

## ARTICLES

# PRODUCTIVITY DEVELOPMENTS AND MONETARY POLICY



*Since 1995, the average rate of growth of euro area labour productivity has remained around 1.3% per year, much lower than in the United States over the same period and than in the euro area in the 1980s and early 1990s. To date, there are no clear signs of an inversion of this declining trend, even if some evidence supports the view that the slowdown may have recently come to a halt. Within such an uncertain environment, monetary policy must exploit all available information to form its best assessment of future productivity developments and of the ensuing outlook for inflation. At the same time, future productivity trends will always remain shrouded in uncertainty; their estimates are likely to be revised with the arrival of new information. A benign assessment of their inflationary implications at any point in time must not lower monetary policy's vigilance against the risks to price stability. It is particularly important that other economic policies play their role in curing the causes of the European productivity slowdown, through a timely and determined implementation of the Lisbon agenda.*

### I INTRODUCTION

The protracted slowdown in productivity growth in recent years represents one of the most notable developments in the euro area. During the period in which the United States enjoyed a productivity revival, apparently linked to the development of new Information and Communication Technologies (ICT), euro area productivity growth fell to the lowest levels seen since the Second World War. The latest data suggest that this declining trend may have come to a halt in recent years but, to date, there is no conclusive sign of an inversion of this trend.

The persistence of the productivity slowdown is a source of concern. For developed economies, where the process of capital accumulation has reached a mature stage, labour productivity growth is the main engine of economic growth per capita in the long run. At the same time, variations in the rate of productivity growth shape the environment in which monetary policy operates.

This article reviews past and current developments in euro area productivity growth and discusses their implications for monetary policy. The difficulty in gauging future trends in productivity growth makes the task of maintaining price stability more challenging for the central bank. Within such an uncertain environment, monetary policy must exploit all available information to form its best assessment

of the future development of productivity and of the ensuing outlook for inflation.

A central bank must also acknowledge that estimates of trends in productivity growth will always remain shrouded in uncertainty. Perceptions of imminent upside risks to price stability may prove to be misplaced with the benefit of hindsight. Conversely, a benign assessment of the inflationary consequences of productivity developments may turn out to be overly optimistic ex post, when more information becomes available. Monetary policy must always remain vigilant against risks to price stability.

While the main focus of the article is on the implications of productivity developments for monetary policy, it should be noted that the best contribution that monetary policy can make to economic growth is to ensure that price stability is maintained in the economy over the medium term.<sup>1</sup> The experience of the past 20 years demonstrates that low and stable inflation is accompanied by low output volatility. In turn, stable macroeconomic conditions and prospects tend to be conducive to growth. Other economic policies must play a role in curing the causes of

<sup>1</sup> Evidence of a detrimental effect of inflation on output growth is provided, for example, in Barro, R. (1997), "Determinants of economic growth: a cross-country empirical study", Lionel Robbins Lecture, Cambridge, Mass.: MIT Press, and Fischer, S. (1993), "The role of macroeconomic factors in growth", *Journal of Monetary Economics* 32, pp. 485-512.

the sluggish growth rate of European productivity through the timely and resolute implementation of the Lisbon agenda.

## 2 PRODUCTIVITY GROWTH: PAST TRENDS

Three broad phases can be identified when comparing western European and US labour productivity growth, measured by real GDP per hour worked, over the post-Second World War period. The first phase (1950s to 1973), the “golden age of productivity”, was characterised by high rates of growth of output per hour worked in both economic areas. Productivity growth was especially high in the euro area, where it remained almost 3 percentage points higher than in the United States from 1960 until 1973 (see Chart 1). For Europe, this was a period of catching-up growth: capital deepening allowed European economies to reduce the gap in productivity separating them from the United States immediately after the War.<sup>2</sup>

In the early 1970s, productivity growth slowed down markedly on both sides of the Atlantic. Nevertheless, Europe continued to perform better than the United States on average, and the productivity gap between Europe and the United

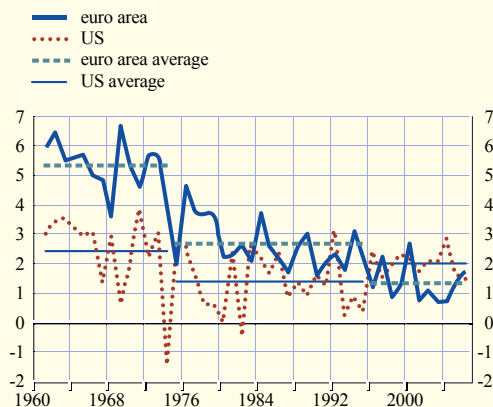
States was almost closed in the first half of the 1990s.

From the mid-1990s onwards, euro area productivity decelerated further. Output growth remained roughly unchanged, but the growth rate of total hours worked increased with respect to the previous periods. Consequently, labour productivity decelerated to an average rate of 1.3%, approximately 1.4 percentage points less than over the 1974-94 period. These developments are not common to the United States. Over the same years, the rate of productivity growth in the United States increased to 1.9% on average, from an average of 1.4% over the previous 20 years. The different productivity performance was reflected in a corresponding disparity in the rates of GDP growth. Between 1995 and 2006, output expanded at an average rate of 3.1% in the United States, compared to 2.1% in the euro area.

Some of the differences between the euro area and US performance are in the sectors producing ICT,<sup>3</sup> but these differences are not sufficient to explain the large discrepancy between overall labour productivity growth in the euro area and in the United States. The bulk of the cross-Atlantic gap in aggregate productivity growth is concentrated in more traditional, ICT-using sectors, where European firms do not seem to have exploited the benefits of new technologies to their full extent. Over the 1995-2005 period,

Chart 1 Productivity growth in the euro area and the United States

(annual percentage changes)



Source: European Commission AMECO database. German data prior to 1991 are inferred from West Germany only. Averages calculated over the periods 1960-74; 1974-94 and 1995-2006.

2 For further discussions of productivity developments in the euro area and in the United States, see Box 4 of this ECB Monthly Bulletin. Other relevant information on this topic can also be found in the ECB Monthly Bulletin article entitled “Labour productivity developments in the euro area: aggregate trends and sectoral patterns”, in July 2004, and the ECB Monthly Bulletin boxes entitled “Developments in euro area labour productivity”, in March 2005, “Developments in euro area labour quality and their implications for labour productivity growth”, in October 2005, and “Labour productivity and price developments in the euro area services sector: the role of competition”, in April 2006.

3 See, for example, S.D. Oliner and D.E. Sichel (2000), “The resurgence of growth in the late 1990s: is information technology the story?”, *Journal of Economic Perspectives* 14, pp. 3-22. There are, of course, different views on the role of the IT-producing sector in the US productivity revival. See, for example, R.J. Gordon (2000), “Does the new economy measure up to the great inventions of the past?”, *Journal of Economic Perspectives* 14, pp. 49-74; K. Stiroh (2002), “Information technology and the U.S. productivity revival: what do the industry data say?”, *American Economic Review* 92, pp. 1559-1576.

compared with the previous 15 years, euro area labour productivity growth fell in most non-ICT related sectors and especially in market services, including distribution, financial and business services, while at the same time, it significantly accelerated in the United States.<sup>4</sup> The slow exploitation of new technologies in European ICT-using sectors is also confirmed by growth accounting analyses, which break down the rate of growth of labour productivity into three main components: capital deepening, increases in labour quality, and the rate of growth of total factor productivity (TFP), which is a more specific measure of disembodied technological progress associated with the use of all factor inputs. These analyses demonstrate that the strongest determinant of the labour productivity slowdown in ICT-using sectors is the net reduction in the rate of growth of TFP.

The weak TFP growth performance suggests the presence of factors which prevent, or slow down, the process of exploitation of all the advantages of the new technologies in the euro area lagging industries. The structural rigidities which characterise the euro area economy – a less flexible labour market, a lower degree of competition in product markets and higher barriers to entry for new firms as well as a less developed capital market – are therefore likely to be responsible for its poor productivity performance. Conversely, the more flexible structural characteristics of the US economy would have proved to be better suited for the challenges and opportunities of technological innovation. The reasons are intuitively clear: a higher degree of competition creates incentives to invest and innovate; flexible labour markets facilitate the re-allocation of resources; developed capital markets, including a mature venture capital industry, are instrumental to the financing of new innovative firms.

The importance of structural rigidities has been confirmed by a few studies that measure differences in the regulatory restrictions of non-manufacturing sectors of OECD countries.<sup>5</sup> These studies find that highly regulated environments tend to be associated with lower

investment and productivity growth. This evidence is broadly in line with the hypothesis that ICTs have the largest impact on productivity growth indirectly, namely by sparking further innovations in managerial processes, procedures and organisational structures, and by facilitating complementary innovations. For example, computers and internet reduce communication costs and allow for more flexible and decentralised organisational structures. The full benefits of the productivity acceleration can only be reaped if there are no obstacles to organisational change.<sup>6</sup>

Studies have found a strong negative correlation between anti-competitive regulation and innovation.<sup>7</sup> The effect comes largely through larger barriers to entry, which reduce competition and the incentive of incumbents to innovate.<sup>8</sup> The negative consequences for productivity growth are minor in an environment where no other firms innovate, but are rather dramatic when technological progress boosts productivity. The recent decline in euro area productivity growth may then be a peculiar result of the coexistence of regulation and

4 Source: EUKLEMS database.

5 For example, A. Alesina, S. Ardagna, G. Nicoletti and F. Schiantarelli (2005), "Regulation and investment", *Journal of the European Economic Association* 3, pp. 791-825, find that regulatory reforms have had a significant positive impact on capital accumulation in the transport, communication and utilities sectors, especially in the long run. G. Nicoletti and S. Scarpetta (2003), "Regulation, productivity and growth", *Economic Policy* 18, pp. 9-72, find that various measures of anti-competitive product market regulations significantly reduce TFP growth at the industry level.

6 See for, example, van Ark, Bart and Inklaar, Robert, 2006, "Catching up or getting stuck? Europe's troubles to exploit ICT's productivity potential", GGDC Research Memorandum GD-79, Groningen Growth and Development Centre, University of Groningen.

7 G. Nicoletti and S. Scarpetta (2005), "Regulation and economic performance: product market reforms and productivity in the OECD", OECD Economics Department Working Paper No. 460. At the same time, there is some evidence that higher competitive pressure leads to more innovative and efficient work organisation. See N. Bloom, R. Sadun and J. Van Reenen (2007), "Americans do I.T. better: U.S. multinationals and the productivity miracle", NBER Working Paper No. 13085.

8 For example, see P. Aghion, N. Bloom, R. Blundell, R. Griffith and P. Howitt (2005), "Competition and innovation: an inverted U relationship", *Quarterly Journal of Economics* 120, pp. 701-28. This paper also shows that the relationship between competition and regulation may be different for different levels of competition.

**Table 1 Euro area labour productivity growth**

(annual percentage changes)

	2002	2003	2004	2005	2006	2006 Q3	2006 Q4	2007 Q1	2007 Q2	2007 Q3
Whole economy	0.2	0.4	1.0	0.7	1.4	1.3	1.7	1.3	0.7	0.7
of which:										
Agriculture and fishing	1.8	-3.6	11.9	-4.8	-0.3	-0.6	2.8	2.3	3.2	
Industry	0.9	1.3	2.1	1.2	3.5	3.5	3.5	2.8	1.6	
Excluding construction	1.3	1.9	3.1	2.2	4.3	4.4	4.7	3.8	3.3	
Construction	0.0	-0.2	-0.6	-1.0	1.8	1.7	1.0	1.5	-2.3	
Services	-0.1	-0.1	0.2	0.7	0.5	0.5	0.7	0.7	0.3	
Trade and transport	0.2	-0.2	0.9	1.0	1.5	1.5	2.2	1.7	1.1	
Finance and business	-0.5	0.6	-0.7	0.3	-0.5	-0.8	-0.5	-0.4	-1.2	
Public administration	-0.2	-0.7	0.1	0.0	-0.4	-0.2	-0.4	0.0	0.0	

Source: Eurostat.

technological innovation. While regulation has probably become less stringent in more recent years, it has become more costly for firms in an era of rapid technological progress driven by ICT.

Despite a large number of studies published in recent years, the sources of the euro area productivity slowdown are still not fully understood. This increases the difficulty of gauging future trends from current developments.

### 3 PRODUCTIVITY GROWTH: RECENT DEVELOPMENTS

The main difficulty when trying to estimate underlying trends in productivity growth is that these unfold amidst extremely high volatility on a quarterly basis. Developments in 2007 are illustrative in this respect.

Data released by Eurostat during the spring of 2007 showed a clear acceleration in labour productivity growth (per person) in 2006, reaching 1.4% compared with 0.7% in 2005. In year-on-year terms, labour productivity growth peaked at 1.7% in the fourth quarter of 2006. At the sectoral level, positive developments in labour productivity were mainly driven by developments in industry (excluding construction). However, labour productivity growth in the services sector also showed signs

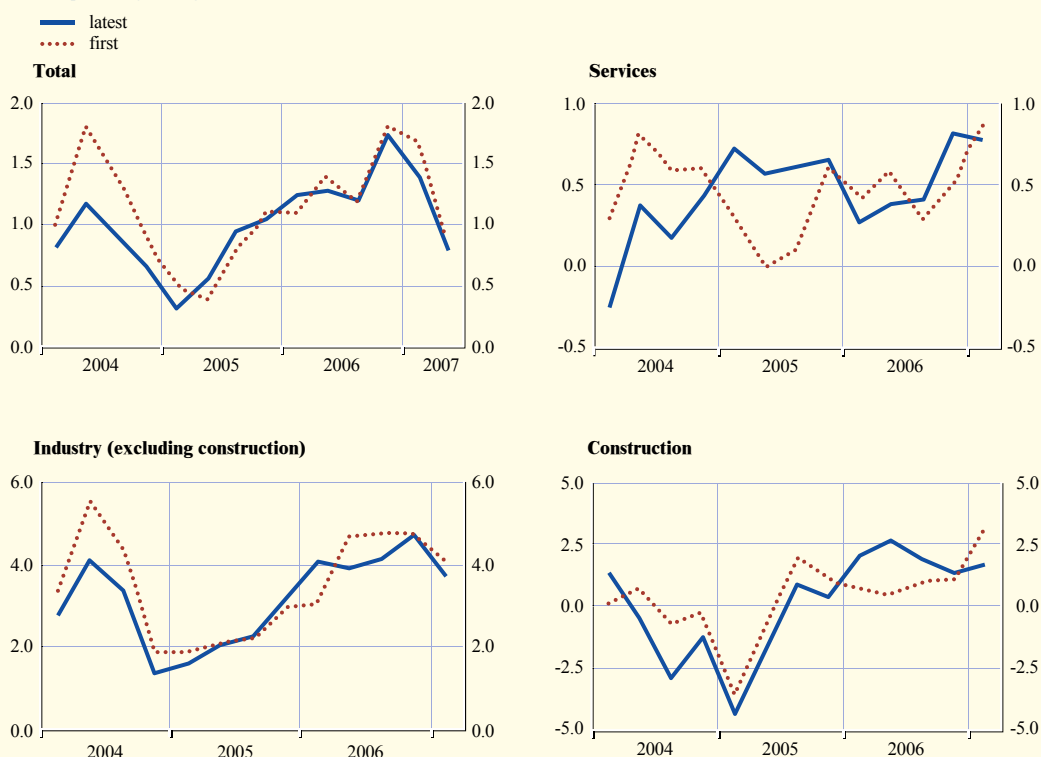
of improvement, recording an increase of 0.8% year on year in the fourth quarter of 2006. These positive developments could be interpreted as a signal of a more positive outlook for the future, possibly a consequence of the successful implementation of some market reforms. However, latest available national account data released by Eurostat in autumn 2007 suggest a more sceptical assessment: labour productivity growth declined in the second quarter of 2007 and currently stands well below its peak at the end of 2006 (see Table 1).

The difficult task of disentangling structural from cyclical movements in macroeconomic time series is further complicated by non-negligible data uncertainty. For example, Chart 2 illustrates the difference between the first estimate of labour productivity growth published by Eurostat for a given quarter and the latest estimates released on 11 October 2007 for the current and past quarters. First estimates published during 2005 clearly underestimated labour productivity growth in the services sector.

A final difficulty when estimating trends in technological developments is that they do not happen in isolation, but typically take place at the same time as other unforeseeable events, such as oil price or exchange rate shocks. The box presents estimates of how observed labour productivity developments in the euro area may be attributed to various shocks within a general equilibrium model.

Chart 2 Euro area (national accounts) labour productivity growth first and latest estimates

(annual percentage changes)



Source: Eurostat.

Note: The latest estimate refers to the second release of euro area national accounts published by Eurostat on 11 October 2007.

## Box

## ANALYSING RECENT PRODUCTIVITY DEVELOPMENTS THROUGH THE LENS OF A GENERAL EQUILIBRIUM MODEL

In the following analysis, developments in labour productivity during the period 2001–07 are interpreted through the lens of the New Area-Wide Model (NAWM)<sup>1</sup>. The NAWM builds on recent advances in developing micro-founded dynamic stochastic general equilibrium (DSGE) models suitable for quantitative policy analysis. Featuring optimising behaviour and forward-looking expectations on the part of households and firms, supply-side factors tend to have a pronounced influence already in the short run, despite the existence of nominal and real rigidities.

Specifically, the model is used to decompose past fluctuations in productivity growth around its trend growth rate into contributions of economically interpretable factors, or “structural shocks”. These structural shocks are identified by estimating the NAWM using a relatively large set of euro area data. To facilitate the interpretation of the historical decomposition, these shocks

<sup>1</sup> Further information on the model can be found in Kai Christoffel, Günter Coenen and Anders Wærne (2007), “Conditional versus Unconditional Forecasting with the New Area-Wide Model of the Euro Area” available at: [www.nber.org/~confer/2007/si2007/efsfrg.html](http://www.nber.org/~confer/2007/si2007/efsfrg.html).

(17 in total) are grouped in four distinct categories: (i) technology shocks (determining supply-side developments); (ii) demand shocks (affecting private and public spending); (iii) mark-up shocks (influencing wage and price-setting decisions on the part of households and firms, respectively); and (iv) foreign shocks (capturing various influences originating in the model's external sector).

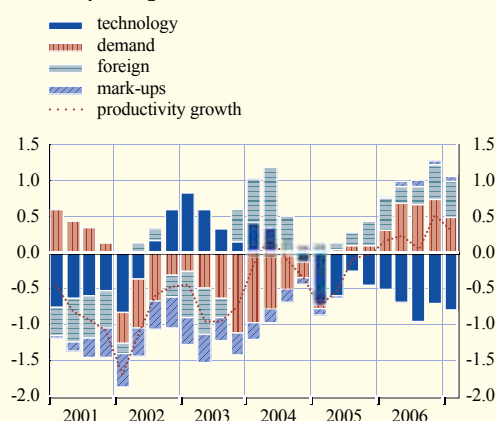
An important feature of the analysis is that a structural model like the NAWM allows going beyond growth accounting exercises. Standard growth accounting decomposes labour productivity developments into contributions of total factor productivity (TFP) growth and capital deepening. However, the decomposition is based on a number of simplifying assumptions, including that markets are perfectly competitive and that the prices of factors of production — capital and labour — tend to remain close to their long-run equilibrium levels. In practice, deviations from perfect competition are widespread and the user cost of capital (or, the capital rental rate) and real wages can vary significantly over time in response to various shocks affecting the economy. While the standard growth accounting framework can be adjusted to account for these features, the NAWM captures these effects naturally within a general equilibrium setting, allowing also for endogenous movements in the capital-labour ratio (i.e. capital deepening).

Another novelty of using the NAWM for productivity analysis is that it distinguishes three types of technology shocks: transitory shocks to TFP, which shift the production capacity of firms for given factor inputs temporarily; permanent shocks, which have a permanent impact on the efficiency of labour inputs in the production of goods and services; and investment-specific technology shocks, which have a direct but transitory impact on the efficiency of newly installed capital goods. A permanent productivity shock translates into a lasting increase in wages and gives rise to an increase in permanent income and therefore in output. By contrast, a transitory increase in productivity will affect demand less strongly, having its main impact on the costs of production. Investment-specific shocks are a key factor explaining capital deepening.

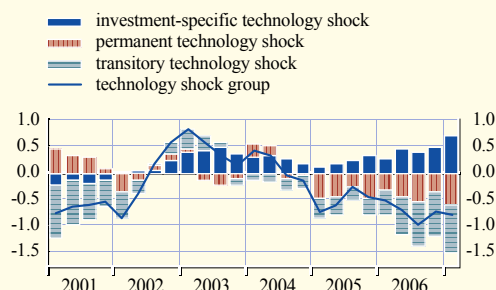
The upper panel of the chart depicts the decomposition of year-on-year labour productivity growth (measured in terms of real GDP per person employed) over the period 2001-07 into

### Decomposition of labour productivity growth (in deviation from steady state)

#### Labour productivity growth in deviation from steady-state growth rate



#### Decomposition of technology shock group for labour productivity growth



Note: Based on simulation of the NAWM, the upper panel of the chart depicts the historical decomposition of year-on-year labour productivity growth over the period from the first quarter of 2001 to the first quarter of 2007. Labour productivity growth rates are reported in deviation from the calibrated steady-state growth rate of 1.2 percent per annum. Observed labour productivity growth is decomposed into the contributions of four distinct groups of shocks. The lower panel shows the decomposition of the technology shock group.



the contributions of the estimated structural shocks. Labour productivity growth is measured in deviation from a steady-state growth rate of 1.2% per annum which has been calibrated to match the average rate of productivity growth over the model's estimation sample ranging from 1985 to 2005. Notice that the decomposition does not aim at explaining the trend growth rate of productivity. The decomposition can be used to illustrate which factors have been important in explaining the movements in labour productivity growth around its trend value. The lower panel of the chart provides a more detailed analysis of the contribution of the technology shock group, which comprises three distinct types of technology shocks, as discussed earlier.

A first observation is that according to the NAWM, over the recent years, the factors identified as technology shocks have contributed less to productivity developments in the euro area than would have been predicted on the basis of historical trends, with the exception of the period 2003-05. This is evident from the fact that the bars indicating the impact of technology has been mostly on the negative side in the upper panel of the chart. This is in line with the observation that throughout the 2001-07 period, growth in output has been mostly below the long-term trend growth rate as calibrated in the NAWM.

Demand shocks and foreign shocks have also played an important role in affecting the rate of growth of observed labour productivity. The contribution of demand shocks was negative during the slowdown in the 2002-05 period. With the recent cyclical recovery of labour productivity starting in 2005 the contribution of demand shocks becomes again important, rising to around 0.5% in 2006. From 2001 onwards until 2004, external developments had a significant negative impact on productivity in the euro area, most likely triggered by the downturn in economic activity in the United States and its negative international spillovers, whereas from 2004 onwards foreign shocks have been contributing positively.

The decomposition of the overall contribution of technology shocks into the contributions of the three distinct types of technology shocks is shown in the lower panel of the chart. This decomposition suggests that from 2005 onwards capital deepening (due to strong investment activity caused by positive investment-specific technology shocks) gradually offsets the adverse effects of transitory and permanent technology shocks on labour productivity growth. Positive contributions of permanent technology shocks are limited to the year 2001 and the first half of 2004, whereas transitory technology shocks make a positive contribution only from mid-2002 to mid-2003.

In summary, the model suggests that there is hardly evidence in favour of sustained improvements in labour productivity growth beyond the steady-state component assumed in the NAWM. When assessed through the lens of the model, recent developments in labour productivity seem mostly driven by demand factors. In particular, the recent pick-up in labour productivity growth is explained by vigorous domestic demand and favourable external developments. The positive contributions of technological advancements are limited to investment-specific technology shocks. Overall, however, the contributions of technological advancements fall short of those predicted on the basis of historical trends.

Given the aforementioned difficulties, the real-time assessment of the degree of permanent changes to productivity should be based on a wide set of indicators, rather than focusing on one or a few summary statistics. Further to trend estimates computed from labour productivity data, for example, it is also important to look at the sources behind productivity growth using growth accounting techniques, as well as using relevant monthly indicators which are available in a more timely fashion.

One way of estimating the long-run trend of labour productivity growth is to employ statistical tests for the presence of a break. Table 2 shows that the current estimate of euro area long-run labour productivity growth is 0.74 over the period from the first quarter of 1997 to the first quarter of 2007. Most of the gains in labour productivity are the outcome of developments in industry. The contribution from the services sector is 0.18 percentage points.

Statistical tests can be slow to detect changes in the equilibrium growth rate of economic time series, which usually take place gradually. The extraction of smooth trends might be preferred from this viewpoint, even if there is evidence that these methods are not always reliable.<sup>9</sup> Chart 3 presents an estimate of this sort, which signals that labour productivity growth has been edging up for the past two years. However, taking into account the uncertainty surrounding these

estimates, it is not possible to conclude that the trend shifted upwards by a significant margin.<sup>10</sup> The figure also shows a mild pick-up in the recent contribution of trend TFP growth. Current estimates of the long-run trend of labour productivity growth, however, stand at 1.1%, well below the 1.7% peak reached at the end of 2006.

Other indicators are broadly in line with these results. Estimates of TFP point to a recent pick-up in its contribution to labour productivity growth, but this contribution remains subdued by historical standards. Moreover, it was accompanied by a non-negligible contribution from capital deepening over 2004-06, a development often observed temporarily during cyclical upturns.

Overall, latest available data do not provide strong signals to suggest that the historical decline in labour productivity growth has been reversed in recent years. However, there is evidence that indicates that the productivity slowdown may have come to a halt.

<sup>9</sup> See, for example, Box 5 of the February 2005 ECB Monthly Bulletin entitled "The unreliability of output gap estimates in real time".

<sup>10</sup> Other methods used to compute long-run trends in labour productivity growth lead to similar conclusions. See, for example, "Drift and breaks in labor productivity", by Luca Benati, *Journal of Economic Dynamics and Control*, Vol. 31, pp. 2847-2877.

**Table 2 Break estimate of the euro area long-run trend of labour productivity growth**

(annual percentage changes)

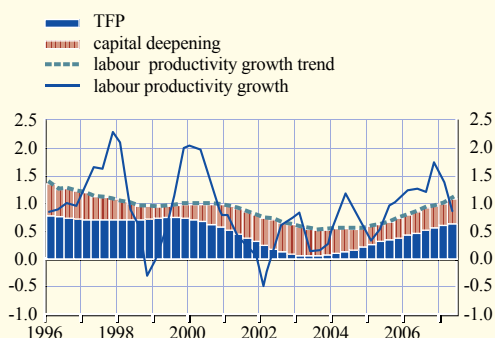
	1970 Q2 - 1979 Q2		1979 Q2 - 1997 Q4		1997 Q4 - 2007 Q1	
	Growth	Contribution	Growth	Contribution	Growth	Contribution
Total	2.91	2.91	1.63	1.63	0.74	0.74
Services	1.79	0.76	0.75	0.38	0.28	0.18
Industry	2.58	0.79	2.58	0.74	2.58	0.53
Construction	0.86	0.08	0.86	0.07	0.86	0.06
Agriculture	4.43	0.82	4.43	0.54	4.43	0.24
Labour Reallocation	-	0.46	-	-0.10	-	-0.28

Notes: Using the techniques described in Bai and Perron (1998) suggests the presence of two breaks in total and services labour productivity growth. Breaks in total and services labour productivity growth occurred in 1979Q2 and 1997Q4. Empirical evidence of the presence of breaks in labour productivity growth in other sectors is not strong and therefore the average rate of growth over the whole sample period is used as the long-run trend of labour productivity growth. For details on the statistical test for the presence of multiple breaks, see Bai, J. and P. Perron (1998), "Estimating and testing linear models with multiple structural changes", *Econometrica*, Vol. 66, No. 1, pp. 47-78.



**Chart 3 Estimate of the euro area long-run trend in labour productivity growth**

(annual percentage changes)



Notes: Computation of the long-run trend in labour productivity growth has been carried out using the statistical production function model described in Proietti, T; A. Musso and T. Westermann (2007), "Estimating Potential Output and the Output Gap for the Euro Area: a model based production function approach", *Empirical Economics*, Vol. 33, pp. 85-113.

#### 4 MACROECONOMIC CONSEQUENCES OF PERCEIVED CHANGES IN PRODUCTIVITY GROWTH

The development of productivity growth, likewise other economic developments, affects the environment in which monetary policy operates. It exerts an influence on aggregate output and prices and can, therefore, endanger the ability of the central bank to fulfil its statutory objectives. For the ECB, the primary objective is to maintain price stability over the medium term. This is defined as a year-on-year increase in the Harmonised Index of Consumer Prices for the euro area below, but close to 2%.<sup>11</sup>

As illustrated in Section 3, it is very hard to recognise changes in trend productivity growth in real time. Nevertheless, in order to provide a benchmark for the discussion of monetary policy implications, it is useful to analyse first the unrealistic scenario whereby a productivity slowdown is known to be permanent. In this case, its consequences for potential output and equilibrium real interest rates can be estimated with sufficient precision.

A fall in trend productivity growth would be associated with a lower rate of growth of potential output. *Ceteris paribus*, the lower potential output growth would generate upward pressure on prices over the medium term. The trend rate of growth of money should decrease in order to neutralise such inflationary pressure. In the medium term, lower rates of economic growth, lower real wage increases and higher levels of unemployment would be sustainable. Growth theories suggest that equilibrium real interest rates would also decrease proportionally to trend productivity growth. If price stability is maintained and inflation expectations remain well-anchored, the lower real rate would spill over one-to-one into a lower nominal interest rate in the new equilibrium.

While medium to long-term tendencies associated with a productivity slowdown are clear, its consequences on prices along the adjustment path are ambiguous. Both inflationary and deflationary pressures could arise, depending on the effects of the slowdown on aggregate demand and aggregate supply.

A productivity slowdown will, in fact, tend to produce two competing effects. The first effect, which can be denoted as "supply effect", derives from the lower potential output growth associated with the productivity slowdown. *Ceteris paribus*, the fall in potential output implies that firms will find it more difficult to satisfy aggregate demand. To some extent, this will lead to a temporary increase in output above potential, namely a positive output gap, for example through a temporary increase in hours worked. At the same time, firms will have an incentive to increase prices, thus generating upward pressure on inflation.

The second effect of the productivity slowdown is to reduce individuals' net wealth, to the extent that lower productivity growth is reflected in a lower growth of future profits and wages, and

<sup>11</sup> See the articles entitled "The stability-oriented monetary policy strategy of the Eurosystem", in the January 1999 ECB Monthly Bulletin, and "The outcome of the ECB's evaluation of its monetary policy strategy" in the June 2003 ECB Monthly Bulletin.

thus in currently lower asset prices and reduced human capital. These expectations, in turn, will tend to depress consumption, to the extent that individuals attempt to avoid large fluctuations in their consumption patterns over time. Investment would also slow down due to the reduction of profitable investment opportunities. For given potential output growth, the fall in consumption and investment, which can be denoted as “demand effect”, will thus give rise to excess aggregate supply thereby leading to downward pressure on inflation.

Whether inflation tends to increase or fall in response to a productivity slowdown will depend on which of these two effects dominates. If supply effects were to dominate in the short run, the central bank would need to increase interest rates for some time, as potential GDP falls more rapidly than actual GDP, to ensure that the price stability objective were not jeopardised. On the other hand, if demand effects were to prove stronger in the short run, the appropriate monetary policy reaction would be to keep interest rates lower than otherwise, so as to prevent the emergence of negative pressures on prices. For example, supply effects will tend to dominate when productivity developments are perceived to be short-lived. In this case, potential output growth would automatically be depressed, but net wealth would not be affected much, given perceptions that future consumption and investment possibilities ultimately remain unchanged. Aggregate demand would thus react little, and notably less than aggregate supply.

Structural features of the economy, which will also lead to a predominance of the supply effects, are a low degree of financial development, or the existence of credit constraints. Well functioning financial markets are important, because asset prices tend to reflect expected changes in future economic conditions. A productivity slowdown would, for example, be quickly reflected in a reduction of the value of wealth invested in the equity market. In a less financially developed economy, adverse productivity developments would affect fewer individuals and, if their propensity to consume is less sensitive to

variations in wealth, possibly cause smaller adjustments in aggregate demand.

The demand effect will dominate instead when productivity developments are perceived to be very persistent, or permanent. A scenario of permanently lower productivity growth is ultimately associated with a slower increase in standards of living and would easily give rise to marked declines in equity prices, hence a strong negative wealth effect.

The demand effect will also tend to dominate in economies characterised by more flexible production structures. In this case, actual output will fall more rapidly in line with potential output through a reduction in firms’ capacity utilisation. Conversely, in the case of a technological acceleration, production structures and organisations will be adapted quicker to reap the benefits of the improved technologies. Obviously, the demand effect will also be stronger when financial markets are fully developed and there is widespread participation in equity markets.

## 5 IMPLICATIONS FOR MONETARY POLICY

Developments in trend productivity growth are difficult to recognise in real time and can generate both inflationary and deflationary pressures in the short run. It is therefore not possible to draw unambiguous conclusions with regard to the most appropriate direction of the monetary policy response to a perceived slowdown in productivity growth. Nevertheless, some broader policy implications can be drawn based on economic research and past experiences.

First, given that most of the short-term dynamics of labour productivity growth tend to be of a transitory nature, while persistent changes occur rarely and are often quantitatively smaller, a cautious approach is warranted when interpreting new developments in productivity. From this viewpoint, it would certainly be too early to interpret the recent, timid increases in euro area labour productivity growth as initial

signs of a productivity revival, possibly spurred on by advances in ICT.

Second, the assessment of the nature — persistent or temporary — of productivity developments must be allowed to change over time, in light of new information and economic data. A central bank must pay attention to all relevant information in order to form its best assessment of productivity developments as part of the analysis of the risks to price stability. If labour productivity growth data point persistently in the same direction, and if movements in other macroeconomic and microeconomic data provide supporting evidence, a conjecture that the recent recovery is cyclical should be progressively revised in favour of the hypothesis that it is more persistent.

The ECB's monetary policy strategy is well equipped to cope with the uncertainty related to possible changes in productivity growth because it does not pre-commit the ECB to react mechanically to some indicators or forecasts. By relying on two pillars, the ECB's strategy explicitly acknowledges that there is uncertainty regarding the true structure of the economy and consequently the true nature of the transmission process. By allowing it to exploit the information from various types of analysis and by focusing in detail on the nature of shocks hitting the economy, the ECB's strategy is likely to continue to serve well in an environment of pervasive uncertainty surrounding future productivity developments.

Third, misperception of the nature of productivity developments is the norm, rather than the exception. Since persistent changes in productivity growth are, by nature, relatively infrequent, they will often be mistaken for temporary fluctuations. Acknowledging that the risk of misperceptions is unavoidable, it is important for monetary policy to prevent such misperceptions from spilling over into inappropriate decisions. Monetary policy should only react gradually to perceived economic developments. When measurement errors are

likely to occur, a strong policy response to mismeasured economic variables can induce undesirable fluctuations in inflation and real output, with adverse, sometimes dramatic, consequences for economic prosperity. One of the proposed explanations of the so-called Great Inflation of the 1970s in the United States relies exactly on the hypothesis that a major misperception of the economy's productive capacity in real time led to an overly expansionary monetary policy. A strong policy response to real-time information runs the risk of proving to be misguided *ex post*, once the assessment of economic conditions is revised on the basis of more reliable information.

Fourth, monetary policy should always remain vigilant about threats to price stability. Underlying inflationary pressures may be detected too late, if arising from developments — such as those connected with productivity growth — that are difficult to recognise in real time. Research work comparing the effects of different policy rules suggests that, when actual inflation dynamics are inconsistent with the definition of price stability, the monetary policy stance should be gradually, but persistently adapted, even if the assessment of inflationary trends remains benign.<sup>12</sup> Conversely, underlying trends, which have not yet affected actual inflation, should be monitored closely, but not necessarily reflected in policy decisions if they are imperfectly measured.

Finally, it is of paramount importance for a central bank to ensure that inflation expectations remain well-anchored. Maintaining inflation expectations closely in line with the ECB's definition of price stability ensures that, if and when inflationary shocks materialise, they are less costly to correct in terms of macroeconomic disruption. At the same time, firmly anchored inflation expectations are a precondition for a measured short-term response to economic

12 See, for example, A. Orphanides and J. Williams, "Robust monetary policy rules with unknown natural rate", *Brookings Papers on Economic Activity* 2:2002, pp. 63-118.

disturbances, with a view to ensuring more balanced macroeconomic conditions.

## 6 IMPLICATIONS FOR OTHER POLICIES

Changes in the trend growth rate of labour productivity are key determinants of economic growth and are relevant for monetary policy-making, but the best contribution that monetary policy can make to sustainable growth is to foster a stable macroeconomic environment through the maintenance of price stability. Structural policies must take responsibility for creating conditions conducive to better productivity and growth performance.

In the euro area, significant progress has been made in some areas, for example to reduce barriers to competition. Several network industries, such as telecommunications, are now fully or largely open to competition.

This progress notwithstanding, the implementation of structural reforms has been thus far too slow, thereby calling for further efforts – as advocated in the revised Lisbon strategy – in order to facilitate the reallocation of resources to their most productive uses, while fostering labour productivity growth and technological advances.

The extension and deepening of the EU internal market remains a priority. Concrete steps in this direction are the pursuit of effective competition in the energy market, the implementation of the Services Directive, and the general process of increasing further financial market integration. At the same time, it is important to create an entrepreneurial-friendly economic environment, to support innovation through higher investment in research and development and human capital formation. This implies less red tape for small and medium-sized enterprises to help them develop at home and across borders, as well as positive action to remove obstacles which prevent access to the finance they need. Venture capital is crucial to support the emergence of new and innovative firms willing to reap the

benefits of opening markets and to embark on creative or innovative ventures for commercial exploitation on a larger scale.

Product market reforms must be accompanied by labour market reforms. Such reform should aim at increasing participation rates by increasing incentives to work. In Europe, incentives to work are undermined by the legal and regulatory environment, the tax systems and social institutions. Any barriers to cross-border labour mobility should be removed, because labour mobility is an essential element of the Internal Market and an important channel for adjustment in the context of monetary union.

Finally, in a world where job security is reduced, education and training systems need to continuously adjust to the labour market needs to enable workers to master transitions between jobs and keep up with technological developments. Activation measures help to shorten unemployment spells which could lead to a loss of workers' capacities and productivity.

## 7 CONCLUSION

Since 1995, the average rate of growth of euro area labour productivity has remained around 1.3% per year, a level which represents a marked slowdown compared to those in the 1980s and early 1990s. At the same time, the US economy enjoyed a remarkable productivity revival.

The bulk of the cross-Atlantic gap in aggregate productivity growth can be explained in terms of different rates of adoption of ICT in traditional economic sectors. Euro area firms appear to have been unable to exploit the benefits of the new technologies to their full extent, in line with the hypothesis that new technologies have the largest impact on productivity growth indirectly, namely by sparking further innovations in managerial processes, procedures and organisational structures, and by facilitating complementary innovations. Increasing the flexibility of the

euro area economies through further structural reforms is an important precondition to foster an inversion of the productivity decline.

To date, there are no clear signs of an inversion of this trend, even if some evidence supports the view that the slowdown may have come to a halt.

Within such an uncertain environment, monetary policy must exploit all available information to form its best assessment of future productivity developments and of the ensuing outlook for inflation. However, estimates of the trend growth rate of productivity are notoriously difficult and bound to remain shrouded in uncertainty. A benign assessment of the implications of underlying productivity developments must not reduce monetary policy's vigilance against the risks to price stability.