening investment incentives would also speed up the process of restructuring and boost productivity.

The latest economic downturn has seen some moderation in inflation due to the sizeable negative output gap which opened up over the financial crisis. However, in line with historical regularities, the downward reaction of inflation in the euro area to changes in the output gap has been relatively contained. Inflation expectations are crucial determinants of the inflation process. As these expectations have remained well-anchored by the ECB's monetary policy during the crisis, at levels below but close to 2% over the medium term, this has contributed to shielding inflation developments from deflationary pressure during the crisis. It is also likely that downward rigidities in wages and prices in the economy played a role in limiting the downward reaction of inflation.