Special Stock Option Watch **English edition**

ZEW news

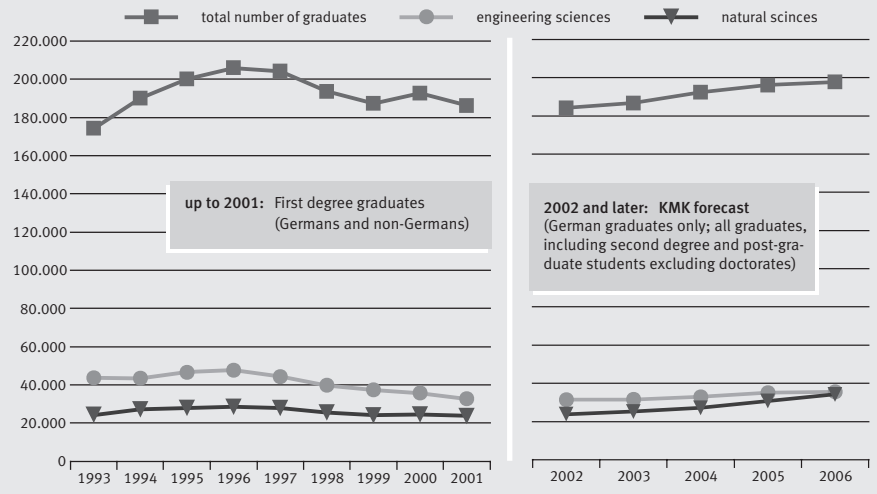
Zentrum für Europäische
Wirtschaftsforschung, Mannheim

Selected Contributions from the Centre for European Economic Research No. 3 · 2003

University and College Graduates in Short Supply

An increasingly large proportion of the German workforce is made up of graduates. The absolute number of people holding university or college degrees, and particularly those with degrees in engineering or the natural sciences has been in decline since the mid-1990s, however. But it is precisely these qualifications that insure Germany's technological performance and competitiveness in the future. These are the results of a new study conducted by ZEW and the Hannover-based Hochschul-Informations-System GmbH (HIS).

Development of graduate numbers



Source: German and non-German first degree graduates to 2001: Federal Statistical Bureau, main reports; Forecast of numbers of German graduates and post-graduates: Kultusministerkonferenz (KMK), subject-specific forecast of numbers of German graduates, KMK Statistical Publications, Volume 156.

■ The threat to the future innovative power of German companies is illustrated by the following figures. While around 48,000 engineers and almost 28,500 natural scientists left German colleges and universities with a degree every year in the mid-1990s, these figures had dropped to a mere 33,500 engineers and 23,500 scientists by 2001. According to forecasts issued by Germany's Standing Conference of the Ministers of Education and Cultural Affairs (Kultusministerkonferenz, KMK), in the period up to the year 2006 there will be a minor increase in the number of students graduating with a degree in engineering; the only significant increase in science graduates in the same period will be among computer scientists.

This development is particularly disquieting bearing in mind that, in international terms, the German workforce already consists of a low share of graduates and the country is particularly short of technology-oriented graduates. The share of those with a university or college qualification in the relevant cohorts for the year 2000 in Germany was thus just 20 per cent, compared with an OECD average of more than 25 per cent. The number of engineers and natural scientists per 100,000 people of working age in the age classes 25 – 34 in Germany at the end of the last century was less than 700 – also considerably lower than the OECD average of just under 1,000. It is therefore reasonable to assume that, unless Germany is able to rapidly boost either the number of its own university and college graduates or to attract considerably larger numbers of technological-

Content

Research Findings

ly qualified workers from beyond its borders, the country will face a severe deficit of skilled professional workers in the future, with the accompanying economic consequences.

What dormant educational potential does Germany still have, and how could its potential be mobilized to avert the threat to the country's welfare which a shortage of technically and scientifically qualified workers implies? There can be little doubt that Germany must enable a significantly larger number of people to profit from higher education in the first place. Year for year, only 33 to 37 per cent (depending on the precise yardstick used) of all school leavers in Germany have the school qualifications which enable them to go to college or university – a figure well below the OECD average of over 55 per cent and also much lower than the share of school leavers entitled to enter higher education in all other important industrialized nations.

One of the main reasons for this state of affairs is that the German school system creates inadequate opportunities for children from families with lower levels of formal educational achievement and lower incomes to attend a college or university. For every 100 children coming from a higher socioeconomic background (higher levels of formal education, higher incomes) 84 manage to reach years 12 and 13 of the German grammar school system, and 72 begin a course of study at a college or university. For every 100 children from the lowest socioeconomic class (lower formal level of education of the parents and lower income) only around 33 achieve the same level of schooling and a mere 8 go on to study after leaving school. These differences do not reflect the relative aptitudes of different social groups but rather the inability of the German school system to iron out and compensate for the different baseline conditions affecting children from different family backgrounds. The low proportion of university students from lower socioeconomic backgrounds is especially problematic – bearing in mind Germany's economic and competitive performance – as students from these backgrounds are more likely to begin studying subjects with a technical or natural science slant. An across-the-board increase in the overall number of students would therefore have a noticeable impact on the number of graduates available to meet the urgent demand for engineers and natural scientists. ◄

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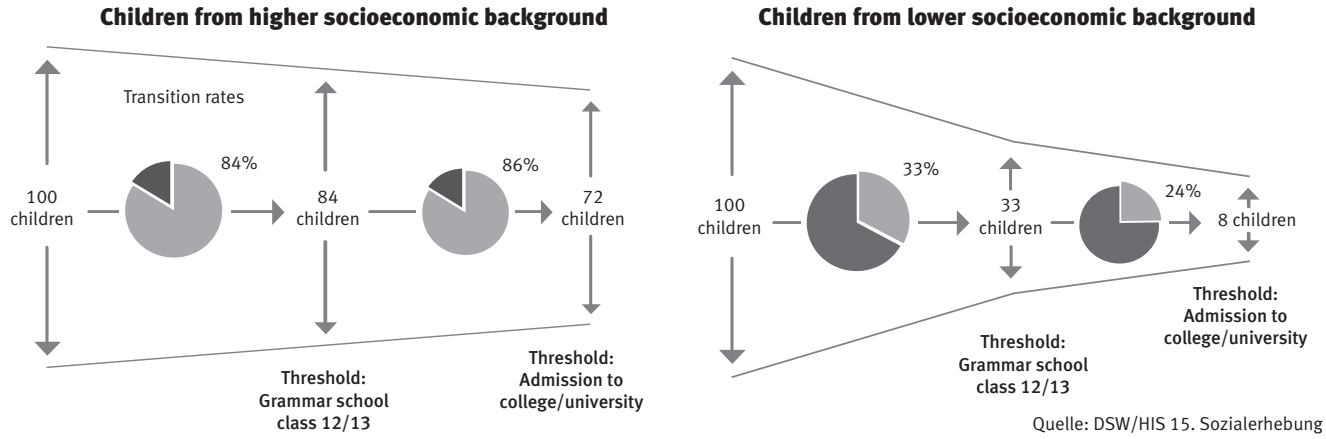
Education funnels: Social selection 1996, in diagrammatic form



Quelle: DSW/HIS 15. Sozialerhebung

Research Findings

The German Chemical Industry: A Force for Innovation

More money is invested by the chemical industry in research and development than by any other manufacturing sector in Germany, and the German chemical industry is one of the most innovative in the world. Not only that, as a new ZEW study of the influence of chemicals innovations reveals, in its role as both customer and supplier for German industry, the chemical sector also has a major impact on innovative developments in Germany by stimulating product and process innovations in other sectors.

■ The chemical industry is a pillar of support for research and development (R&D) in Germany. Expending a total of around 4.2 billion euro in 2001 (excluding the pharmaceuticals sector), chemicals accounted for ten percent of German industry's R&D investments. Chemicals thus come second in the R&D rankings, exceeded only by the automobile industry and on a par with mechanical engineering, electronics, and the communications industry. International comparisons also show that the German chemicals sector attaches great importance to research. On average the industry (excluding the pharmaceuticals sector) spends five per cent of its sales revenue on R&D – a significantly higher proportion than the global average for the industry. In 1999, around 16 per cent of worldwide R&D resources in the chemical industry originated from German firms, while their share of the value added in the field of chemicals among industrial countries was a comfortable nine per cent. Quite clearly, Germany is one of the leading international locations for chemicals.

Close relationship with research

Hardly any other sector of industry maintains such a close relationship with research, and the chemical industry is unequalled in the degree to which it exploits the latest scientific findings in new products. This, in turn, is especially significant for innovation activities in German business and industry as a whole as the chemicals sector is the crucible for new materials and components which provide the basic building blocks for production in other sectors of the economy. New material properties enable products to be enriched with new functions and fields of application, as well as promoting more efficient, environmentally-friendly, and cheaper production methods. Chemical innovations thus stimulate the innovation activities of the sector's customers both at the product and process levels.

The considerable influence of chemical innovations on the development of new or improved products in other sectors of the economy is demonstrated by the example of Bayer Plastic's Makrolon® product. Nowadays, Makrolon® is not only used as the storage layer of CDs, CD-ROMs and DVDs, but is also, for example, employed in the manufacture of roofing for public platforms and stages, diffusing glass for car headlights, and for spectacles. The electrical, electronic, and building industries are just as likely to use Makrolon® in their products as vehicle manufacturers or firms in the medical engineering or packaging industries.

This is just one of many examples which illustrate how, among all the suppliers to German businesses, the chemical industry spurs on the development of the largest number of new products. In 1998, other sectors supplied by the chemical industry, generated sales with chemical-driven innovations worth almost three billion euros. As a customer, the industry and triggers innovation revenues in other sectors of around 2.2 billion euro a year for its own suppliers. In Germany, total sales of new products based on innovations originating in the chemical industry are worth more than 19 euro billion per annum.

The role of chemicals in triggering other process innovations should not be underestimated either. Practically every tenth euro saved by industry thanks to process improvements based on sourced input technology is the result of innovations in the chemical industry. Thanks to the impetus provided by the industry, other sectors supplied by the chemical industry reported cost savings in 1998 worth around 1.2 billion euro. In total, chemicals-driven process innovations enable more than nine billion euros in costs to be cut in Germany every year. ◄

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Research Findings

German Companies Bear Double Tax Burden

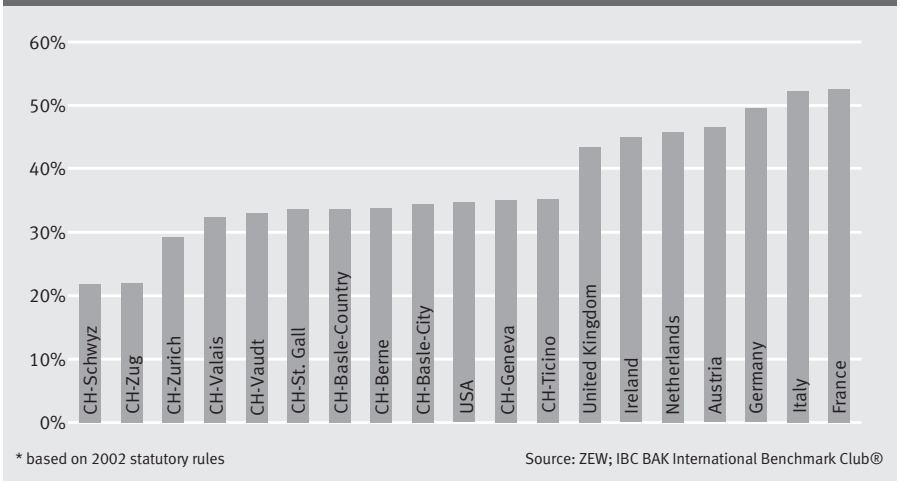
As if their high effective tax burden wasn't enough, companies in Germany are also at a disadvantage in comparison with their international competitors in terms of the high effective tax rates paid by highly-qualified employees. A ZEW study reveals that the effective tax rates on highly-qualified employees are lowest in Switzerland and the USA, followed by the United Kingdom, Ireland, the Netherlands, and Austria. In comparative terms, the highest tax rates are found in Germany, Italy, and France.

■ The ZEW study, which was performed on behalf of BAK Basel Economics' IBC BAK International Benchmark Club, not only looks at tax rates in Germany and eleven Swiss cantons, but also encompasses the USA (Massachusetts), the United Kingdom, Ireland, France, Italy, the Netherlands and Austria. The indicators of tax rates used include the entire gamut of taxes that are applicable to earned income and corporate profits. The main sources of the effective tax burden on highly-qualified employees are graduated income tax scales and the statutory pension scheme. Concerning the corporate tax burden, the key factors determining the effective average tax rate are corporation tax rates and, especially in France, taxes on non-income values.

Higher gross wages in countries with high effective tax rates

As highly-qualified employees are internationally mobile, they tend to be courted by globally competing companies. Therefore, the study assumes that employees in countries with higher effective average tax rates demand higher gross wages from their employers in order to compensate for the higher levels of deductions. To the extent that they are successful, the cost of employing them rises correspondingly for the relevant companies. As Germany has one of the highest effective tax rates (see chart), German-based companies are at a disadvantage compared with companies in the United Kingdom, the USA, or Switzerland which are able to pass on significantly higher net salaries to highly-qualified employees based on the same underlying gross income. Employers in Germany, for example, need to spend around 200,000 euros a year in order to pay a highly-qualified employee a disposable after-tax income of 100,000 euros. In the USA, on the other hand, employers need only find around 153,000 euros to pay their employees the same after-tax income. Employers in the Swiss cantons of Zug and Schwyz have the lowest costs in this respect at less than 130,000 euros.

The effective burden of taxes and charges on a highly-qualified employee on disposable income of €100,000



* based on 2002 statutory rules

Source: ZEW; IBC BAK International Benchmark Club®

High effective corporate tax burden

This picture is confirmed by an analysis of the corporate tax burden. Locations which already offer lower rates of corporation tax are also at an added advantage in many cases when competing to attract new companies if they are also able to offer lower taxes on the salaries payable to highly-qualified workers. A striking exception, however, is the USA, where highly-qualified employees pay relatively modest taxes despite the very high taxes paid by companies. Quite the reverse is true for Ireland. The Irish offer a business tax rate of a mere 12.5 per cent as a magnet to attract corporations. On the other hand, among the different locations studied, Ireland occupies a middling position as far as the taxes levied on highly-qualified employees are concerned.

ZEW has developed a new calculation model to determine the tax burden on highly-qualified employees. Corporate tax burdens are worked out using the internationally recognized method established by Devereux and Griffith. While the structure of the study is such that it is not possible to make direct comparisons of whether the overall tax burden is higher on employees or deployed capital, it is however possible to estimate the attractiveness of various locations for individual companies. ◄

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ZEW Conference

The Economics of Information and Communication Technologies

■ On the 4th and 5th of July 2003 the ZEW in Mannheim held its third conference on "The Economics of Information and Communication Technologies". The conference was financially supported by the Landesstiftung Baden-Württemberg foundation and by the German Science Foundation (DFG). More than 50 internationally recognised academics from Germany and other European countries as well as Israel, Canada and the USA contributed to the presentations and discussions. The members of the academic committee were: David Autor (MIT, USA), Ernst R. Berndt (MIT Sloan School of Management, USA), Karen B. Clay (Carnegie Mellon University, USA), Oliver Fabel (University of Constance), Francis Kramarz (CREST-INSEE, France), Georg Licht (ZEW), Martin Peitz (University of Mannheim) and Konrad Stahl (University of Mannheim). They reviewed the large number of papers that were submitted and thus made an important contribution to creating an interesting programme.

The aim of the conference was to present new research results on the economic aspects of information and communication technologies (ICT) and to examine these in the course of a critical discussion. Key topics covered were the effects of ICT diffusion on productivity and growth and the special economic aspects of digital markets and telecommunications. The total of 31 papers presented discussed – as in the previous years – both the micro- and macroeconomic aspects of ICT and covered both theoretical and empirical-econometric studies.

Impact of ICT on mobility and productivity

In the opening plenary session Paul Chwelos (University of British Columbia, Canada) presented an approach for analysing the economic significance of spatial mobility in computer use. Taking Personal Digital Assistants (PDAs) as an example, he has developed a hedonic price index that takes the advantages of mobility into account. Jack E. Triplett (Brookings Institution, USA) then presented an empirical study examining the influence of ICT on the rise of labour productivity in the services sector during the 1990s in the USA. He demonstrated that the influence of ICT was considerable. However, the influence of ICT on the rise of productivity after 1995 – in other words, the time during which productivity was seen to rise particularly strongly – was not any greater than it was before. However, multifactor productivity in the services sector also saw particularly strong growth after 1995 and therefore – in addition to improved ICT capital resources – played a crucial role in boosting labour productivity.

The participants in the 3rd ZEW ICT conference.

Analysis of digital markets

In the following parallel sessions a total of 28 papers were presented. The main focus was on the analysis of digital markets. For example, online markets for music, newspapers, magazines and contact lenses were examined with a view to competition and price formation on digital markets. Some conference papers looked at topics that present a specific problem for electronic markets, such as abuse of trust, attacks by hackers and piracy on the Internet. Other contributions dealt with the labour economic impacts of ICT use in particular with respect to the wage structure, qualification requirements and further training. Some sessions focussed on competition in telecommunications markets. Issues relating to Open Source Software and the innovation of network products were also covered.

During the final plenary session Karen Clay (Carnegie Mellon University, USA) presented a study undertaken in the USA that analyses consumer learning where information is incomplete, taking an online grocer acting as a monopolist as an example. Using household data from this online grocer on tariffs and usage choices over 70 weeks, a dynamic stuctural model with foreward looking consumers was estimated. Given this model, the study examines various theories of consumer learning, welfare impacts due to uncertainty, and possible price discrimination strategies of the monopolist.

The conference programme can be viewed on the ZEW Homepage under www.zew.de/ikt-konferenz. It is also possible to download conference papers from this site. ◄

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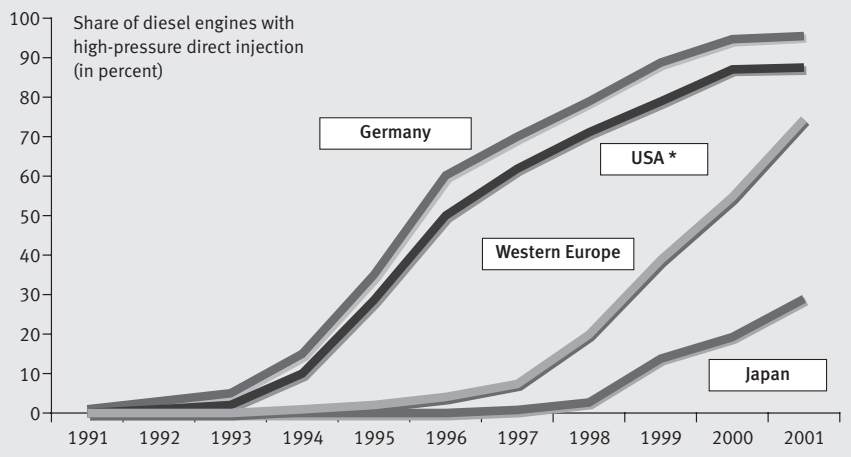
ZEW Conference

5th Blueprint Workshop: Green Technology Foresight

■ The fifth workshop of the thematic network "Blueprints for the Integration of Science and Technology Policy" (Blueprint) held in Brussels focussed on green technology foresight. The network is funded by the EU Commission and coordinated by the ZEW. The issues of the workshop are particularly topical, as forecasts are intended to play an important role in the 6th Framework Programme "Improving the Human Research Potential and the Socio-Economic Knowledge Base" of the European Commission.

International diffusion of diesel high-pressure direct injection systems



* USA: predominantly light duty trucks

Source: ZEW, Bosch

Mads Borup from the Risö Research Centre in Denmark spoke about the experiences gained in the field of green technology foresight in Europe, and in particular in Scandinavia and the Netherlands. Conventional delphi methods were widely used while carrying out the studies. But the studies also include other specific foresight methods for environmental technologies such as lifecycle analyses and a technique known as backcasting which identifies the need for technological changes on the basis of environmental policy goals or agreed reduction goals, for instance, for greenhouse gases.

René von Schomberg, from the European Commission DG Research, presented a research programme designed to shape a new area of long-term planning to secure the future of our societies – a programme which he referred to under the heading of the "third arena" to complement existing "market" and "regulative" approaches. According to von Schomberg this "third arena" calls for research which focuses on increased eco-efficiency as well as issues such as sustainability indicators, participation, technology foresight and assessment processes, the precautionary principle and system innovations. While the workshop participants agreed in principle on the need for research in these areas, Philip Vergragt from the Technical University of Delft criticised the vagueness of the term "third arena". In the discussion the participants also felt that there was hardly any mention of the cited research needs in the European Commission's work programme to the Sixth Framework Programme.

Lead markets for environmental technologies

The penetration of environmental technologies of national and international markets depends crucially on environmental policy. If a country identifies an international environmental problem at an early stage, such as the depletion of the ozone layer or global warming and starts to spearhead a regulatory trend, it might become a lead market for the corresponding environmental technology. Marian Beise of the ZEW presented some examples for lead markets of environmental technologies (see ZEW Discussion Paper No. 03-01 for further reading on these examples and an approach to lead markets in environmental protection). Denmark, for instance, has become a lead market for wind power. Compared to other leading countries in wind power generation, notably Germany, Denmark uses a much higher share of its wind power potential on the domestic market and is more export oriented. Germany has developed into a lead market for diesel high-pressure direct injection systems (see figure). While there are hardly any international markets for car designs meeting exclusively ecological criteria, the high-pressure direct injection technology satisfies consumer demand for fuel-efficient cars while also providing dynamic vehicle performance. German regulations promote this demand trend for fuel-efficient vehicles.

Ian Miles of PREST (Policy Research in Engineering, Science and Technology) at the University of Manchester assessed the lead market approach as a well-elaborated concept to explain international technology diffusion and conduct empirical validations. On the other hand, he felt that the part on policy diffusion was not yet sufficiently developed. Miles suggested that the approach should be extended to "lead policy markets" and should be elaborated further.

The workshop participants gave positive feedback concerning the applicability of the lead market concept. Firstly, lead market analyses were very stable over time, i.e. the lead market position of the past often influences future market success. Secondly, the lead market concept is already being applied in a joint research project with Daimler-Chrysler in order to identify future potential lead markets.

All workshop contributions and comments as well as a synthesis report are available for download on the website of the network (www.blueprint-network.net). ◄

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ZEW Financial Market Test

Results of the Survey in June 2003

■ The Financial Market Test conducted by the ZEW is a monthly business survey of German financial market experts which started in December 1991. The survey asks for the predominant expectations about the development in six international financial markets.

As a whole around 350 experts take part in the survey. 280 of them work in banks, 50 in insurance companies and investment companies and 20 in other industries. Participants in the survey are financial experts of the finance departments, the research departments and the economic departments as well as the investment and securities departments of the firms. In detail, the financial experts are questioned on their medium term expectations about the development of important international financial markets with respect to the business cycle, the inflation rate, short term and long term interest rates, the exchange rate and share prices.

To construct forecasted figures, the qualitative response categories (increasing, unchanged, declining) are transformed into quantitative figures by the Carlson/Parkin procedure. Additional information to the applied procedure is available as an abridged version published by the ZEW. The present survey was conducted between May 26, 2003 and June 16, 2003. All calculations are termed to June 20, 2003. ◄

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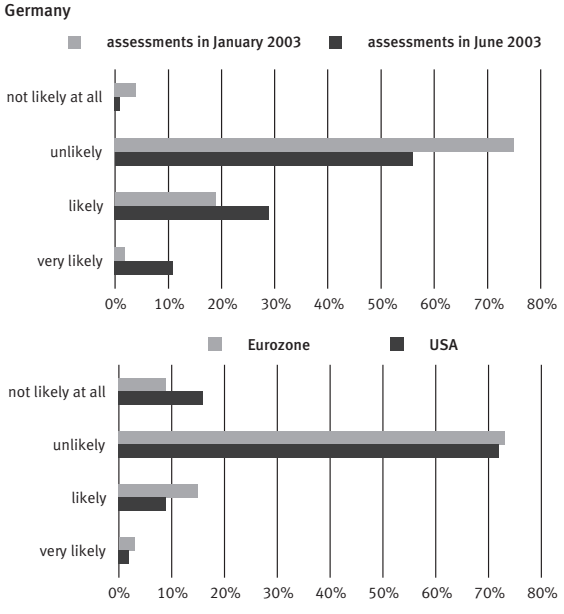
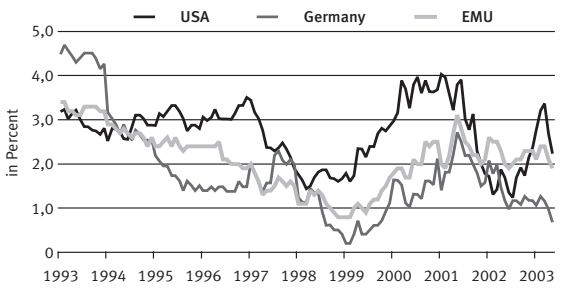
Danger of deflation

How do you assess the likelihood of deflation in Germany, the eurozone, and the USA in the next few years?



Developments in inflation



Total numbers of answers: 289
Source: *Thomson Financial Datastream; ZEW

■ The deflation debate continues to preoccupy international monetary policy makers. Ben Bernake, member of the Federal Open Market Committee of the US Federal Reserve aroused considerable attention with a speech in which he detailed the measures the Central Bank could take to combat deflation. And Alan Greenspan, Chairman of the US Federal Reserve, hardly ever seems to miss the opportunity to mention the word deflation in his speeches. However, it is Germany that financial markets and, most recently, the International Monetary Fund have identified as one of the countries that are most susceptible to the danger of deflation at the present time.

In the January survey of the ZEW financial market test respondents were asked for the first time to comment on the likelihood of a sustained price decline in Germany. Nearly 80 percent of the respondents felt that a Japanese style deflation was unlikely or not likely at all in Germany. But the results of the recent June survey show that the experts are no longer as confident in their assessment as half a year ago. Now a good 40 percent of analysts believe that deflation is likely or even very likely. In line with the Monetary Fund study, they believe that Germany is far more threatened by deflation than the entire eurozone. 72 percent of the experts feel that deflation is unlikely to occur in the eurozone, and nine percent stated that there was no such danger. As many as 16 percent of experts rule out deflation in the USA, and 72 percent reckoned that deflation was unlikely. Apparently the firm resolution of the members of the US Federal Reserve to combat deflation created a lasting impression on financial markets.

In addition, the European Central Bank's last substantial cut in interest rates by 50 basis points had a positive influence on the results. A separate analysis of responses prior to and after the interest rate decision on June 5 reveals that the share of experts claiming that deflation in Germany was unlikely climbed from 45 to 63 percent after the interest rate decision. This gain in confidence was probably also bolstered by the ECB strategy aiming at an inflation rate below and nevertheless close to the two-percent ceiling, thus increasing the distance to deflation. ◄

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ZEW Calendar

ZEW Summer Workshop 2004 on "Global Commons" (June 21-23, 2004)

■ The 6th ZEW summer school under the heading "Managing the global commons" will take place at the Centre for European Economic Research (ZEW) in Mannheim from June 21 to June 23 in 2004. The workshop is organised by the department of environmental and resource economics and addresses Ph.D. students who are actively researching in the fields of water economics, economics of biodiversity, climate change, resources and global trade as well as cooperation and negotiations in international environmental policy. As key lecturers professors Scott Barrett (Johns Hopkins University), David Zilberman (University of Berkeley), Erwin Bulte (University of Tilburg) and Stefan Baumgärtner (University of Heidelberg) have been asked to participate. The best paper presented at the ZEW summer workshop is awarded the "Heinz König young scholar award", which is assigned for the first time in memorial of the ZEW's founding director.

For more information please contact Dr. Carsten Vogt, Phone +49/621/1235-212, Email vogt@zew.de.

ZEW Publications

■ **Discussion Papers**

Download the Discussion Papers at our web site: ***www.zew.de/en/publikationen***

Ullrich, Katrin: *A Comparison between the Fed and the ECB: Taylor Rules*, No. 03-19.

Hempell, Thomas: *Do Computers Call for Training? Firm-Level Evidence on Complementarities Between ICT and Human Capital Investments*, No. 03-20.

Böhringer, Christoph; *Lange, Andreas: Economic Implications of Alternative Allocation Schemes for Emission Allowances – A Theoretical and Applied Analysis*, No. 03-22.

Czarnitzki, Dirk; Fier, Andreas: *Publicly Funded R&D Collaborations and Patent Outcome in Germany*, No. 03-24.

Hagen, Tobias: *Three Approaches to the Evaluation of Active Labour Market Policy in East Germany Using Regional Data*, No. 03-27.

Gürtzgen, Nicole: *Revisiting the Impact of Union Structures on Wages – Integrating Different Dimensions of Centralisation*, No. 03-28.

Ammermüller, Andreas; Weber, Andrea Maria: *Education and Wage Inequality in Germany – A Review of the Empirical Literature*, No. 03-29.

Beblo, Miriam; Beninger, Denis; Laisney, François: *Family Tax Splitting: A Microsimulation of its Potential Labour Supply and Intra-Household Welfare Effects in Germany*, No. 03-32.

Steiner, Viktor; Jacobebbinghaus, Peter: *Reforming Social Welfare as We Know It? A Microsimulation Study for Germany*, No. 03-33.

Lauer, Charlotte: *Education and Unemployment: A French-German Comparison*, No. 03-34.

Franz, Wolfgang: *Will the (German) NAIRU Please Stand up?*, No. 03-35.

Eberts, Elke: *The Connection of Stock Markets Between Germany and the USA. New Evidence From a Co-Integration Study*, No. 03-36.

Mion, Giordano: *Spatial Externalities and Empirical Analysis: The Case of Italy*, No. 03-38.

Barrios, Salavdor; Bertinelli, Luisito; Strobl, Eric: *Coagglomeration and Growth*, No. 03-39.

Peri, Giovanni: *Knowledge Flows, R&D Spillovers and Innovation*, No. 03-40.

Lutz, Stefan H.: *International Coordination of Quality Standards and Vertical Product Differentiation*, No. 03-41.

Beck, Martin; Fitzenberger, Bernd: *Changes in Union Membership Over Time: A Panel Analysis for West Germany*, No. 03-42.

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