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## Research Technical Paper

### *Prospects for Growth in the Euro Area*

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### **Abstract**

We review the recent performance of the Euro area economy, focusing in detail on the separate roles played by labour input, capital input, and total factor productivity (TFP). After a long period of catching up with US levels of labour productivity, Euro area productivity growth has, since the mid-1990s, fallen significantly behind. We show that this recent divergence has accelerated since 2000, and that this is mainly due to the poor rate of Euro area TFP growth. Based on prevailing trends, we estimate that potential output growth in the Euro area currently may be running as low as 1.5 percent per year. In addition, if TFP growth stays at recent levels, the output growth rate will decline further due to weaker capital deepening. To consider future Euro area prospects for growth, we examine a set of alternative scenarios, each of which posits a potential increase in a determinant of output growth. One of these scenarios focuses on the potential effects of greater labour market deregulation.

# 1 Introduction

For much of the post-War period, the rate of economic growth in Europe was similar to that observed in the US. This process came to a halt during the mid-1990s. Since then, the US economy has grown substantially faster than that of Western Europe: US GDP has grown at an average rate of 3.3 percent per year compared with 2.0 percent in the Euro area. This difference in growth performance has generated considerable debate about how to boost the growth rate of the European economy and has had an important influence on the policy focus of national governments, the European Commission, and the European Central Bank (ECB). For national governments and the Commission, there has been an increased focus on the need for deregulation of product and labour markets. This reform agenda has been formalised in the Lisbon Agenda set of policy proposals and discussed in high-profile publications such as the 2003 *Sapir Report*.

In relation to monetary policy, the ECB's constitution calls for it to promote economic growth provided this does not undermine its primary goal of price stability. Indeed, the ECB has become a key participant in public debates about the need for structural reforms to boost the potential capacity for growth in the Euro area. Discussions of this issue have, for instance, regularly featured in the official statements accompanying the decisions of the ECB Governing Council and in the public statements of the ECB President.<sup>1</sup> Of course, another reason the ECB needs to keep track of the potential growth rate of the Euro area economy is because it also needs to have some measure of the "speed limit" at which the economy can operate over a sustained period of time without generating inflationary pressures.

In this paper, we review the performance of the Euro area economy over the period 1970:Q1-2006:Q2 and provide an assessment of its current potential for growth. We also discuss the role that structural reform policies may be able to play in boosting the potential growth rate. Our review of the evidence suggests a number of reasons to be somewhat downbeat about the current potential for economic growth in the Euro area. Growth in labour productivity (defined as output per hour worked) was higher than in the US until the mid-1990s, but has steadily declined over time since then, averaging only 0.9 percent per year over the period 2001:Q1-2006:Q2 compared with 2.0 percent for the US. We also focus in detail on the separate roles played by labour input, capital input, and total factor

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<sup>1</sup>For example, see Jean-Claude Trichet: Testimony before the Committee on Economic and Monetary Affairs of the European Parliament, 23rd May 2005. Available online at: [www.bis.org/review/r050530b.pdf](http://www.bis.org/review/r050530b.pdf).

productivity (TFP) in determining economic growth. These calculations provide further evidence of a deteriorating performance: We calculate average TFP growth for the Euro area over 2001:Q1 to 2006:Q2 of only 0.3 percent per year, compared with 1.6 percent for the US over the same period. While it is possible that differences in measurement methodologies contribute to part of the measured gaps in productivity growth, it appears that these differences account for very little of the turnaround in the relative performances of TFP.<sup>2</sup>

Based on a detailed examination of recent trends, we argue that the potential growth rate of output per hour in the Euro area appears to be about 0.9 percent per year. Combined with the recent growth rate of 0.6 percent per year in hours worked, this suggests that the growth rate of Euro area GDP in the near-term may be as low as 1.5 percent per year. This is far below the 3 percent target set as part of the Lisbon strategy, and even further below the figure generated by the application of our methodology to the US, which provides an estimate of about 3.2 percent.

More worryingly, we document that the composition of recent growth implies that, if current trends continue, then the potential growth rate of the Euro area is likely to decline further. This is because recent growth has relied mainly on increases in capital and labour inputs, with negligible improvements in total factor productivity. Our estimates of the present trend growth rate are based on taking the current prevailing growth in capital input as given. However, a key insight from growth theory originating with Solow (1956) is that growth in capital is endogenous and depends on sustained improvements in technological efficiency. We show that the current trend growth rate of TFP is consistent with a long-run (steady-state) growth rate of output per hour of only 0.5 percent per year.<sup>3</sup> Even if this was combined with an optimistic assumption about long-run hours growth, it implies that unless there is a turnaround in TFP growth, the long-run growth rate of Euro area GDP will be just over 1 percent.

Our relatively negative assessment contrasts somewhat with the more positive conclu-

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<sup>2</sup>Lawless (2006) reports that the application of hedonic indices to European national accounts closes only one-tenth of a percentage point per year of the gap between US and EU productivity growth over the period 1995-2002.

<sup>3</sup>This is an important source of difference between our projections and those in a recent ECB study by Musso and Westermann (2005). Their study is more optimistic about current trend growth rate of labour productivity in the Euro area, assuming 1.4 percent instead of 0.9 percent; they also assume that the rate of capital deepening will not change in the future, while we project this to decline.

sions of Olivier Blanchard (2004) who argues that Europeans have tended, since the 1970s, to take additional leisure time as the reward for a faster level of productivity growth, so a focus on overall GDP growth or GDP per capita figures tends to understate the true positive extent of European economic performance. Blanchard's analysis, however, was largely based on data through 2000, and the period since then has seen a substantial weakening in European productivity growth. Indeed, we calculate that the gap between the levels of US and European labour productivity has widened from about 9 percent in 2000 to about 16 percent in early 2006.

In the final part of the paper, we discuss the effects on GDP growth and productivity of structural reform programs designed to boost labour input and capital investment. We simulate the effects of a labour market reform package that closes about half of the gaps between the Euro area and US in participation rates, unemployment rates, and average workweeks. While we find that such a package would boost growth above 2 percent for a period of time, it would only do so at the expense of a significant worsening of productivity growth and would not change the poor long-run growth prognosis implied by recent trends in TFP growth. We also find that even a substantial increase in the capital investment share of GDP is unlikely to boost the medium-run growth rate above 2 percent in the absence of any improvement in the trend rate of TFP growth.

In addition, the evidence suggests that obtaining these positive reform outcomes may not be so easy. The limited amount of labour market reform seen already has not had much effect on labour market performance: Hours worked per capita are about the same today as they were ten and twenty years ago. Furthermore, the share of nominal GDP accounted for by capital investment has been moving down over time despite a wide range of product market deregulation measures. Overall, our analysis suggests that policies aimed at improving TFP growth will be crucial if the Euro area is to return to higher levels of economic growth over the next decade.

The contents of the rest of the paper are as follows. Section 2 reviews the growth performance of the Euro area and compares it with the US, focusing on GDP growth, labour productivity and hours worked. Section 3 presents evidence on TFP and investment. Section 4 examines the likely growth potential over the medium- and long-run of the Euro area economy if current trends prevail. Section 5 then considers a set of scenarios involving policies aimed at boosting the growth rate over the coming years. In particular, we focus on the effects of policies aimed at labour market deregulation and boosting capital investment.

Section 6 concludes with a discussion of the outlook for Euro area TFP growth.

## 2 Review of Growth Performance

### 2.1 Output and Productivity Growth

Figure 1 provides a long-run perspective on the relative performances of the US and Euro area economies, illustrating their records of GDP growth, growth in hours worked, and growth in labour productivity (defined as output per hour) between 1970:Q1 and 2006:Q2. Recent data for the Euro area come from Eurostat. Because most of the Eurostat series only go back to the early 1990s, we extended the database back using the same growth rates as the corresponding series in the ECB's Area-Wide Model dataset described in Fagan, Henry and Mestre (2001). Data for the US are drawn from the websites of the Bureau of Labour Statistics and the Bureau of Economic Analysis: The details behind the construction of these datasets are provided in an appendix.

The upper-left panel of the figure shows that, since 1970, GDP Growth in the US has generally exceeded that in the Euro area. However, for most of this period, this higher growth rate has reflected a faster growth rate of hours worked (the upper-right panel). Indeed, up until the mid-1990s, the growth rate of labour productivity in the Euro area consistently exceeded that in the US (the lower-right panel). This pattern is often explained as the result of Europe's potential for "catching-up" with the US, as it learned to adopt US technologies and thus close the substantial gap in labour productivity levels which had prevailed during the immediate post-War period. The catch-up story has also been used to explain the fact that European productivity growth has eased off over time, as the gap between productivity levels was closed.<sup>4</sup>

When considered in the light of the "catch-up" story, the period since the mid-1990s has represented something of a puzzle. Not only has European productivity ceased catching up, but productivity has decelerated even as the US has undergone a period of productivity growth stronger than any seen since the golden economic age of the 1960s. Indeed, using figures from the Groningen Centre for Growth and Development to obtain estimates of Purchasing Power Parity consistent *levels* of labour productivity, it is apparent that a

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<sup>4</sup>Blanchard (2004) and Dew-Becker and Gordon (2006) both emphasise the catch-up story as an explanation for Europe's superior productivity performance and its subsequent slowdown.

substantial gap has re-emerged between US and Euro area productivity.<sup>5</sup> After reaching almost parity with US by the mid-1990s with a gap of 4 percent in 1995, we estimate that this gap stands at about 16 percent in 2006:Q1 (see the bottom-right panel of Figure 1). However, unlike the last time a gap of this magnitude prevailed (circa 1982) Europe is still falling behind in terms of productivity: For reference, Euro area productivity growth in the first half of the 1980s was running at an average rate of 2.4 percent per year, compared with 0.7 percent over the three years ending in 2006:Q1. In contrast, as of yet, there is no sign of the Euro area starting to close the productivity gap or even catching up with the growth rate of US productivity.

## 2.2 Labour Market Developments

Figure 2 provides a perspective on the behaviour of hours worked in the US and the Euro area. Total hours worked can be defined as the product of four elements: Population times Labour Force Participation Rate times Employment Rate times Hours Worked Per Employee. The figure provides evidence on how the US economy has generated stronger hours growth through each of these four factors.

**Population Growth** has been consistently higher in the US than in the Euro area, averaging about 1 percent per year compared with 0.4 percent for the Euro area. This gap has reflected both higher rates of immigration and a higher birth rate. In recent years, the rate of population growth in the Euro area has moved up to about 0.6 percent, largely due to increased rates of immigration, most notably from Eastern European countries that have joined the European Union.

**Labour Force Participation** (defined here as the ratio of the labour force to total population) was slightly higher in the Euro area than the US in the early 1970s, but fell behind during the 1970s and 1980s. This difference in performance reflected a smaller increase in labour participation among working age individuals and a larger increase in non-working-age relative to working age population in Europe (this latter factor reflecting a weaker birth rate and less immigration). Participation rates in both the US and Euro area have essentially flattened out in recent years, with the long upward trend due to higher female participation rates having apparently run its course.

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<sup>5</sup>These calculations were derived from the Groningen Centre's Total Economy Database.



**Unemployment Rates** are another area where European and US performances have diverged. European unemployment was negligible in the early 1970s but climbed steadily until the mid-1990s. After retreating somewhat in the late 1990s, unemployment rates in the Euro area have remained relatively steady at a high rate of about eight to nine percent during the current decade.

**Average Workweeks** (i.e. the average hours worked per week for each person employed) represent perhaps the most dramatic difference between US and European labour market developments. While European and US average workweeks were similar in the early 1970s, the Euro area workweek has declined significantly to below 30 hours worked per week, while the US workweek fell off a little in the 1970s but has remained at about 36 hours per week since then. Alesina, Glaeser, and Sacerdote (2005) note that differences in vacation time account for most of the gap that has opened between European and US workweeks.

Figure 3 illustrates the behaviour since 1970 of hours worked per capita in the US and Euro area. This series summarises the combined effects of these last three factors (the participation rate, unemployment rate and average workweek). Table 1 also provides an accounting decomposition of growth in hours worked over various periods into its four components. Figure 3 shows that from the 1970s to the mid-1980s Euro area hours worked per capita declined steeply, with increasing unemployment and, more importantly, a sharply declining workweek offsetting the effects of an increasing participation rate. Since then, Euro area per capita hours have been roughly flat at about thirteen hours worked per week per person. In contrast, US hours per capita started off behind Europe in the early 1970s and then trended upwards through the late 1980s, with the strong upward trend in participation offsetting a weaker decline in the average workweek. The period since the late 1980s has seen US hours per capita fluctuate around 17 hours per week.

The behaviour of hours worked per capita in Europe over the past decade must be viewed as somewhat disappointing. This is because this relatively unchanged outcome has occurred against a background in which there is broad agreement that the European labour market is over-regulated and in which various steps have been taken in the direction of deregulation. For instance, measures to encourage temporary contracts have been more widely introduced, tax credit systems that provide better incentives to work in low-paid jobs have become more widespread, and tax rates on labour have declined. However, despite these measures, there has been little change in participation rates, unemployment rates or

average workweeks since 2000.

### 3 Capital Investment and Total Factor Productivity

In addition to labour input, capital investment is another important factor determining labour productivity. For this reason, it is generally considered that one can get a better picture of how well an economy uses its resources by focusing on total factor productivity (TFP), which is defined as the efficiency with which it combines its labour and capital inputs to produce its output. Here, we present evidence on Euro area and US TFP growth based on a simple growth accounting exercise.

#### 3.1 Growth Accounting

Our starting point is the standard assumption that output is produced according to a Cobb-Douglas production function

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad (1)$$

where  $Y_t$  is real GDP,  $K_t$  is capital input,  $L_t$  is labour input (defined as hours worked), and  $A_t$  is total factor productivity. Output growth can then be written as

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \alpha \frac{\dot{K}_t}{K_t} + (1 - \alpha) \frac{\dot{L}_t}{L_t} \quad (2)$$

So, with data on output growth, capital growth, and labour growth in hand, this equation can be used to calculate TFP growth.

Our empirical calculations use the standard value of  $\alpha = \frac{1}{3}$  for all cases.<sup>6</sup> For the US, our data on capital are based on estimates of the total stock of fixed assets provided by the Bureau of Economic Analysis, which are available through 2004. A simple interpolation method was used to create quarterly data, and stock estimates though 2006:Q2 were generated by growing out the stock according to a perpetual inventory formula using the 2004 estimate of the average depreciation rate of the stock. For the Euro area, no official

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<sup>6</sup>An alternative is to use the labour share of income to calibrate the parameter  $1 - \alpha$ . However, for both the US and Euro area, this value has averaged about two-thirds, in line with our assumptions. In addition, we should note that our calculations can be considered accurate for any neoclassical production function, provided our estimate of the elasticity with respect to labour input is well captured by our two-thirds assumption.

estimates of the capital stock exist, so our estimates are based on an initial assumption that capital in 1970 was at the steady-state value implied by the Solow growth model (this is discussed in greater detail in the appendix) and subsequently calculated based on the assumption that capital depreciates at six percent per year. Our results, however, are not particularly sensitive to either this initial assumption or the assumed depreciation rate.

Figure 4 shows that capital input has generally grown faster in the US than in the Euro area. In particular, the figure highlights the strong growth in the capital stock during the mid to late-1990s when the US went through a period of very strong growth in investment. Over the whole period examined, one of the implications of the stronger US capital growth is that the TFP growth record of the Euro area relative to the US has been even stronger than its positive labour productivity growth record. Indeed, the figure shows that TFP growth in the Euro area exceeded the comparable series for the US over almost every three year period from the early 1970s until 1992. The period since, however, has shown US TFP growth moving ahead. In particular, the period since 2000 has seen the gap between Euro area and US TFP growth widen, with the Euro area appearing to have settled down at a very low growth rate of 0.3 to 0.4 percent per year.

Table 2 presents more detailed results from a growth accounting exercise which allocates output growth according to its three components. The table confirms the improvement over time in the TFP performance of the US economy and its superior growth of capital and labour inputs, as well as the steady decline in European TFP growth. Table 3 provides an alternative accounting breakdown, describing the determination of labour productivity growth as a function of TFP growth and “capital deepening” (growth in capital per unit of labour). In other words, it provides the figures behind the identity

$$\frac{\dot{Y}_t}{Y_t} - \frac{\dot{L}_t}{L_t} = \frac{\dot{A}_t}{A_t} + \alpha \left( \frac{\dot{K}_t}{K_t} - \frac{\dot{L}_t}{L_t} \right) \quad (3)$$

These figures show that both capital deepening and TFP growth have moved downwards over time in the Euro area, while the opposite has occurred in the US. The decline in TFP growth has been even sharper than the decline in capital deepening. As we will discuss in the next section, however, capital deepening should not be considered a completely independent source of productivity growth because it depends on TFP growth over the long-run.

### 3.2 Measurement Issues

As is the case with any growth accounting decomposition, these calculations must come with some important caveats. Both left- and right-hand-sides of the growth accounting equation are subject to significant measurement error, and our measures of real GDP, labour input, and capital input could potentially be considered imperfect. This is because our approach has been to compare US and Euro area economic performances over a long period using comparable statistical measures, and this necessitates using measures that may be slightly less sophisticated than those available for one of the regions or over shorter time periods. Overall, however, we don't think that measurement problems can "explain away" our finding of a steady deceleration in Euro area TFP growth and the emergence of a widening gap relative to US TFP growth since 2000.

Perhaps the most commonly raised measurement issue is that the output of high-tech sectors in the US are measured using quality-adjusted "hedonic" indices while there is limited application of such methods in Europe. This difference could potentially overstate US productivity growth relative to the Euro area. Studies based on re-calculating European GDP growth using US hedonic indices for high-tech sectors, however, have not confirmed this common conjecture. Because the relevant high-tech industries account for a relatively small fraction of European value added, the application of the hedonic index method makes very little difference to estimated European output growth.<sup>7</sup> Of course, the US hedonic index methodology also boosts estimates of the growth rate of real capital input, but Sakellaris and Vijselaar (2005) show that the relative patterns of TFP growth in the US and Euro areas are relatively unaffected by the application of such methods to both output and input growth.

A final measurement issue is changes in the composition of labour. Perhaps Europe's poor TFP growth performance could be due to the fact that it has been adding lower quality workers over time? A study by Schwerdt and Turunen (2006) suggests, however, that the pattern of labour quality growth in the Euro area over the period 1983-2004 was relatively steady, implying this explanation does not seem to work in practice.

### 3.3 Investment Shares

One route through which the Euro area could, at least temporarily, offset the effects on productivity growth of weakening TFP growth is through raising the fraction of GDP

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<sup>7</sup>See Lawless (2006) for a study of this issue.

devoted to capital investment. However, in this area also, the Euro area performance has been fairly weak. The left-hand panel of Figure 5 charts the ratio of real investment to real GDP for the US and Euro area, using 1995 as a base year. One needs to be extremely careful in interpreting ratios of real series of this type because they can be very sensitive to the base year chosen when the relative prices of the two series are shifting over time, as is the case here.<sup>8</sup> However, the nominal investment share does provide a useful comparison point free from base-year issues, and the right-hand-panel confirms that the Euro area has tended to invest a higher fraction of GDP than the US. However, the European nominal investment share has fallen over time, and is now just a touch above the US level.

The difference between these real and nominal series is explained in Figure 6, which reports the price deflator for investment relative to the GDP deflator. This chart shows that real investment growth in both areas has been boosted by a steady decline since about 1980 in the relative price of investment. The data show that this factor has played a stronger role in boosting real investment in the US than it has in Europe. One may suspect that this difference is due to the application in the US of hedonic methods to estimate price indices for high-tech capital goods. However, investment in such equipment has been less prevalent in the Euro area, and calculations provided by the Groningen Centre show that the relative price of European investment would have not have fallen as much as in the US even if high-tech prices were measured using hedonic methods.

Measurement issues aside, Figures 5 and 6 make it clear that a decline in the relative price of investment has been a significant factor boosting growth in real capital investment, and thus growth in capital input, for most of the period since 1980. Figure 6 provides a potentially negative warning for the future: For both areas, the pattern of falling relative prices for investment appears to have stalled for the moment, with the relative price being approximately flat since 2000. The Euro area data do not provide a disaggregation to allow us to examine the factors behind this flat relative price. However, an examination of the US data show that it is due to both an acceleration of prices for structures (perhaps relative to strong construction spending) and a slowing of the pace of price declines for high-tech goods. Assuming this latter pattern also accounts for the European pattern, it suggests that any further declines in the nominal investment share will result in real investment growing slower than in the past, and thus a further weakening of capital deepening.

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<sup>8</sup>See Whelan (2002) for a more extensive discussion of this issue.

## 4 Estimating Potential Output Growth

Based on the analysis presented to date, what are the implications for future Euro area growth? In this section, we answer this question by focusing on two different horizons. The first provides an estimate of what we view as the current medium-run potential growth rate, which we view as the likely growth rate over the next couple of years if current trends in labour markets, capital investment, and TFP continue. The second examines the implications over a longer-run context using the Solow growth model as an analytical framework.

### 4.1 The Medium-Run Outlook

In this section, we outline three different estimates of the potential growth rate of the Euro area economy (Cases 1, 2 and 3). These estimates are all based on the recent trends within the Euro area economy and can be regarded as relating to medium-term growth prospects. These results are summarised in Table 4.

In Cases 1 and 2, we extract trends from the basic data using the Hodrick-Prescott (HP) filter. The HP filter is commonly used to divide time series into its long-run components and those components linked to the business cycle.<sup>9</sup> In Case 1, our estimate of the potential growth rate is based on filtering the log of real GDP  $y_t$  (we will use lower cases to denote logs). This reveals an average annual increase in output of just 1.46 percent. As a technical matter, we note that the HP filter is a linear operator, so the growth rate derived in this manner is identical to that obtained from separately filtering  $a$ ,  $k$  and  $l$ . This allows us to decompose this 1.46 percent trend into separate components, with 0.34 percent due to increases in TFP, 0.73 percent due to capital growth and the remaining 0.39 percent due to the rate of increase in total labour hours.

Similarly, we can decompose the 0.39 percent due to labour by filtering the individual components of  $l$ : Population (*Pop*), labour force participation (*P.Rate*), the employment rate (*Emp.Rate*) and the average workweek (*Hours*). This decomposition shows that most of the increase is coming from the increase in population levels. This increase of about 0.6 percent per year contributes 0.4 percent per annum. However, the total labour contribution is reduced marginally by a decline trend in the average workweek (-0.09 percent) which is estimated to be a bit stronger than the contribution of the positive trend increase in the participation rate (0.07 percent).

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<sup>9</sup>We use the standard value of  $\lambda = 1600$  for the filtering parameter.

In Case 2, we switch off the changes in participation and the workweek and assume that the only change emanating from the labour market is due to the growth in the population. Therefore, we are assuming that there is no net change in hours worked per capita (the sum of the non-population components of the total labour figure). This assumption is motivated by the patterns illustrated in Figure 8 which suggest that there is essentially no trend at present in participation, employment, or the workweek. This produces an estimate of potential output growth of 1.49 percent.<sup>10</sup>

In Case 3, we present trend growth rates for each output component based on averages over the period 2000:Q1 and 2006:Q2. We choose this period because it represents something close to a full business cycle: Output growth was strong during early 2000, the economy then went into recession, and has since subsequently recovered. For reference, the unemployment rate in mid-2006 has been about 7.9 percent, which is close to the 8.3 percent value prevailing in mid-2000. As such these results provide a type of common-sense alternative measure of the trend growth rate, providing a simple form of business-cycle adjustment. These results turn out to be only slightly stronger than the other estimates, producing an average growth rate of 1.62 percent.

In general, all the results suggest that the medium-term outlook for potential Euro area GDP is a growth rate of approximately 1.5 to 1.6 percent. However, it should be noted that an important factor in this estimate is the relatively strong contribution from population growth. This pattern has been largely due to the inward migration from Eastern Europe associated with the enlargement process. As this process enters a more mature era, it seems likely that population growth and thus hours worked will slow down, implying a further decline in potential output growth.

Finally, it is worth noting that the application of similar methodologies to the US economy implies far higher estimates of potential output growth. Application of the HP-Filter, as in our Case 1, implies a figure of 2.9 percent. However, this incorporates an assumption of a declining trend in per capita hours worked, which Figure 3 suggests may not be warranted given that this series has been about flat on average over the past fifteen years. Assuming a flat trend for this series, one gets an estimate of potential output growth for the US of 3.2 percent. (See Table 5).

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<sup>10</sup>Other changes that could be made, such as substituting actual recent population growth for its filtered growth rate, or substituting actual capital stock growth over the recent period for its filtered rate, do not make substantial differences, and still produce a figure of about 1.5 percent.

## 4.2 The Longer-Run Outlook

In addition to assessing the medium-run outlook consistent with current trends, we are also interested in calculating the longer-run implications of the continuation of these trends. One factor that needs to be taken into account is the fact that the growth rate of the capital stock depends on investment and thus on output. It is standard for estimates of potential output growth to follow the approach underlying Table 4 and use estimates based on actual or trend growth rates of capital input to assess the contribution of capital deepening to labour productivity. Indeed, such procedures are used by the European Commission in its calculations of potential output used to cyclically adjust the budget deficits of EU member countries. However, in the longer run, capital growth cannot be considered a purely exogenous contributor to growth.

To address this issue, we have designed a simulation that describes how the Euro area economy would evolve over time if recent values for TFP growth and the investment share of GDP are maintained. Our simulation is based on simulating the following model

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad (4)$$

$$K_t = (1 - \delta)K_{t-1} + I_{t-1} \quad (5)$$

$$I_t = s_t Y_t \quad (6)$$

$$\Delta \log A_t = g \quad (7)$$

$$\Delta \log L_t = n \quad (8)$$

using four baseline assumptions:

- TFP grows at our estimate of its current trend rate of 0.35 percent per year, so  $g = 0.0035/4$ .
- The ratio of real investment to real GDP is assumed to stay constant at its 2006:Q1 value of about  $s = 0.217$ .
- Per capita hours are assumed to remain at their current levels, so  $n$  is determined by our assumption about population growth.
- Population growth is assumed to remain at its current high level of 0.6 percent per year for the duration of the forecast period.



Each of these assumptions could be questioned and in the next section we consider the effect of changing some of them. The assumption about TFP growth could be considered pessimistic given that it would likely entail the Euro area falling further behind the US level of TFP. However, one sense in which it is mildly optimistic is that it assumes an end to the long trend of declining TFP growth. Similarly, the assumed ratio of real investment to real GDP is relatively low by historical standards, and so could be considered pessimistic. On the other hand, given the patterns documented in Figures 5 and 6 (a declining nominal investment share and a flat current trend for the relative price of investment) this could also be an optimistic scenario.

The assumption concerning population growth may appear rather high, particularly when one considers the longer-term demographic projections of Eurostat. These projections show population growth actually declining in the Euro area post 2020.<sup>11</sup> However, the primary consideration of the present exercise is not to examine the implications of future demographic change on future Euro area growth, but to trace through the long-run implications of current trends in TFP and investment. Changing population projections at various stages in the forecast horizon would obscure these dynamics somewhat. For these reasons, we keep the assumed population growth constant at the present rate.

Figure 9 plots the values for the growths rate of output and output per hour generated by this simulation. (For comparison purposes, this and the following simulation charts will show historical values as three-year moving averages). Initially, in the medium term up to 2009, the growth rate of output per hour is equal to 0.9 percent as calculated in the previous section. Combined with our near-term assumption of 0.6 percent growth in hours, this produces the the 1.5 percent growth in GDP calculated in the previous section.

An important aspect of the simulation is the decline in the growth of output throughout the forecast horizon. This moderation in output growth feeds through to a lower growth rate of investment and the rate of capital deepening is, accordingly, diminished. In the very long run, the growth rate of output per hour falls to 0.52 per cent per annum. Thus, in the long run we have output growth of only 1.1 per cent per annum. To understand why this happens, it is useful to review the analytics of long-run growth as described by the famous model of Robert Solow (1956).

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<sup>11</sup>See Maddaloni et al (2006) for an extensive discussion of Euro area demographic projections.

### 4.3 The Solow Model and Long-Run Growth

Our simulation is essentially a practical application of the famous Solow model of economic growth, which is based on a standard production function, and a constant rate of TFP growth a constant share of real investment in GDP. This model provides a useful way of thinking about the linkages between medium- and long-run growth rates.

To describe this, we start by defining the capital-output ratio as

$$X_t = \frac{K_t}{Y_t} \quad (9)$$

Output per hour can now be expressed as

$$\frac{Y_t}{L_t} = A_t^{\frac{1}{1-\alpha}} X_t^{\frac{\alpha}{1-\alpha}} \quad (10)$$

This decomposition has been used in a number of previous studies, most notably by Hall and Jones (1997). Relative to the more familiar decomposition of output per hour into TFP and capital-per-hour terms, this decomposition has an important advantage. The long-run capital-output ratio can be shown to be independent of the level of  $A_t$ , something which is not true of capital-per-hour. Hence, this formulation completely captures the effects of  $A_t$  on long-run output, while the more traditional decomposition features a capital deepening term that depends indirectly on the level of technology.

DeLong (2003) shows that the capital-output ratio in this model follows a so-called “error-correction” equation of the form

$$\Delta X_t = \lambda (X^* - X_t) \quad (11)$$

such that it adjusts towards a long-run or “steady-state” level determined by

$$X^* = \frac{s}{\frac{g}{1-\alpha} + n + \delta}. \quad (12)$$

where the adjustment speed is

$$\lambda = (1 - \alpha) \left( \frac{g}{1 - \alpha} + n + \delta \right). \quad (13)$$

McQuinn and Whelan (2006) use data from the Penn World Tables on 96 countries to show that convergence speeds for the capital-output ratio tend to conform closely to the Solow model’s predictions.

These calculations show that, over the long-run with constant values for  $g$  and  $n$ , the capital-output ratio converges to its steady-state. Thus, equation (10) tells us that all

growth in output per hour ends up being due to the  $A_t^{\frac{1}{1-\alpha}}$ . This term grows at rate  $\frac{g}{1-\alpha}$ . Thus, in our example with TFP growth of  $g = 0.0035$  and a value of  $\alpha = \frac{1}{3}$ , we end up with a long-run growth rate of  $\frac{g}{1-\alpha} = 0.0052$  or 0.52 percent per year.

The analytics of our long-run scenario can thus be explained as follows. Our calculations show that the Euro area capital-output ratio is currently below the value consistent with the steady-state implied by our parameters. For this reason, the economy undergoes a long period of transitional growth with labour productivity growth being slightly higher than its long-run 0.52 percent value.<sup>12</sup> Over time, however, the capital-output ratio approaches its steady-state level and labour productivity growth transitions towards 0.52 percent. With a 0.6 percent trend for hours worked, this implies a steady-state growth rate of 1.1 percent per year. These calculations show that, over the long-run, the current trend growth rate of TFP would imply an even weaker growth rate of output per hour than is implied by our medium-run estimate of 1.5 percent.

## 5 Scenarios for Faster Growth

In this section, we consider three experiments consistent with faster growth. The first experiment can be thought of as the outcome of a programme of labour market deregulation, in that we consider increases in the labour force participation rate, reduction in the unemployment rate and an increase in the average workweek relative to their respective baseline levels. In the second experiment, we increase the rate of the Euro area investment again relative to its baseline level. Crucially, in both scenarios we maintain TFP growth at its present low rate. In a final scenario, we explicitly increase the rate of TFP growth.

For all experiments, the new growth rates of the variables of interest are evaluated with respect to their original baseline rate.

### 5.1 Labour Market Deregulation

Much of the discussion of Europe's relatively poor growth performance over the past few decades has focused on the fact that its labour market is more regulated than that of the US. Here we consider the potential effects of a successful labour market reform program.

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<sup>12</sup>Note that the speed of adjustment is  $(1 - \alpha)(\frac{g}{1-\alpha} + n + \delta) = \frac{2}{3}(0.0054 + 0.003 + .06) = 0.0456$  so the capital-output ratio closes about 4.5 percent of the gap to its steady-state value each period.

In Figure 10, we plot the assumptions underlying our scenario. We assume a set of gradual changes that occur over the period 2006 to 2016. For example, in the case of the unemployment rate, we gradually lower the rate from 8 percent in 2006 to 6 percent in 2016. The average workweek is increased from 29 hours in 2006 to 32 hours in 2016. Participation rates gradually increase from 47 percent at present to 48.5 percent over the same period. After 2016, the levels no longer change.

The exact changes hypothesised in this scenario result in per capita hours worked in the Euro area closing about half of the current gap relative to the US level. Thus, from each graph in Figure 10, one can observe that, the hypothesised scenario levels lies approximately half way between the 2006 Euro area level for that variable and the current US level. The bottom right chart shows that among the different labour components, the largest effect on hours worked is that of the increase in the average workweek. This is not surprising, as the increase in the workweek affects the entire labour stock, whereas increases/decreases in participation rates/unemployment rates only operate at the margin. Worth noting is that, when combined with Eurostat projections for working age population, this scenario sees the Euro area meeting the Lisbon target of a seventy percent ratio of employment to working age population by the end our adjustment period in 2016.

It is well beyond the scope of our analysis to outline exactly what type of policies can achieve the outcomes envisioned in the scenario. It seems likely, however, that achieving this would require a wide range of policy initiatives. For example, boosting participation rates may require separate policies targeting the over-fifties with measures to postpone early retirement as well as tax and social policies measures aimed to further increase participation among women. Reductions in unemployment may require more effective training policies for the low-skilled as well as further steps in the direction of more efficient and integrated tax and social welfare systems, thus reducing “replacement rates” and providing stronger incentives for work.<sup>13</sup> Finally, increases in hours per capita may require the easing of restrictive legislation such as the French 35-hour workweek law or provisions related to overtime payments.

It is true, of course, that a certain amount of labour market deregulation has already taken place. However, Figure 3’s evidence on hours per capita suggests that actions to date

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<sup>13</sup>We acknowledge, of course, that there is little agreement on the importance of the role played by tax rates in determining cross-country differences in per capita hours worked. Prescott (2003) ascribes almost all of the differences between European and US hours worked to differences in tax rates. Blanchard (2004) and Alesina, Glaeser and Sacerdote (2005) argue that tax rates are much less important.

have had little effect in improving labour market performance. Against this background, we consider the outcome described in Figure 10 as representing a likely “best-case” scenario.

Figure 11 plots the outcome of the labour market deregulation scenario for output and output per worker relative to the baseline forecast. The right-hand panel shows that the simulation produces a stronger growth rate for GDP, with growth generally above two percent during the initial years when the deregulation programme is being implemented. However, for such major changes to the labour market, the outcome described here is fairly modest: Over the ten-year period 2006-2016, the growth rate in our deregulation scenario is only 0.6 percentage point per year higher than in the baseline case. And after 2016, when all of the changes have occurred, the growth rate in this scenario converges back to the original low baseline rate of growth.

The left-hand panel of Figure 11 shows the impact of the labour market deregulation on the growth rate of labour productivity. The scenario brings about a significant worsening of productivity growth relative to the baseline. One possible explanation for such an effect is that the deregulation brings lower productivity workers into employment: This mechanism has been stressed by Dew-Becker and Gordon (2006). However, this is not what is driving our results. Instead, our results are due to the underlying assumption of diminishing marginal returns to labour implicit in the Solow model. While each of the units of labour are assumed to be identical, as more and more labour is added, diminishing marginal productivity implies that the resulting impact on output growth becomes less effective.

Overall, we conclude from these results that the implication of a relatively comprehensive set of labour market reforms is more pronounced in the short term but, over the longer term horizon, the overall impact on growth is quite small.

## 5.2 Higher Investment Share

In the case of the investment ratio, we hypothesise a scenario in which the ratio of real investment to real GDP will increase from its present rate of almost 21.7 percent to 23 percent in 2016. This new rate along with the historical rates for both the Euro area and the US are plotted in Figure 12. After 2016, the rate is assumed to be constant at the new higher figure.

Again, we would note that it is beyond the scope of our analysis to outline exactly what type of policies can achieve this improved investment outcome. However, it seems likely that this would involve a package of “business-friendly” measures such as lower corporation

tax rates, strengthened tax incentives such as depreciation allowances, as well as further moves towards product market deregulation such as the strengthening of the single market and the reduction of bureaucratic red tape.

The results of the scenario are presented in Figure 13. In this case, owing to the effect of the higher investment rate on the capital stock, we include baseline and scenario graphs for the growth rates of the capital-output and capital-labour ratios. As with the labour deregulation scenario, even though the investment rate has been increased quite significantly relative to its historical level, the implications for longer-term output growth are rather limited. One can see that by the end of the forecast horizon, output growth is still approaching 1 percent per year. Clearly, under this scenario labour productivity along with both the capital-output and capital-labour ratio are improved somewhat relative to their baseline level. However, again, this effect dissipates as one moves towards the long run horizon.

### 5.3 Faster TFP Growth

In Section 4.3 we highlighted the crucial linkage between TFP improvements to long-run output growth. In this scenario we highlight this by increasing quite substantially the level of TFP growth in the Euro area relative to its present, relatively, poor rate. We assume that by 2016, Euro area TFP growth is increasing at a rate of 1.5 percent per annum. Relative to the recent Euro area performance, this may appear quite high. However, as Figure 14 shows, such growth rates were achieved in the Euro area up to the late 1980s.

What do we have in mind for this scenario? Figure 4 has already shown that Euro area TFP growth consistently exceeded US rates from 1970 to 1990. As a relatively large gap has started to open again between US and Euro area levels of TFP, one might expect that the “catch-up” mechanism will play an important role in boosting European TFP. However, this mechanism appears to have done little to help Euro area productivity performance in recent years, and it may be that achieving this improvement could require various policy initiatives on the part of national governments. For instance, policy changes relating to IT adoption, promotion of R&D, completion of the single market, and reductions in bureaucratic red tape may be required to properly facilitate the potential for efficiency gains posed by the gap relative to the US.

Figure 15 illustrates the results from this scenario. Both output and output per worker enjoy sustained increases in their growth rates over both the medium and longer term,

with output per worker growing at about 2.2 percent per annum. Capital deepening also improves significantly. The sustained dynamic response of output in this scenario contrasts with the relatively meagre response in the previous two scenarios. Evidently, as is consistent with the central message of Solow (1956), the most effective route to sustained increases in output is through improvements in the efficiency with which economies utilise their capital and labour inputs.

## 6 Conclusions

We take a number of messages from our results. The first is that the recent productivity performance of the Euro area has been very poor. The gap between US and European productivity performances in the 1990s was a key inspiration for the Lisbon Agenda policy process that began in 2000. However, despite this official diagnosis of a productivity problem, the period since 2000 has seen a further worsening of the productivity growth rate of the Euro area.

The second message is that the composition of recent growth suggests the potential for a further worsening of the Euro area's productivity performance. Recent growth has relied heavily on increases in capital and labour inputs, with very little improvement in Total Factor Productivity, which measures the efficiency with which inputs are used. We have used the Solow growth model to illustrate how the continuation of recent rates of TFP growth will lead to a further decline in productivity growth. Specifically, we calculate that a continuation of the recent trend of 0.3 percent per year growth in TFP will eventually lead to a fall in the growth rate of output per worker to only 0.5 percent per year.

The third message is that policies aimed at labour market deregulation or increased rates of capital investment, while beneficial, will only have a limited impact on the medium- or long-run growth rates of the Euro area economy. For instance, our simulation of a highly successful set of labour market policies shows a temporary increase of 0.6 percent in output growth, fading away to zero after the deregulation program is finished.

Together, these results suggest that Euro area policy-makers need to focus their energies on policies likely to improve overall economic efficiency and so boost TFP growth. The Lisbon agenda process has suggested many such policies but there has been limited progress as of yet. It may be that significant progress has to be made on the implementation of this agenda before a positive outcome, such as described in our final scenario, can come to pass.

An important caveat to our analysis, and indeed to any forward-looking analysis, is that the future for the Euro area economy may look more positive than its recent past even in the absence of new policy initiatives. Indeed, the first half of 2006 has produced the strongest productivity performance seen over the past few years, and it is possible that we are on the cusp of a new era of faster productivity growth driven by a catch-up process relative to the United States. However, the catch-up process has not helped the Euro area to grow faster during the period since 2000, and recent performance provides little room for complacency. The implementation of a policy agenda aimed at facilitating greater economic efficiency seems likely to be an important element in any European productivity recovery.

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## A Data Appendix

### A.1 Euro Area Data

The data for the Euro Area come from a number of sources. All series used in our analysis are quarterly and cover the period 1970:Q1 to 2006:Q2. The recent values for GDP, real and nominal investment, the unemployment rate, employment and population are mainly taken from NewCronos, which is the principal database of EuroStat, the Statistical Office of the European Communities. However, the availability of these series varies somewhat. For instance, GDP and investment are only available from 1995:Q1, while employment is available from 1991:Q1. Unemployment rates are available from NewCronos from 1993:Q1. To “backcast” these series to 1970:Q1, growth rates for the corresponding variables from the Area-Wide Model (AWM) database of the European Central Bank was used. This dataset covers the period 1970:Q1 to 2003:Q4. Details of this model and the dataset are available in Fagan, Henry, and Mestre (2001).

Three points to note about both the AWM and the NewCronos data are:

- The dataset includes Greece, hence, it can be considered an Euro 12 data set.
- For nearly all countries ESA95 data is used (where available).
- The data are seasonally adjusted and also adjusted by working days.

Population data for the 12 countries were also taken from the NewCronos database. In particular, the annual series from the Population and Social Module was used. This annual series gives the Euro Area population at the first of January each year. We set this value as the fourth quarter observation from the previous year and then linearly interpolated the series for the quarterly observations. For 2006, we assumed that population has continued to grow at the same rate as in 2005, which is 0.6 percent for the year as a whole.

Labour force participation rates were calculated such that they equal  $(\text{Employment}) / (\text{Population} \times (1 - \text{Unemployment Rate}))$ . For 2006:Q2, employment data were unavailable but we do have an observation on the unemployment rate. From this information, the observation on employment for 2006:Q2 was backed out by assuming that the participation rate in 2006:Q2 was unchanged from its 2006:Q1 level.

There are no official capital stock data for the Euro area. Following most other studies, we adopt the perpetual inventory method to “roll out” the capital stock as per equation

(5) in the text. We do this using a depreciation rate of six percent per year. However, the issue of a starting value for the stock still arises. We assume that the capital stock level in 1970:Q1 was such that the corresponding capital-output ratio ((9) in the text) was equal to its steady-state level in that quarter. Consequently, the capital stock in 1970:Q1 was determined as

$$K_{1970:1} = X_{1970:1}^* \times Y_{1970:1}$$

or

$$K_{1970:1} = \frac{s^F}{\frac{g^F}{(1-\alpha)} + n^F + \delta} \times Y_{1970:1}$$

where  $s^F$ ,  $g^F$  and  $n^F$  are the HP-filtered levels of  $s$ ,  $g$  and  $n$  respectively. To capture the idea that the steady-state capital-output ratios correspond to the very long-run, we used a filter parameter of  $\lambda = 16000$  rather than the usual value of  $\lambda = 1600$  which corresponds to a business cycle frequency. However, our growth accounting calculations were not much affected by the choice of starting value for the capital stock series or the choice of depreciation rates.

The data on the average Euro area workweek were constructed from figures taken from the Groningen Growth and Development Centre (GGDC), available online at [www.ggdc.net](http://www.ggdc.net). The figure for the Euro Area was calculated by adding the total hours worked for the 12 Euro area countries and then dividing this figure by the summation of the total civilian employment series. This annual series was then interpolated and scaled by 1/52 to arrive at the average weekly amount of hours worked in the Euro area.

Finally, while all calculations of productivity growth rates in this paper use our series for real GDP divided by our series for total hours worked, the relative *levels* comparison charted in Figure 1 comes from using GGDC Purchasing Power Parity adjusted figures for 2000 as a reference point, and the growing these series forwards and backwards using our estimates of productivity growth.

## A.2 US Data

All US data come from either the Department of Commerce's Bureau of Economic Analysis website ([www.bea.gov](http://www.bea.gov)) or from the Department of Labor's Bureau of Labor Statistics website ([www.bls.gov](http://www.bls.gov)).

Data on GDP and investment come from the detailed National Income and Product Accounts (NIPA) tables on the BEA website. The figures for GDP come from Tables

1.1.3 and 1.1.5. The series on real investment was obtained by applying Fisher chain aggregation to the series on real private investment and real government investment. To do this calculation, we used data on nominal private investment from Table 5.1 and nominal government investment from Table 3.9.5. Data on price deflators for these series were obtained from Tables 5.3.4 and 3.9.4.

Our series on the US capital stock is based on the official series published by BEA. Specifically, we used the annual series for fixed assets, constructed from the quantity index and nominal values on Fixed Asset tables 1.1 and 1.2. The quarterly series were then equated with the annual series for the fourth quarter of each year, and the data for the rest of the year were linearly interpolated. These data go through 2005, so the 2006:Q1 and 2006:Q2 values were obtained by assuming that the aggregate depreciation rate (obtained by inverting a perpetual inventory formula) has remained at its 2005 value.

Data on population come from the BLS. Data on employment, unemployment, and labour force participation came from the BLS website based on the monthly household survey (Current Population Survey). For the workweek, our growth accounting calculations are based on an index for weekly hours worked per employee in the business sector, taken from the part of the BLS website relating to the Productivity and Costs release. This index is based largely on the monthly establishment survey. The levels shown in Figures 2 and 3 were obtained by using data from the GGDC to provide a level for this index comparable to the levels used to construct workweek series for the Euro area.

Table 1: Decomposition of Average Labour Growth Rates (%)

Period	Euro Area				
	Total	Pop.	P. Rate	Emp. Rate	Workweek
1970:1-2006:2	-0.1	0.4	0.3	-0.2	-0.6
1970:1-1980:1	-0.7	0.5	0.2	-0.3	-1.0
1980:1-1990:1	-0.2	0.3	0.6	-0.3	-0.7
1990:1-2000:1	0.3	0.4	0.2	-0.0	-0.3
2000:1-2006:2	0.7	0.6	0.3	0.1	-0.3
1996:1-2006:2	0.9	0.5	0.4	0.3	-0.3
1996:1-2001:1	1.3	0.4	0.7	0.6	-0.4
2001:1-2006:2	0.5	0.6	0.2	-0.0	-0.2
Period	United States				
	Total	Pop.	P. Rate	Emp. Rate	Workweek
1970:1-2006:2	1.4	1.4	0.2	-0.0	-0.3
1970:1-1980:1	1.8	2.0	0.5	-0.2	-0.6
1980:1-1990:1	1.7	1.2	0.4	0.1	-0.1
1990:1-2000:1	1.4	1.1	0.1	0.1	0.0
2000:1-2006:2	0.4	1.2	-0.3	-0.1	-0.4
1996:1-2006:2	1.2	1.3	-0.1	0.1	-0.2
1996:1-2001:1	1.8	1.4	0.2	0.3	-0.1
2001:1-2006:2	0.6	1.2	-0.3	-0.1	-0.3

**Note:** *Pop.* refers to population, *P.* is the participation rate, *Emp.* is employment and *Workweek* is average hours worked by employees.

Table 2: Decomposition of Euro Area and US Output Growth Rates (%)

Period	Euro Area				United States			
	$\Delta y$	$\Delta a$	$\Delta k$	$\Delta l$	$\Delta y$	$\Delta a$	$\Delta k$	$\Delta l$
1970:1-2006:2	2.4	1.7	0.8	-0.0	3.1	1.3	0.9	0.9
1970:1-1980:1	3.5	3.0	1.0	-0.5	3.3	1.1	1.0	1.2
1980:1-1990:1	2.2	1.7	0.6	-0.1	3.1	1.1	0.9	1.1
1990:1-2000:1	2.1	1.2	0.7	0.2	3.1	1.4	0.8	0.9
2000:1-2006:2	1.6	0.4	0.8	0.4	2.6	1.5	0.8	0.3
1996:1-2006:2	2.1	0.8	0.7	0.6	3.3	1.6	0.9	0.8
1996:1-2001:1	3.0	1.3	0.7	0.9	3.8	1.6	1.0	1.2
2001:1-2006:2	1.4	0.3	0.7	0.4	2.7	1.6	0.8	0.4

Table 3: Decomposition of Euro Area and US Output per Worker Growth Rates (%)

Period	Euro Area			United States		
	$(\Delta y - \Delta l)$	$\Delta a$	$(\Delta k - \Delta l)$	$(\Delta y - \Delta l)$	$\Delta a$	$(\Delta k - \Delta l)$
1970:1-2006:1	2.5	1.7	0.8	1.7	1.2	0.4
1970:1-1980:1	4.2	3.0	1.2	1.5	1.1	0.4
1980:1-1990:1	2.4	1.7	0.7	1.4	1.1	0.3
1990:1-2000:1	1.8	1.2	0.6	1.7	1.4	0.3
2000:1-2006:1	1.0	0.4	0.5	2.2	1.5	0.7
1996:1-2006:2	1.2	0.8	0.4	2.1	1.6	0.5
1996:1-2001:1	1.6	1.3	0.3	2.0	1.6	0.4
2001:1-2006:2	0.8	0.3	0.6	2.2	1.6	0.6

Table 4: Alternative Estimates of Euro Area Trend Growth Rates (%)

Description	$\Delta y$	$\Delta a$	$\Delta k$	$\Delta l$	Labour Components:			
					<i>Pop</i>	<i>P.Rate</i>	<i>Emp.Rate</i>	<i>Workweek</i>
<i>Case 1 :</i>								
HP-Filter	1.46	0.34	0.73	0.39	0.41	0.07	-0.00	-0.09
<i>Case 2 :</i>								
Filtered A								
Filtered K								
0 $\Delta\%$ Hours P. C.	1.49	0.35	0.73	0.41	0.41	0.00	0.00	0.00
<i>Case 3 :</i>								
2000-2006 Averages	1.62	0.42	0.76	0.43	0.37	0.17	0.08	-0.19

**Note:** *Pop.* refers to population, *P.* is participation, *Emp.* is employment and *Workweek* is average hours worked by employees. ‘0  $\Delta\%$  Hours P. C.’ refers to the imposition of a 0 growth rate for the non-population components of the total labour figure.



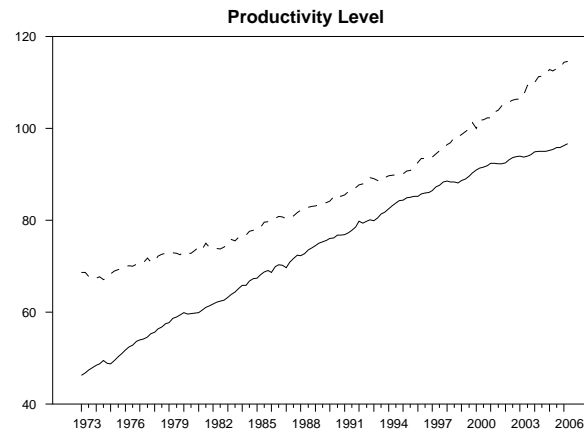
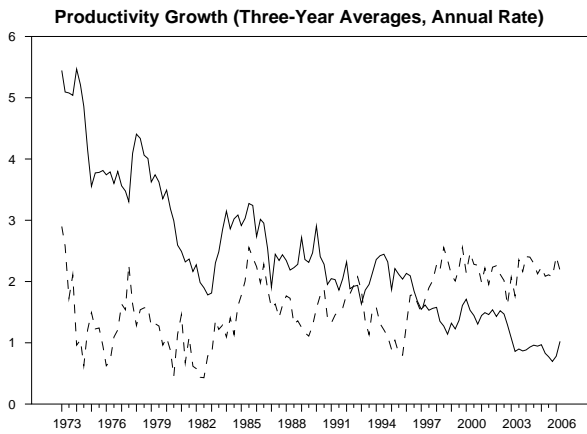
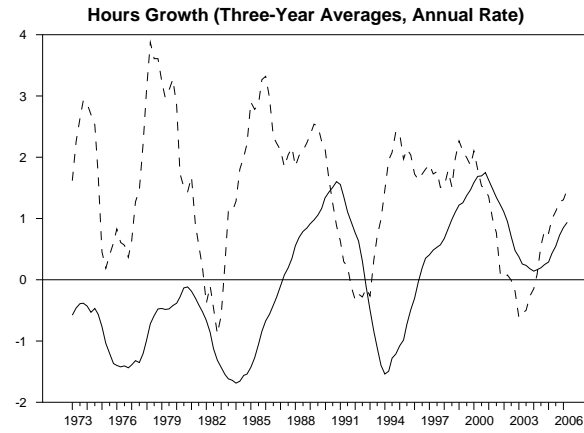
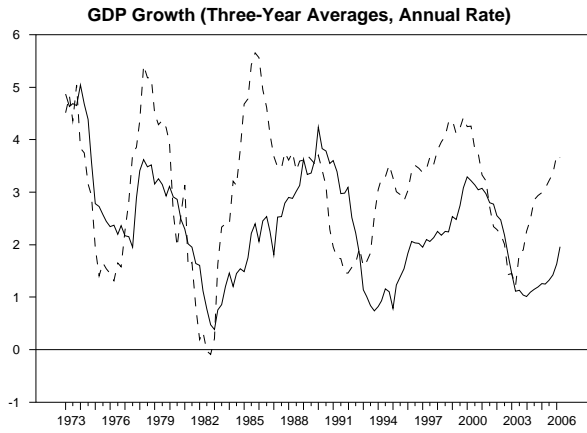
Table 5: Alternative Estimates of US Trend Growth Rates (%)

Description	$\Delta y$	$\Delta a$	$\Delta k$	$\Delta l$	Labour Components:			
					<i>Pop</i>	<i>P.Rate</i>	<i>Emp.Rate</i>	<i>Workweek</i>
<i>Case 1 :</i>								
HP-Filter	2.96	1.60	0.76	0.60	0.83	-0.15	0.08	-0.16
<i>Case 2 :</i>								
Filtered A								
Filtered K								
0 $\Delta\%$ Hours P. C.	3.19	1.60	0.76	0.83	0.83	0.00	0.00	0.00
<i>Case 3 :</i>								
2000-2006 Averages	2.59	1.52	0.80	0.27	0.82	-0.19	-0.06	-0.29

**Note:** *Pop.* refers to population, *P.* is participation, *Emp.* is employment and *Workweek* is average hours worked by employees. ‘0  $\Delta\%$  Hours P. C.’ refers to the imposition of a 0 growth rate for the non-population components of the total labour figure.

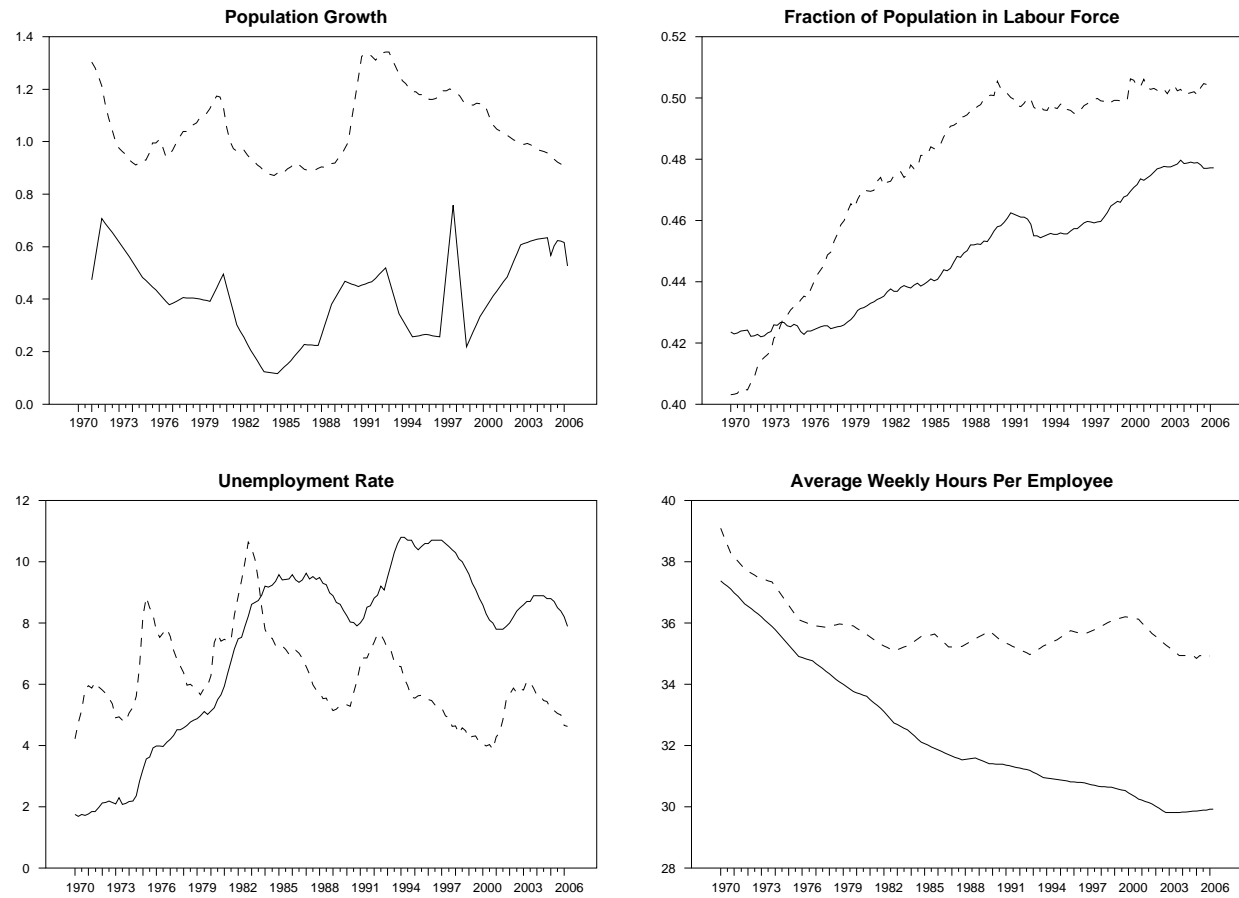
# Figure 1

Comparison of Euro Area and US Economic Performance (Solid Lines=Euro Area)



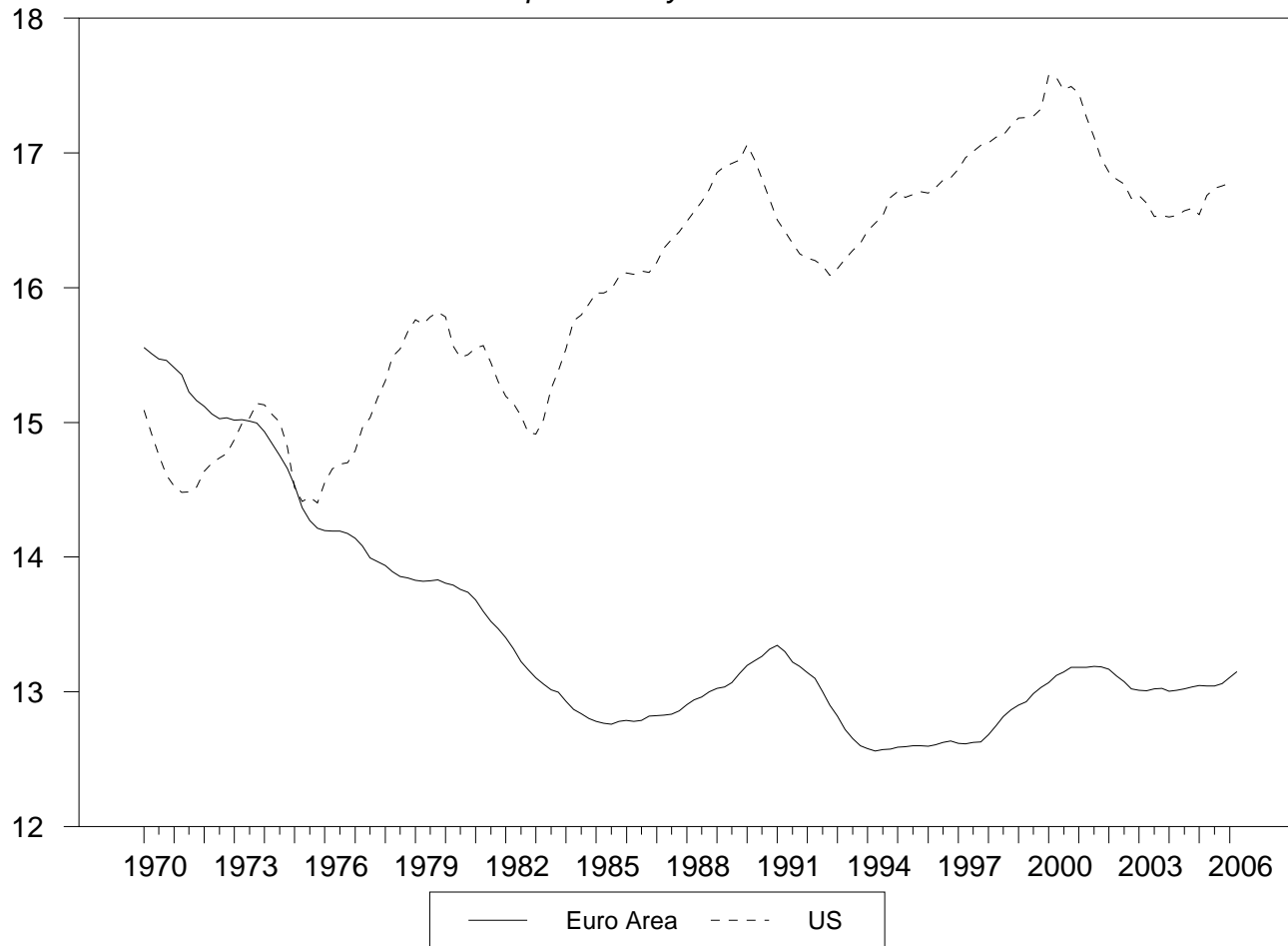
## Figure 2

Comparing Euro Area and US Labour Market Outcomes (Solid Lines=Euro Area)



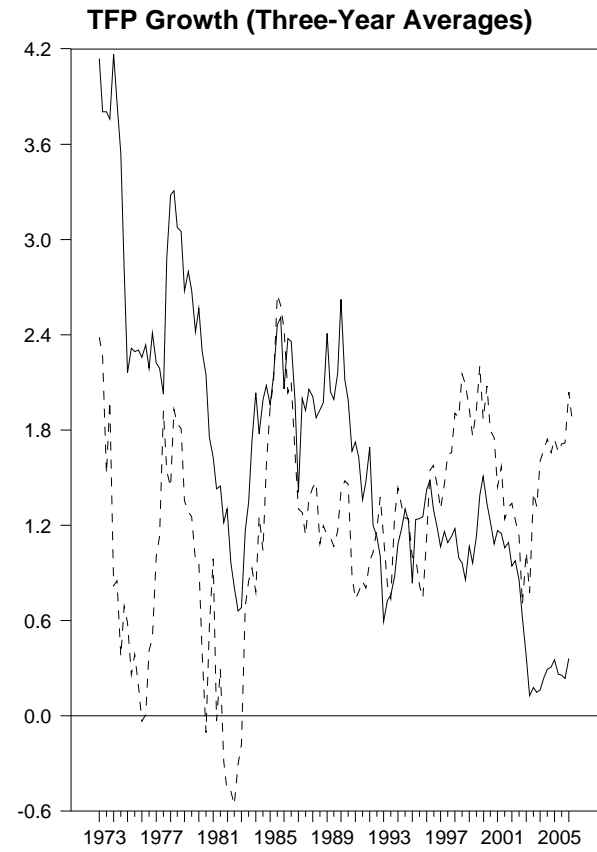
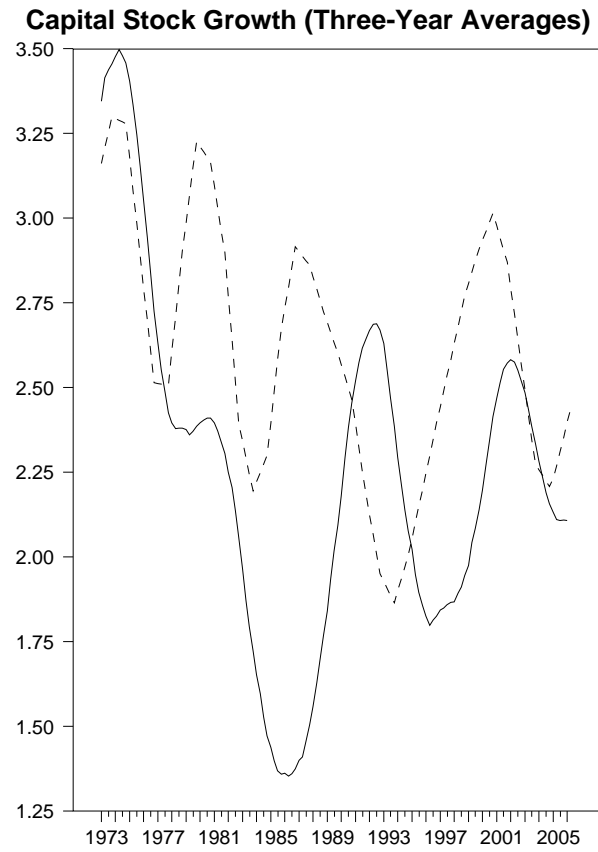
**Figure 3**

*Per Capita Weekly Hours Worked*



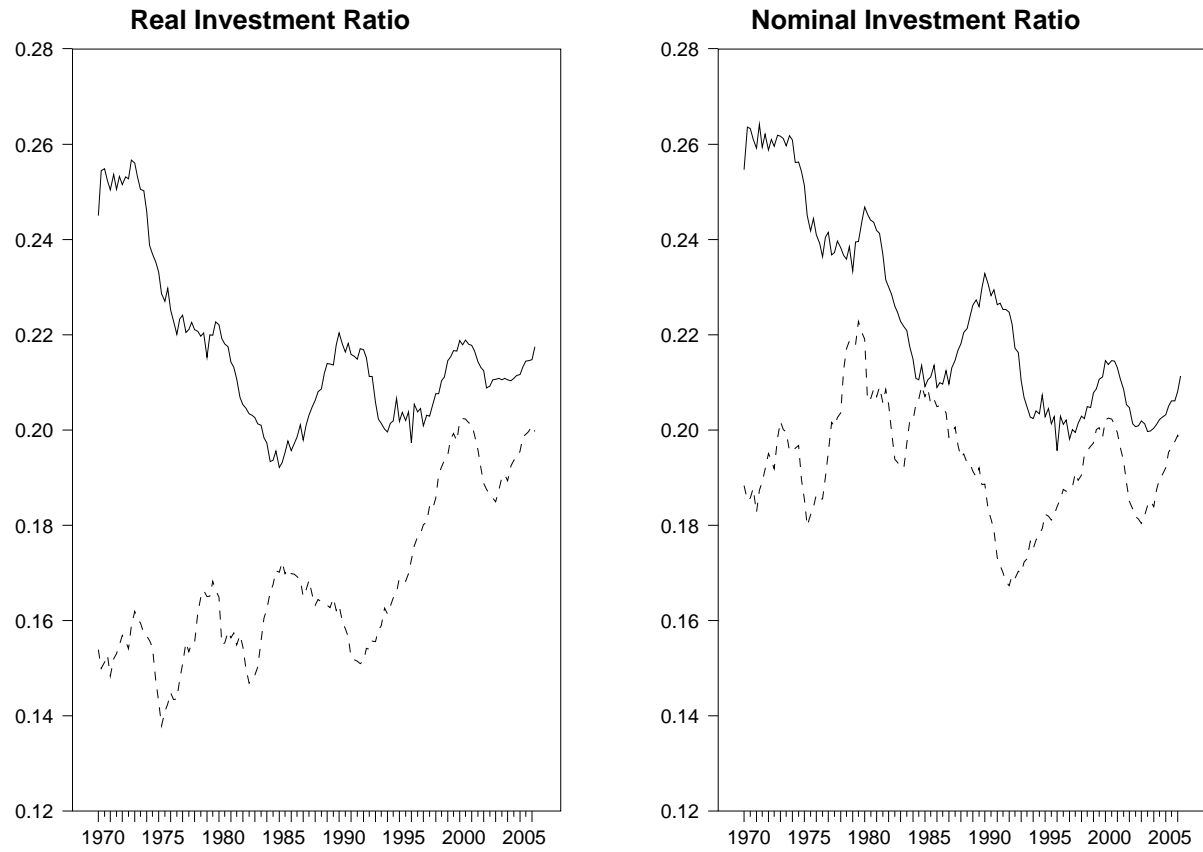
# Figure 4

Capital and TFP Growth (Solid Lines=Euro Area)



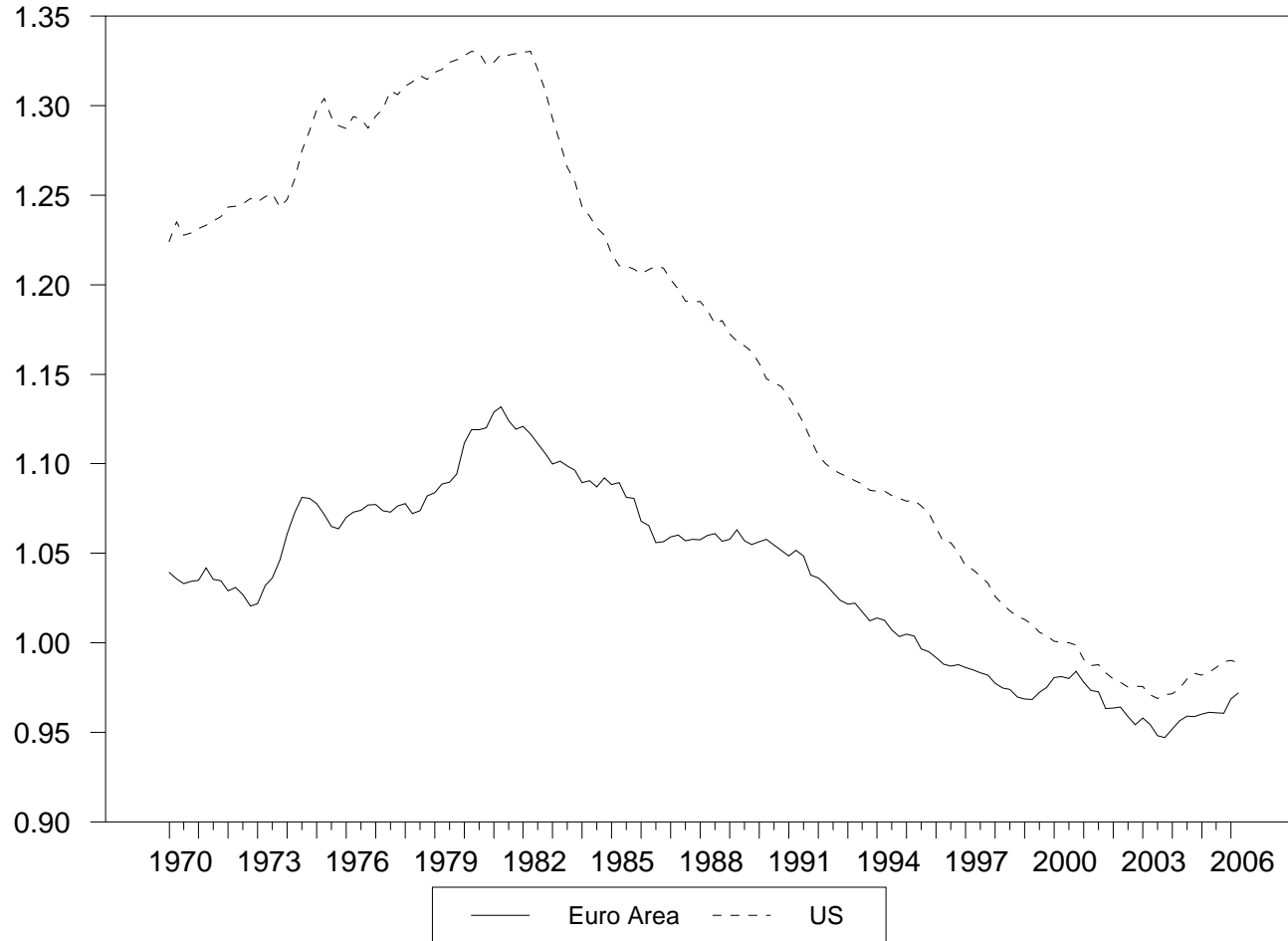
## Figure 5

*Comparing Euro Area and US Investment Shares (Solid Lines=Euro Area)*



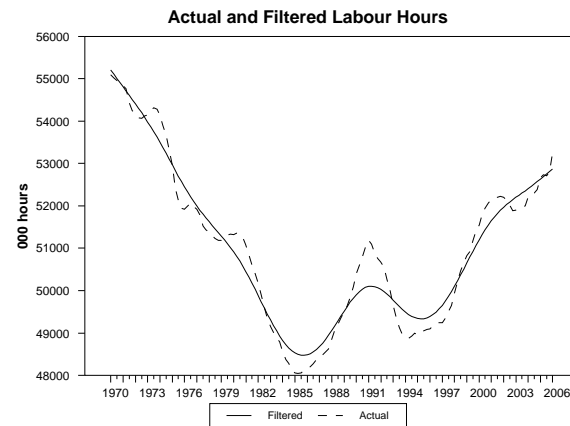
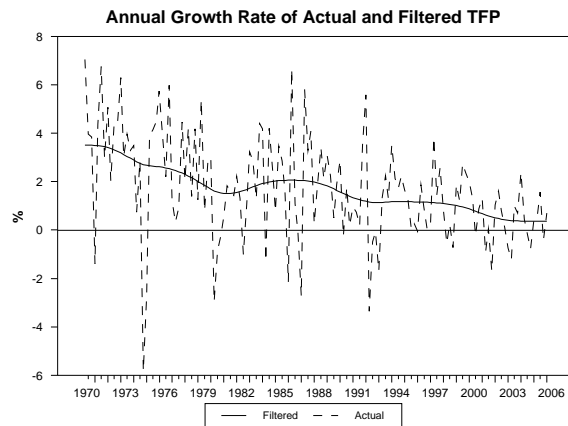
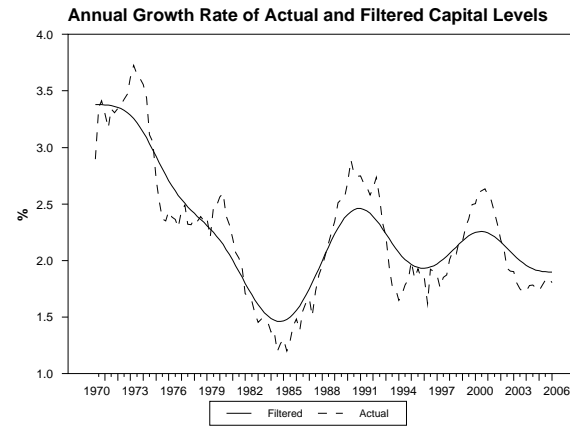
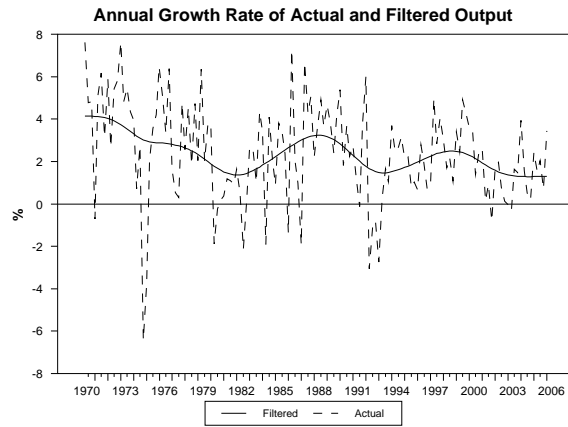
**Figure 6**

*Price of Investment Relative to GDP Deflator*



# Figure 7

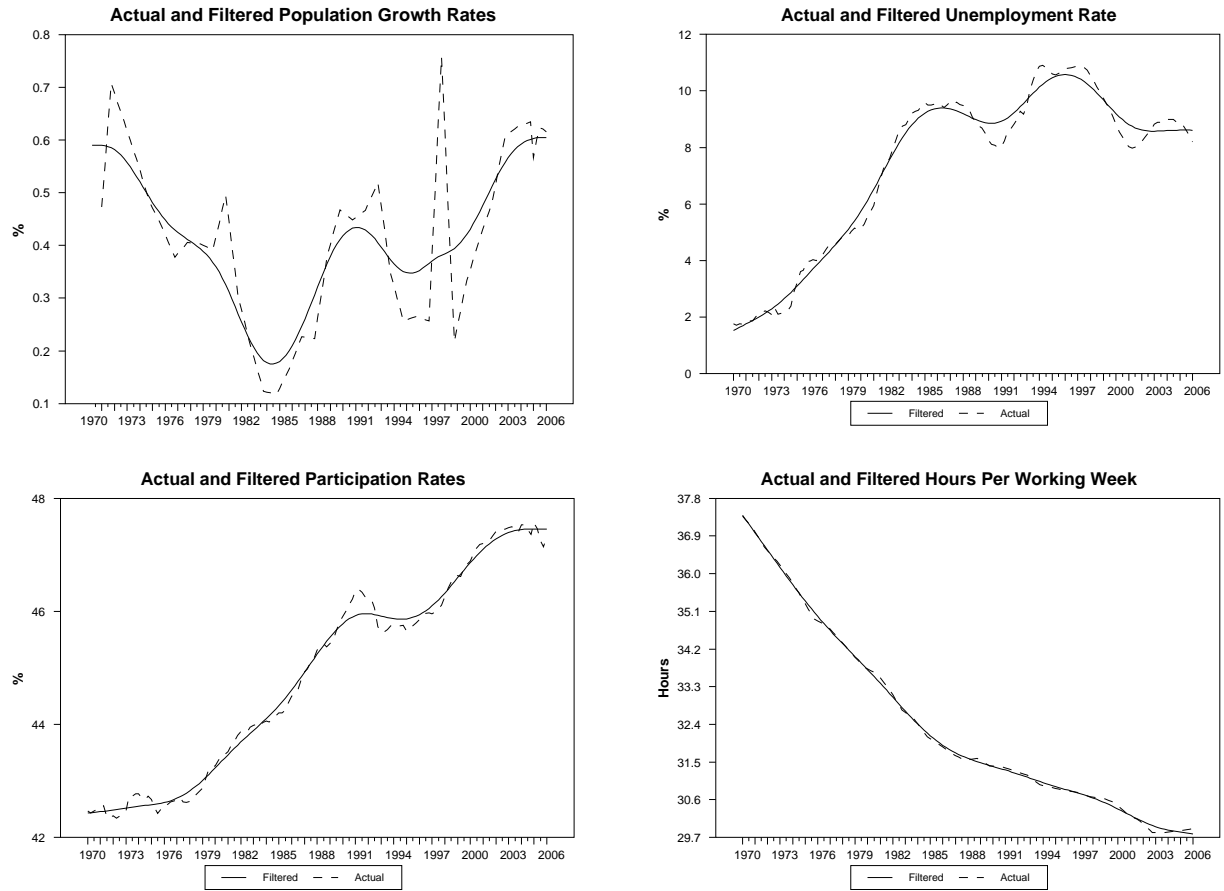
## *Euro Area Actual and Filtered Output Components*





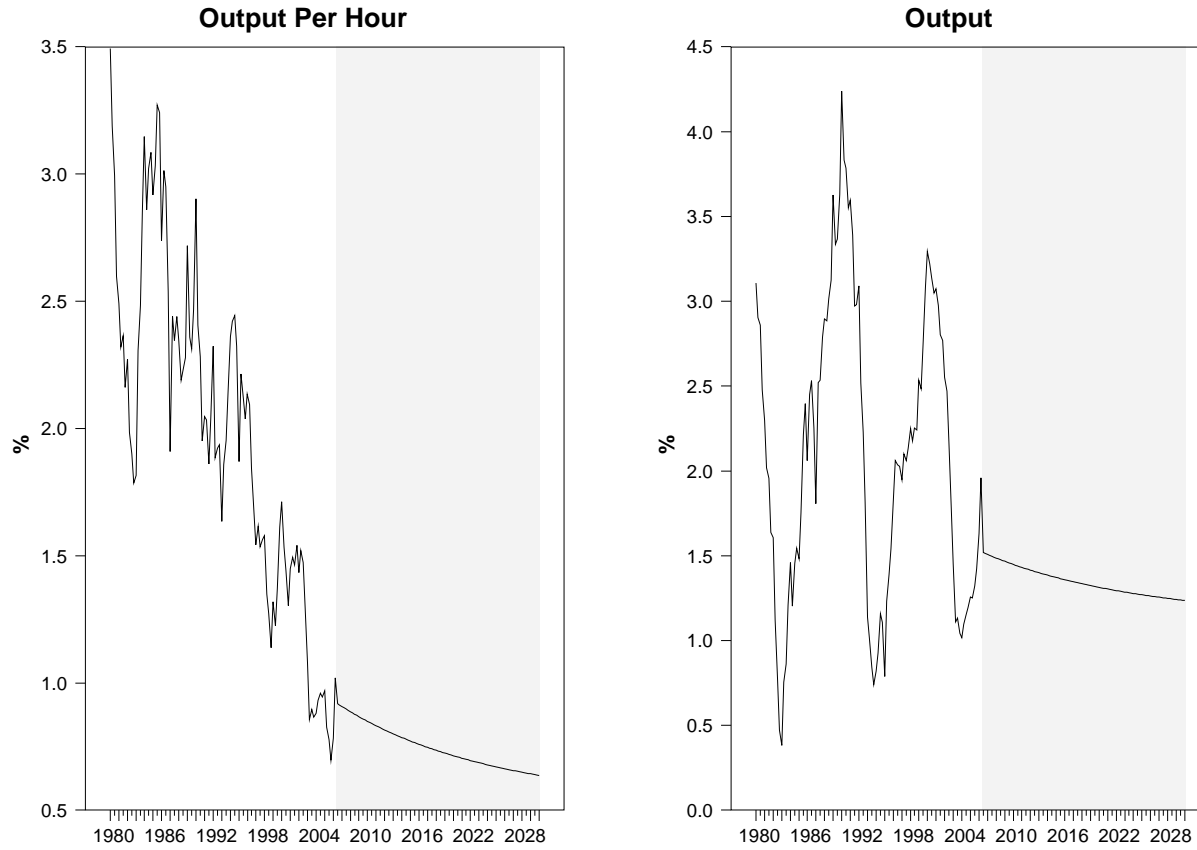
# Figure 8

## Euro Area Actual and Filtered Labour Hours Series



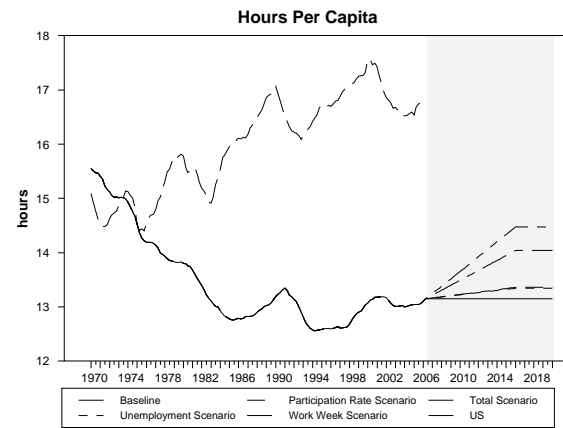
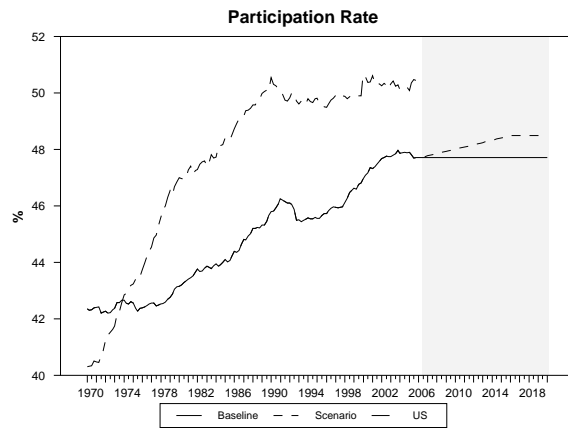
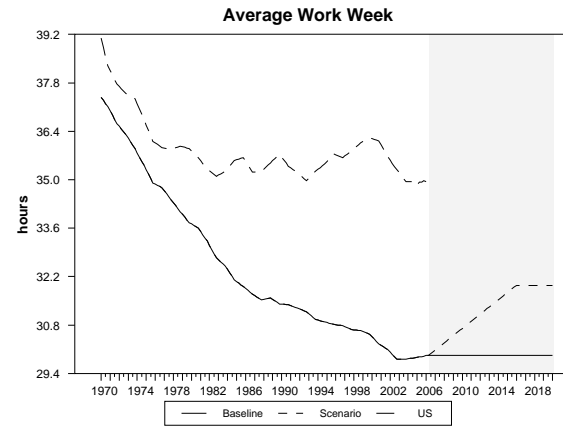
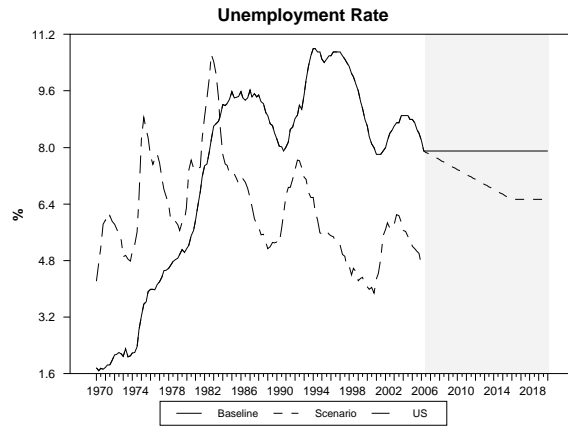
# Figure 9

*Output and Output Per Worker Growth Rates: Baseline Forecasts*



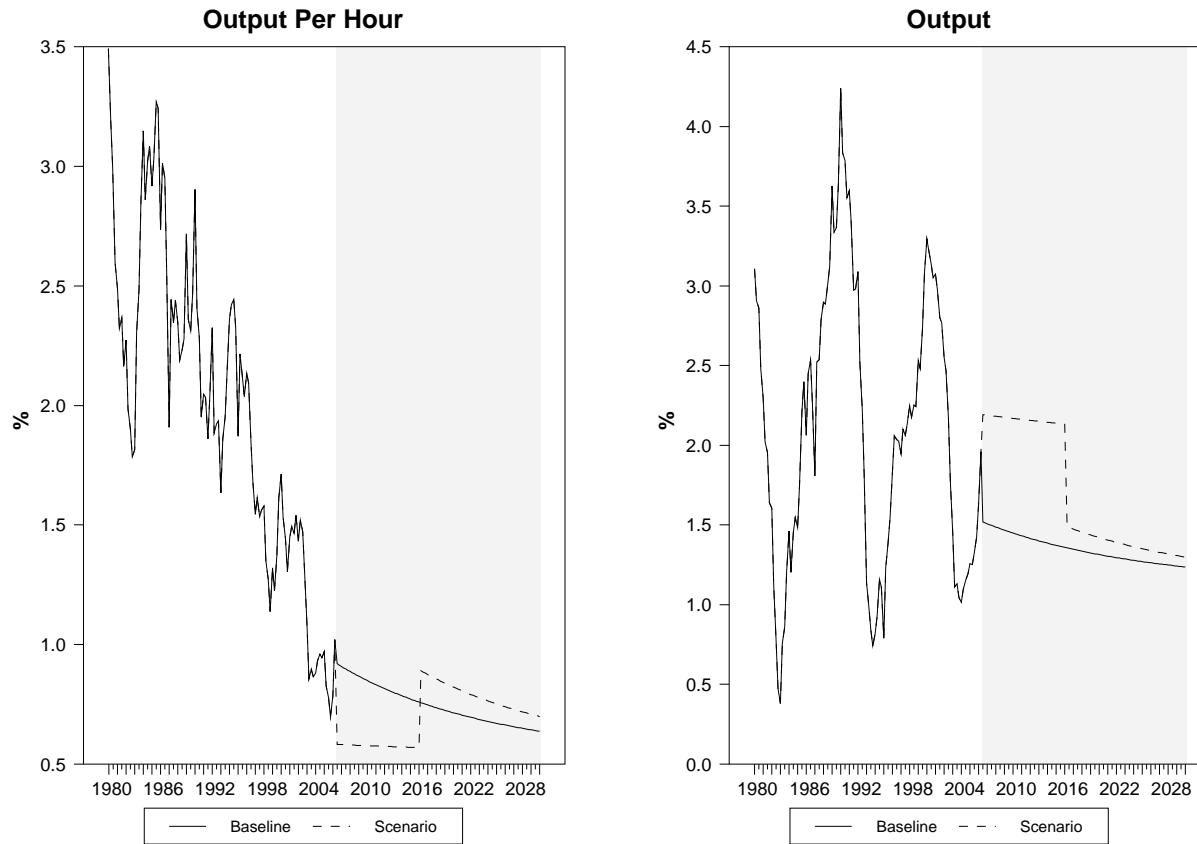
# Figure 10

## Labour Scenario Assumptions



# Figure 11

*Simulating Effects of Improved Labour Market Conditions*



**Figure 12**

*Investment Rate Scenario Assumption*



# Figure 13

## Simulating Effects of an Increased Investment Rate

