



January 18, 2005

Current Issues

Stronger productivity growth in the US: largely a statistical artefact

- While the increase in US labour productivity since the mid-1990s has been celebrated as the result of the new economy, productivity growth in the euro area has been disappointing – at least at first glance.
- According to official statistics, the rise in labour productivity in Euroland, at 1 ½% p.a., was only half as strong as in the US in this period.
- However, the productivity gap between the two economic areas is largely a statistical artefact caused by different classifications as well as varying calculation and measurement methods.
- If the same methodology is applied, the US lead in productivity over Euroland narrows to roughly ½ pp p.a. and the productivity gap against Germany is almost closed.
- In terms of the absolute productivity level (GDP per hour worked), America's position is only mediocre by international standards. Per man-hour France reaches 113% of the US performance, Belgium achieves 108% and the Netherlands realize 102%. Germany (mainly due to unification) lags slightly behind the US with 93%.
- As GDP per employee or per man-hour also rises in the event of capital deepening, it is more confusing than revealing to define it as "labour productivity". A better measure of productivity is total factor productivity, which captures the efficiency of both labour and capital inputs.
- Since the mid-1990s, the rise in total factor productivity (TFP) in the US and Euroland, at 1.4% and 0.8% per year, respectively, was only half as strong as the increase in traditional labour productivity.
- The slower TFP growth in Euroland relative to the US was accompanied by a considerable increase in employment, suggesting that the growth mix of employment and productivity was indeed an economic and social-policy success.
- If the Lisbon target to make the EU the most competitive and most dynamic economic region by 2010 is to be met, both an increase in employment and much stronger productivity growth are needed.
- Above all, this requires the across-the-board promotion of innovation, education and professional training.
- Such efforts are all the more indispensable as the demographic challenge of a declining potential labour force and increasingly ageing societies could have strongly negative wealth effects after 2010.

Authors: Bernhard Gräf, +49 69 910-31738 (bernhard.graef@db.com)
 Marc Schattenberg, + 49 69 910-31889 (marc.schattenberg@db.com)



Editor

Stefan Schneider
 +49 69 910-31790
 stefan-b.schneider@db.com

Technical Assistant

Pia Johnson
 +49 69 910-31777
 pia.johnson@db.com

Deutsche Bank Research
 Frankfurt am Main
 Germany
Internet: www.dbresearch.com
E-mail: marketing.dbr@db.com
Fax: +49 69 910-31877

Managing Director
 Norbert Walter

Stronger productivity growth in the US: largely a statistical artefact

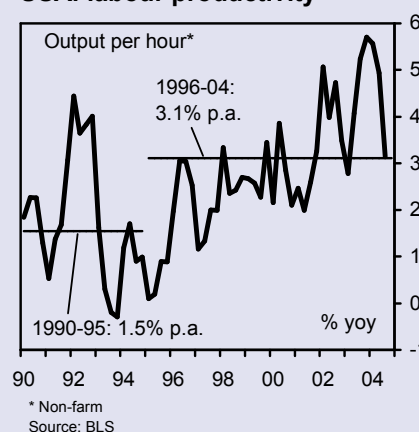
The level and development of productivity are among the most important measures for the assessment of a national economy. Labour productivity shows how effectively labour input is used to generate output of goods and services. While the strong rise in the US since the mid-1990s has been celebrated as a result of the new economy, productivity growth in the euro area has been disappointing – at least at first glance. Appearances are misleading, however. The large productivity growth differential between the US and Euroland can be explained by considerable differences in the statistical methods of data collection. If the same methodology were applied on both sides of the Atlantic, the lead of the US would narrow perceptibly. Furthermore, labour productivity is not necessarily the best proxy for the evaluation of productivity, as it neglects the input of capital, which saw above-average increases during the new economy in the US. For this reason total factor productivity, which captures how effectively both factors – labour and capital – are used in production, is the better measure. It reveals that, although Euroland is still lagging behind the US, some countries of the euro area such as Finland, France and Ireland have either kept up with the US or even surpassed it. On top of this, the slower productivity growth in Euroland has been accompanied by an increase in employment and a decline in unemployment, suggesting that the growth mix of employment and productivity has, in fact, yielded positive results.

New economy in the US ...

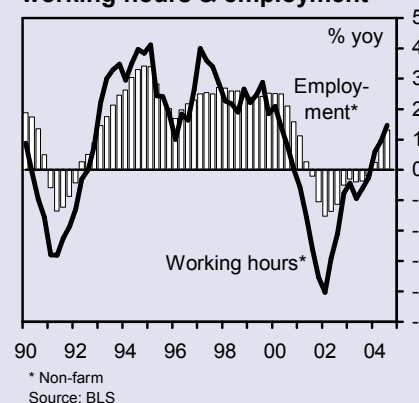
True, productivity growth in the United States decelerated strongly in Q3 2004. In the year-over-year comparison, it slowed to 3.1%, down from its peak of 5.7% in Q4 2003, little surprising in light of the labour market recovery. In Q3, non-farm employment rose by close to 400,000 persons (+1.3% yoy). In addition, the number of working hours per employee edged up slightly; hours worked were up 1 ½% on the pre-year level in Q3. US growth has thus become more labour intensive.

Nevertheless, America's "productivity miracle" of the new economy is anything but over. While in the first half of the 1990s labour productivity still advanced by 1.5% p.a., it has since then accelerated by 3.1% annually. Observers have attributed this boost in labour productivity to the production and use of information technology¹. The current slowdown is a cyclical normalisation of the productivity development. This is also reflected by the productivity gap, i.e. the deviation of current productivity from its long-term trend, which, in line with the concept of the output gap, can be interpreted as the utilisation of labour. In the past, similar productivity gaps always used to be short-lived. Despite the slowdown, however, US productivity is still roughly consistent with its long-term average.

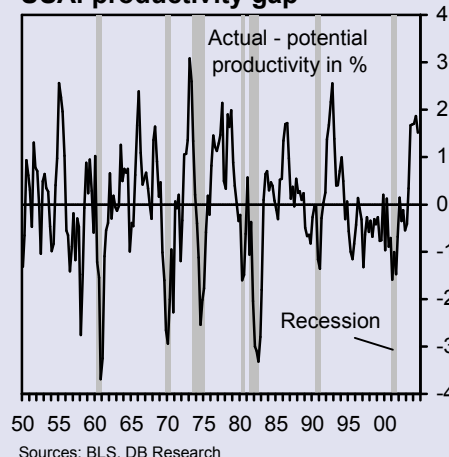
USA: labour productivity



USA: working hours & employment



USA: productivity gap



¹ Among the classical advocates of the new economy theory are, for example, Jorgenson, Dale W. and Kevin J. Stiroh: Raising the Speed Limit: U.S. Economic Growth in the Information Age, in: Brookings Papers on Economic Activity 1, 2000; Oliner, Stephen D. and Daniel E. Sichel: The Resurgence of Growth in the Late 1990s: Is Information Technology the Story? Federal Reserve Board Finance and Economics Discussion Paper, No. 2000-20.

... disappointing development in Euroland – at first glance

While the US productivity performance was celebrated by the markets as a “productivity miracle”, productivity growth in the euro area – at least on the basis of official data – was sluggish at first glance. In the first half of the 1990s, the increase in labour productivity in Euroland, at 2 ½% p.a., was still higher than in the US, but since the mid-1990s the annual growth rate has slowed to just above 1 ¼%. The productivity gap between the two economic areas would thus be over 1 ½ pp. This raises the question as to whether Euroland is actually lagging behind so strongly. The answer is no!

Productivity growth dampened by agricultural and public sectors

The strong differences in productivity figures are mainly due to the fact that different statistical definitions and varying measurement methods are applied on the two sides of the Atlantic. Productivity is the quotient of real output and labour input. It may be approximated by employment (output per employed person). However, the output per hour worked is the more relevant measure for most considerations.

While total gross domestic product (GDP), i.e. including the public sector, is taken as the basis of output in Euroland, official US productivity data solely refer to the non-farm private sector (including public-sector companies). Relative to total GDP, the development of US productivity looks much less spectacular. According to OECD calculations, average annual labour productivity in the US rose by only just over 2% p.a. from 1995-2003 (total GDP), instead of 3.1% (non-farm). At roughly ¾ pp p.a., the productivity gap between the euro area and the US would thus be only half the level suggested by the official US figures. In France, the increase in GDP per working hour, at 2.2% p.a., was in fact slightly higher than in the US, and even Germany, at 1 ¾% p.a.², lagged only slightly behind.

Comparability of productivity distorted by different deflation methods

Still, that is probably not the whole truth. As deflation methods differ and software investment is included in GDP in the US, the productivity gap between Euroland/Germany and the US should be smaller than official statistics suggest. While the number of hours worked can be measured relatively easily, the calculation of real output and real GDP is difficult. To capture it, a country's current-price GDP has to be adjusted for prices. This is a particular challenge if sustained significant price changes and considerable changes in quality occur. This applies e.g. to IT goods and personal computers. In the PC segment prices for top-of-the-line products have remained largely unchanged. However, their quality is continuously improved, so the price measurement has to be adjusted for the different quality. For this purpose, hedonic measures have been applied in the US and to an increasing extent also in Europe. This kind of pricing is not related to PCs as a whole but to their individual components, e.g. to the microprocessor (depending on clock speed) as well as the memory and hard disk (depending on capacity and access speed). In general, the hedonic price method generally leads to more significant price declines for such goods than the usual price-finding methods. In Germany, hedonic measures have been applied in the composition of the consumer price index and recently

GDP per working hour

	1990-95	1996-03	
	% p.a.	% p.a.	gap to USA %-points p.a.
IE	3.5	5.1	3.0
GR	0.1	3.0	0.9
FI	2.6	2.4	0.3
FR	1.7	2.2	0.1
PT	3.1	2.2	0.1
USA	1.3	2.1	-
DE	2.4	1.8	-0.3
EMU	2.6	1.3	-0.8
BE	2.8	1.2	-0.9
IT	2.5	1.1	-1.0
NL	1.9	0.9	-1.2
ES	2.5	-0.3	-2.4

Sources: OECD, IMF, Federal Statistical Office

Prices & productivity

Labour productivity:

$$LP = Y / A$$

where

LP = labour productivity

Y = real production

A = labour input (in hours)

Real production:

$$Y = Y_{\text{nom}} / D$$

where

Y_{nom} = nominal production

D = price deflator

i.e.

$$LP = Y_{\text{nom}} / (D * A)$$

Labour productivity declines if labour input and prices rise and increases if prices fall.

² See Federal Statistical Office, 2003 national accounts, Fachserie 18, Reihe 1.2.



also in the price measurement of EDP investment goods.³ While in the US prices for IT goods have fallen by 90% since 1991, the price decline in Germany was limited to 55%. But as IT investment goods are identical all over the world and there is free trade between the US and the EU, prices should differ only marginally, e.g. as a result of product specifications, transportation costs and the competitive situation. The large differences in the deflators thus suggest different pricing methods. A stronger price decline and, at the same time, an unchanged nominal level of production mean an increase in real output and thus higher productivity, though. This effect may have boosted GDP growth by up to ¼ pp p.a.⁴ and may have raised US labour productivity correspondingly. If the same deflator is applied, the productivity gap between Euroland and the US narrows further and almost disappears in the German-American comparison.

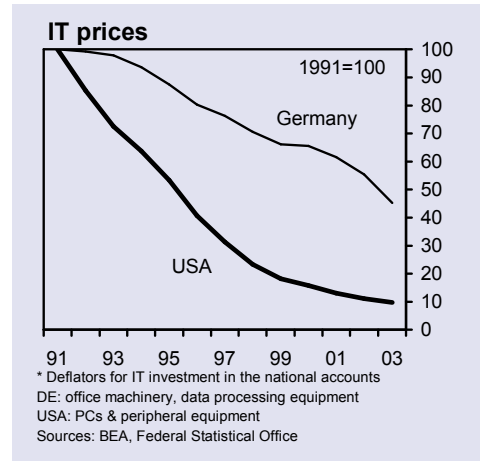
Productivity level: America's position only mediocre

Are German employees thus as productive as their colleagues in the US? The answer is no. As mentioned above, the development of labour productivity in Germany and the US has been almost identical since the mid-1990s. There are – albeit only slight – differences in the level of productivity, however. According to OECD data, German output per hour worked accounted for only 93% of the corresponding US level in 2002, partly due to the impact of German unification. In an international comparison productivity levels differ strongly across countries. For example, France's GDP per man-hour is roughly 113% of the US performance, compared with 108% for Belgium and 102% for the Netherlands. Portugal, at only 53%, brings up the rear in Euroland.

Labour productivity the right measure for productivity?

As mentioned above, a comparison of labour productivity across countries is very difficult, as output is only related to the production factor, in this case labour. However, employees are able to step up output per working hour if the capital input in their jobs is increased, i.e. labour productivity is also boosted by capital deepening.⁵

Especially in the new economy investment in the US rose above average and thus contributed more strongly to the rise in labour productivity than in Euroland. At over 8 ½% p.a., the rise in US private-sector investment was almost twice as strong in the second half of the 1990s as in the first half, and IT spending even surged by roughly 20 ¾% p.a. (1991-95: 12 ¾% p.a.). According to IMF calculations, capital deepening in the various industries contributed roughly 0.6 pp to the annual increase in labour productivity of close above 2% p.a. in the

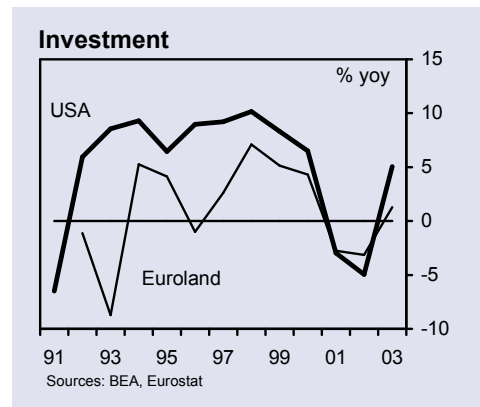


GDP per hour worked

2002
USA=100

FR	113
BE	108
IE	105
NL	102
USA	100
IT	94
DE	93
EMU	92
AT	88
FI	82
ES	74
GR	65
PT	53

Source: OECD



³ See Federal Statistical Office, Hedonic price measurement for EDP investment goods, June 2004 and press release of June 16, 2004, Hedonic price measurement for EDP investment goods – Erratum. According to these figures, the shift in prices for EDP investment goods in the PPI from January to April 2004 was -5.4%, compared with -3.7% according to the traditional method.

⁴ See Ahmad, Nadim, François Lequiller, Pascal Marianna, Dirk Pilat, Paul Schreyer, and Anita Wölf: Comparing labour productivity growth in the OECD area: the role of measurement, OECD Statistics Working Paper 2003/5. According to the Federal Statistical Office of Germany, the implementation of hedonic methods in Germany will probably have a less pronounced effect in Germany due to its different economic structures, however. In particular, EDP capital goods are imported to Germany to a much higher extent than to the US. With regard to GDP growth, the positive effect on real investment is thus largely compensated by an opposite effect on price-adjusted imports. See Federal Statistical Office, Hedonic price measuring for EDP capital goods, June 2004.

⁵ From the neo-classical Cobb-Douglas production function $Y = TFP * A^\alpha * K^{(1-\alpha)}$, where Y = production, TFP = total factor productivity, A = labour input, K = capital stock, α = share of labour compensation in total income follows that $Y/A = TFP * (K/A)^{(1-\alpha)}$. Thus labour productivity rises if K is increased and falls if the labour input rises.

US, up from only 0.3 pp in the 1990 to 1995 period. By contrast, the rise in capital spending in Euroland in the second half of the 1990s was only 4% on average. Correspondingly, it added only 0.4 pp p.a. to the increase in labour productivity.

Total factor productivity more revealing

A better measure for the efficiency of the production process than labour productivity is total factor productivity. Total factor productivity does not relate GDP to a single production factor but rather captures how efficiently the production factors labour and capital are combined and can be estimated as the residual of a production function.

Total factor productivity: better performance in the US

Total factor productivity captures the input of production factors in the overall economy; problems of definition and hedonic effects therefore play a minor role. Since the mid-1990s, total factor productivity has been more favourable in the US than in Euroland. In the US it rose by an annual rate of 1.4% from 1995 to 2002, up from 1% in the first half of the 1990s, while total productivity increases in Euroland slowed from 1.6% to 0.8% p.a. in the respective periods. However, there are countries in the euro area whose total factor productivity matches or even outperforms the US performance. For example, total factor productivity in France went up by 1.4% from 1995 to 2003, compared with as much as 2.6% in Finland and 4.4% p.a. in Ireland.

Reasons for more sluggish productivity growth in Euroland: structural changes in the labour market

According to an IMF study⁶, the slower total factor productivity growth in Euroland since the mid-1990s is mainly due to structural changes in the labour market. True, the differences in the development of total factor productivity in the US and Euroland are also due to technological changes (IT, new economy). This applies especially to the diffusion and application of IT where productivity growth in the US, at 4.8% p.a. from 1995 to 2001, was almost three times as high as in Euroland. However, all in all the IMF holds the view that technological developments played a secondary role, while changes in the labour market were of major importance.

Structural changes in wage formation led to a very moderate wage development in Europe which increased employment and caused relative prices of labour and capital to shift in favour of labour. As a result, Euroland has increasingly used labour as a production factor since the mid-1990s. Employment rose, but this came at the price of slower productivity growth, as the productivity of newly hired employees is usually lower. The labour-market changes are due to the following factors:

- employees have learned from the mistakes of the past after observing the consequences of excessive wage demands;
- the unions' bargaining power has declined;
- individual wage agreements (at company level) directed toward saving jobs have increased;
- pacts between the government and trade unions for more employment, in which the government provides relief to employees

⁶ See Estevao, Marcello M.: Why is Productivity Growth in the Euro Area so Sluggish? IMF Working Paper 2004/200.

Labour productivity growth & capital

	EMU		USA	
	90-95	95-03	90-95	95-03
Labour productivity, % p.a.	2.6	1.2	1.3	2.1
contribution of: capital deepening %-points p.a.	1.0	0.4	0.3	0.6

Source: IMF

Total factor productivity

Under the standard neo-classical production function

$$Y = TFP * f(A, K)$$

where

Y = real production

TFP = total factor productivity

A = labour input

K = capital stock

follows that in the case of perfect competition and linear homogeneity

$$\Delta \ln Y = \Delta \ln TFP + \alpha \Delta \ln A + (1 - \alpha) \Delta \ln K$$

where

α = share of labour compensation in total domestic income

which means that

$$\Delta \ln TFP = \Delta \ln Y - \alpha \Delta \ln A - (1 - \alpha) \Delta \ln K$$

i.e. the change of total factor productivity is derived as a residual from production growth and the weighted sum of the growth rates of the production factors labour and capital.

Example:

Germany 1996-2002

(on the basis of OECD data)

Real GDP ($\Delta \ln Y$): +1.4% p.a.

Hours worked ($\Delta \ln A$): -0.3% p.a.

Capital ($\Delta \ln K$): +2.5% p.a.

Share of labour compensation in total domestic income (α): 0.67

Total factor productivity growth 1996-2002:

$$\begin{aligned} \Delta \ln TFP &= 1.4\% - 0.67 * -0.3\% \\ &\quad - 0.33 * 2.5\% \\ &= 0.8\% \text{ p.a.} \end{aligned}$$

with regard to taxes and social-security contributions in exchange for low wage demands;

- active labour-market policies directed toward increasing labour demand, e.g. public subsidies to companies for hiring;
- labour-market reforms allowing a better use of temporary and part-time work.

Europe has thus temporarily given greater priority to employment than to productivity gains. No doubt, this is a rational strategy considering the different situations in the US and Euroland. In 2002 the productivity level in Euroland stood only 8% below the US level. In terms of labour input, measured as the annual working hour per capita (includes the effects of the labour-force participation rate, weekly working hours, holidays, vacation), Europe lags roughly 25% behind. It is therefore sensitive to start at this point in order to boost growth and welfare for the population.

Euroland 1995-2003: slower productivity growth but higher employment

While the average number of hours worked per capita has fallen since the mid-1990s, employment in Euroland has temporarily risen by over 2%, and since 1995 the rate of unemployment has declined to just below 9% (from roughly 11%). This is in contrast to the stronger productivity gains and the decline in employment in the first half of the 1990s on the one hand and the development in the US on the other. Weak productivity growth in the US from 1990-1995 was accompanied by sharp increases in employment, while the growth mix of productivity and employment from 1995-2003 showed just the opposite result. Strangely enough, productivity even accelerated further during the growth dip of 2001. The price to be paid was a sharp decline in employment, which was more pronounced than in the 1991 recession, even though the slowdown in growth in 2001 was more moderate. This was also due to the expansionary monetary policy of the Fed, which lowered the cost of capital drastically and thus shifted the relative prices of labour and capital in favour of capital. The weakening of employment in Euroland was less pronounced. Although the 2001 growth dip was similar to that in the US, employment continued to increase, albeit at a slower pace.

Lisbon strategy: more productivity growth required

The boost to growth from higher employment and higher productivity in the euro area since the mid-1990s reflects that the economic and social-policy strategy is successful – at least as long as there is a continuing trade-off between productivity and employment and there is no possibility to push up both and thus the growth potential of the overall economy. With the Lisbon strategy, Europe’s heads of state and government have set themselves an ambitious target, however. The objective is to make the EU the most competitive and dynamic knowledge-based economic area in the world by 2010 with a high degree of social cohesion and environmental protection. The formulation of this target shows a further difficulty in the comparison between Euroland and the US which ranges way beyond the comparability of data – an approach which is more reflective of Europe’s fundamental economic and social-policy paradigm. Unlike the US, “the old Europe” often places the stress on the social consequences of economic-policy measures, which affects labour productivity negatively. Given the target of implementing the Lisbon strategy and the explicit goal of greater social cohesion, the EU therefore has to set out on its own path towards greater productivity.

Total factor productivity

	1990-95 % p.a.	1996-02 % p.a.	Gap to USA %-points p.a.
IE	3.3	4.4	3.0
FI	1.3	2.6	1.2
GR	0.0	1.8	0.4
FR	0.8	1.4	0.0
USA	1.0	1.4	-
NL	0.7	0.9	-0.5
EMU	1.6	0.8	-0.6
DE	1.2	0.8	-0.6
BE	0.7	0.6	-0.8
IT	2.0	0.1	-1.3
ES	0.6	-0.8	-2.2

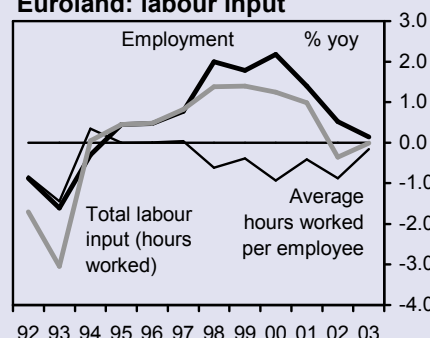
Sources: OECD, IMF

Sectoral productivity growth

	1995-2001 % p.a.		Share of GDP 2001, in %	
	EMU	USA	EMU	USA
Total economy	1.5	2.3	100	100
ICT-producing industries	7.3	8.0	5.5	7.0
ICT-using industries	1.7	4.8	27.6	31.6
Non-ICT industries	0.9	0.0	66.9	61.4

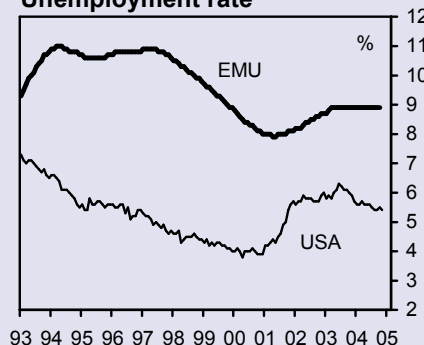
Source: IMF

Euroland: labour input



Sources: OECD, DB Research

Unemployment rate



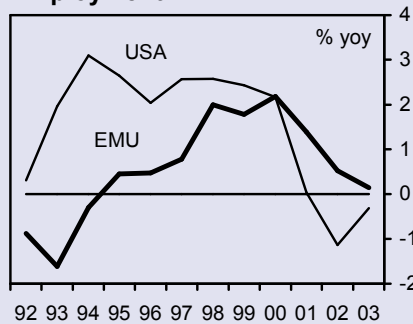
Sources: BLS, Eurostat

Remedies and strategies from the US, e.g. for the labour market, are difficult to transfer and, at best, point out the direction.

To achieve the Lisbon objective it will not be sufficient to maintain the employment and productivity levels of the 1990s. Both an improvement in the labour-market situation and stronger productivity growth are required – calling for further reforms to ensure greater labour-market flexibility and, above all, the across-the-board- promotion of innovation, education and professional training. All these challenges have to be tackled in the next few years. After 2010, when the baby-boom generations reach pension age and the ageing of societies begins to accelerate, the demographic problem will increasingly weigh on Europe. Much remains to be done to achieve the Lisbon target. It's time to act.

Authors: Bernhard Gräf, +49 69 910-31738 (bernhard.graef@db.com)
 Marc Schattenberg, + 49 69 910-31889 (marc.schattenberg@db.com)

Employment



Sources: BLS, ECB, Deutsche Bundesbank

USA: GDP growth & employment



Sources: BEA, BLS

© 2005. Publisher: Deutsche Bank AG, DB Research, D-60262 Frankfurt am Main, Federal Republic of Germany, editor and publisher, all rights reserved. When quoting please cite "Deutsche Bank Research".

The information contained in this publication is derived from carefully selected public sources we believe are reasonable. We do not guarantee its accuracy or completeness, and nothing in this report shall be construed to be a representation of such a guarantee. Any opinions expressed reflect the current judgement of the author, and do not necessarily reflect the opinion of Deutsche Bank AG or any of its subsidiaries and affiliates. The opinions presented are subject to change without notice. Neither Deutsche Bank AG nor its subsidiaries/affiliates accept any responsibility for liabilities arising from use of this document or its contents. Deutsche Banc Alex Brown Inc. has accepted responsibility for the distribution of this report in the United States under applicable requirements. Deutsche Bank AG London being regulated by the Securities and Futures Authority for the content of its investment banking business in the United Kingdom, and being a member of the London Stock Exchange, has, as designated, accepted responsibility for the distribution of this report in the United Kingdom under applicable requirements. Deutsche Bank AG, Sydney branch, has accepted responsibility for the distribution of this report in Australia under applicable requirements.

Printed by: Druck- und Verlagshaus Zarbock GmbH & Co. KG