Appendix: Problems of international comparisons of growth – a supplementary analysis

Aim

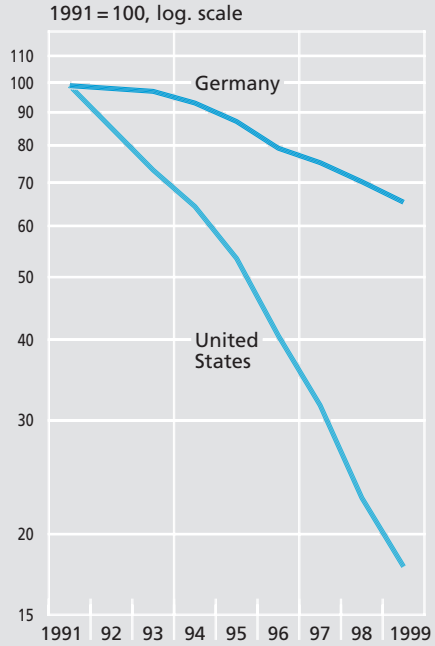
This article aims to draw attention to the statistical problems of international comparisons of growth. It is not primarily concerned with the question of whether the methods used in the United States or in Europe are to be preferred. Despite many efforts to improve the comparability of statistics, much remains to be done in this area. There is a need for action, in particular, by international organisations, such as the United Nations, the OECD and the Statistical Office of the European Communities (Eurostat). For the time being, however, a knowledge of the methodological and conceptual features of the national statistics is of major importance for the user of the data.

Price adjustment of expenditure on IT goods

In the August 2000 Monthly Report, reference was made to the fact that the discrepancy between the United States and Germany in developments in real IT equipment is caused, to quite a considerable extent, by the differing methods used in statistical price measurement for evaluating and/or capturing changes in quality.[1] Adjusting the price of expenditure on IT equipment in Germany using the corresponding time series for the US price deflator produces, for the nineties, a much more dynamic growth of the real variables than is shown in the official statistical data. There are similar methodological differences between the United States and other member states of the EU.

1 See Deutsche Bundesbank, Problems of international comparisons of growth caused by dissimilar methods of deflation – with IT equipment in Germany and the United States as a case in point, Monthly Report, August 2000, page 8.

Prices of IT equipment in Germany and the United States



Inclusion of other demand components and ...

Taken in isolation, this finding – as was pointed out in the August 2000 Monthly Report – also has an impact, in purely mathematical terms, on the growth of real gross domestic product (GDP). However, the IT goods contained in other demand components, especially in private consumption as well as in imports and exports, likewise have to be taken into consideration. Furthermore, it should be noted that, in terms of the national accounts, the US price deflator differs from the approach used in Germany (and other countries) not merely with regard to the quality aspect of price measurement. Since 1995, for example, the US Bureau of Economic Analysis has been using a chained Fisher quantity index[2] for determining real GDP. The rate of growth of the economy as a whole is averaged from the rate of expansion of real GDP, calculated on the basis of the preceding year's prices, and the rate produced when evaluating GDP at the prices of the respective reporting period. By contrast, the real aggregates of the national accounts in Germany – and in most of the other countries in Europe – are expressed at constant prices of a given base year (currently 1995), i.e. as a Laspeyres quantity index. The US method, which works with current price structures and therefore takes account of substitution effects immediately, tends to generate rates of growth in the years following the base period which are lower than those generated when using the traditional approach.

... differences in price deflator methodologies

"Growth effects" of differing price measurement

According to estimations at the Bundesbank, real GDP growth in Germany on an average of the years 1996 to 1999 would have been shown as being just under 0.2 percentage point higher if the hedonic price measurement of IT goods and a methodological approach which is similar to the US deflator concept (chained Laspeyres quantity index) had been applied in Germany.[3] Since, given the complex situation with regard to the data, simplifying assumptions had to be made, however, this outcome is to be interpreted with due caution.

2 For details, see Scheuer, M./ H.-A. Leifer, Zur Umstellung der Berechnung des realen Bruttoinlandsprodukts in den USA auf einen Kettenindex, WiSt, 25. Jg., 1996, pages 473–478, and Nierhaus, W., Wirtschaftswachstum in den Volkswirtschaftlichen Gesamtrechnungen: Ein Vergleich Deutschland – USA, ifo-Schnelldienst, 2001, Heft 3, pages 41–51.

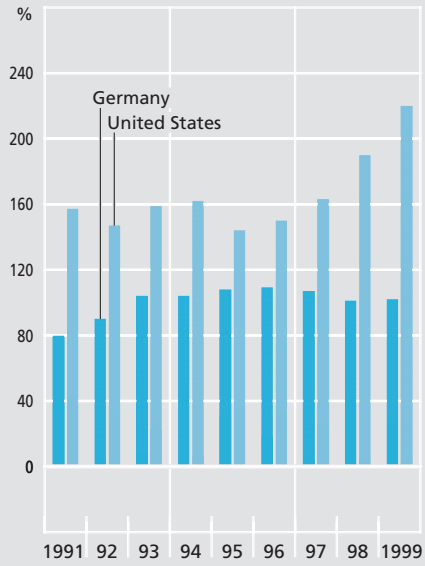
3 With regard to these calculations, it should be specifically noted that the US import and export deflators were not applied to Germany since the trends, even in an isolated analysis of circumstances in the United States, do not appear very plausible. Instead, a uniform deflator, i.e. the US price index for IT goods, was used for all expenditure aggregates.

Since we are concerned here – as indicated above – with the comparability of the German and US GDP growth rates and not with the more far-reaching question of the relative advantages and/or shortcomings of certain statistical methodologies, the reverse approach is also of interest, i. e. calculating the national accounts aggregates of the United States using the methods which are customary in Germany. As may be demonstrated, the contribution to GDP growth in the United States made by the US IT sector on an average of the years 1994 to 1998 is halved to ½ percentage point.[4] Overall economic output during this period would therefore have grown "only" by 3¼ % annually rather than by 3¾ %. US Bureau of Economic Analysis staff put the "growth effect" of hedonic price measurement at "only" around ¼ percentage point, however.[5] The fact that the negative adjustment to US growth is much higher than the upward adjustment when using the US approach in the German national accounts, appears entirely plausible, since the IT sector – measured in terms of value added – has a much greater weight in the United States than in Germany. The transfer of the deflator methodology there has a correspondingly greater impact.

Software-hardware ratios in Germany and the United States

The problems of comparing national accounts data internationally are not due solely to IT equipment but derive from a large number of classes of goods and national accounts categories.[6] These problems are especially marked in the case of components with a comparatively dynamic growth, pronounced shifts in market shares or changes in relative prices. In the IT sector, this is the case not only for hardware but also for software. In Germany, nominal software investment during the period from 1992 to 1999 rose by around 70 % in total, or just under 7 % annually.[7] By contrast, in the United States it went up by 215 %, or 15½ % annually, during the same period. If software investment is expressed as

Software-hardware ratios in Germany and the United States *



* Software investment as a percentage of hardware investment at current prices.

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4 See Callow, J., The European Digital Economy, Euro-11 Special, Credit Suisse First Bosten, July 2000, page 11.
5 See Landefeld, St.J and B. T. Grimm, A Note on the Impact of Hedonics and Computers on Real GDP, Survey of Current Business, December 2000, page 20.
6 In the United States, hedonic price measurements are now made for one-fifth of GDP. See Landefeld, St.J and B. T. Grimm, A Note on the Impact of Hedonics and Computers on Real GDP, Survey of Current Business, December 2000, page 18.
7 According to the figures of the Federal Statistical Office, software investment in 1995 accounted for nearly three-quarters of the intangible assets formed. For the preceding and following years, the Federal Statistical Office did not show software investment separately in the relevant publications, but subsumed them instead under "intangible gross fixed capital formation". The data for those years were therefore estimated.

a ratio of enterprises' expenditure on hardware, US software investment in 1995 stood at US$ 144 for every US$ 100 spent on hardware. This compared with a ratio of 108 : 100 in Germany. By 1999, the ratio in the United States had risen to 220 : 100, whereas expenditure on hardware and software in Germany was in equilbrium at a ratio of roughly 100 : 100. Such differences are difficult to explain given the technological complementarities that exist between IT equipment and software.

Since this comparison is based on nominal data, the differences between Germany and the United States in terms of price measurement (which also do not have as great an impact on software investment as they do on IT equipment) are not a factor. The marked differences in the figures for the software-hardware ratios cannot simply be explained in terms of differing statistical recording methods insofar as these may be traced using the published accounts of the methodologies. Rather, there are some indications that the approaches – which are indeed quite similar in conception – are "managed" differently in practice. In the United States, expenditure on software and software development, for example, is obviously regarded to a greater extent as investment and thus as contributing to growth. In the official statistics in Germany and in some other EU countries, on the other hand, it tends to be treated more as an input. At all events, the much steadier software-hardware ratio in Germany fits much better overall with the existing technological complementarities between hardware and software, which are likely to change only gradually over a fairly long period. However, the statistical basis for determining software expenditure, in general, and software investment, in particular, is very narrow – not only in Germany but also in the majority of other industrial countries. Nevertheless, there are no indications that the level of software investment in Germany is being systematically underestimated. Measured as a share of GDP or GNP, it is clearly above the EU average.[8] This finding suggests that the highlighted differences are not a "bilateral phenomenon" between the United States and Germany.

Impact on GDP growth

In order to make a rough estimate of the extent to which the bilateral comparison of growth may have been affected by differences in capturing software investment, the US software-hardware ratios were applied (in line with the procedure in the case of IT goods) to German IT equipment. As a result, there is an acceleration in the pace of growth in software investment in Germany. Relative to real GDP, there is, in purely mathematical terms, an increase in growth of just under ¼ percentage point on an average of the years 1996 to 1999. By contrast, US economic growth is reduced if US software investment is derived from the German software-hardware ratios. Owing to the higher macroeconomic weight of software investment in the United States, the "growth loss", at around 0.3 percentage point on an average of the years 1996 to 1999, is somewhat

8 According to the official statistics, the ranking of software investment is especially low in the United Kingdom. The same conclusion is reached by the Bank of England, which has calculated a software-hardware ratio of 40 : 100. For details, see also Wadhwani, S., Monetary Challenges in a New Economy, speech held on October 12, 2000, page 18.

greater than the matching "growth gain" in Germany.

"Growth effect" overall

Taking together the factors under discussion here, i. e. the impact of the differing methods of price measurement and the diverging approaches to the software-hardware ratio, there is a perceptible reduction in the differences in growth between the United States and Germany shown hitherto. If the US methods and computation approaches are applied to Germany, the difference in growth between the two countries in the second half of the nineties is around 0.4 percentage point lower annually. If the relevant US aggregates are adapted in a similar manner on the basis of the methods and computing approaches used in Germany, the disparity in growth becomes even flatter.

Comparable findings for the United Kingdom and France

The result in relation to Germany is consistent with comparable estimations for the United Kingdom. According to calculations at the Bank of England, the statistical "growth bias" vis-à-vis the United States in the period from 1994 to 1998 likewise averaged 0.4 percentage point.[9] In France, the "bias" vis-à-vis the United States was somewhat smaller, at a total of 0.3 percentage point.[10] This is unsurprising, however, as the French statistics have been undertaking a hedonic price measurement for IT goods for some years now and – like the United States – used a chain index methodology. By contrast, the differences in terms of the approaches to software investment are – as in the case of Germany and the United Kingdom – considerable. Another factor to be taken into consideration in this context is that the respective systems of calculation differ in detail.

US growth lead remains considerable

The "growth effect" estimated here is not small in scale. Nevertheless, this can "explain" only a small part of the overall difference in statistically recorded growth between the United States and Germany, amounting to 2¾ percentage points on an average of the years 1996 to 1999. This was also the case with regard to the differences in growth between the United Kingdom and France, on the one hand, and the United States, on the other, even though these differences were markedly smaller in the second half of the nineties at 1½ and 2 percentage points annually, respectively.

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9 See Wadhwani, S., Monetary Challenges in a New Economy, speech held on October 12, 2000, page 21.
10 See Lequiller, F., The new economy and the measurement of GDP growth, Working Paper, February 2001, page 35.