

Data, adjusted for seasonal and working-day variations, on the expenditure components of GNP

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For some time the Deutsche Bundesbank has been collecting and publishing¹ seasonally adjusted data based on the unadjusted quarterly figures released by the Federal Statistical Office on the most important variables of the national accounts. To eliminate the seasonal variations which recur regularly with almost the same intensity, the quarterly modified version of what is known as the Census Method is used.² The figures calculated in this way enable the quarterly and half-yearly data of the national accounts to be compared directly without the results of this comparison being influenced by trends in earlier periods – as was the case in the previous year's analysis.

When adjusting the national accounts statistics to eliminate seasonal fluctuations, it has, however, proved to be a disadvantage that the unadjusted figures for GNP and its expenditure components are affected by working-day variations, which can considerably impair the quality of the seasonally adjusted data. For example, real GNP will be higher in the first quarter of a given year if Easter falls in April instead of March, because more working days are then available for production. However, as this pattern varies from one year to another, only the "average" influence of public holidays is taken into account and eliminated when ascertaining the seasonal components. But the working-day variations resulting from the deviations of the number of working days from the multi-year average of the respective month or quarter can be quantitatively estimated with the aid of a regression equation. The effects of other working-day variations – associated, for instance, with the variation in the dates on which certain public holidays, the school holidays or the summer and winter sales occur – can likewise be included in the working-day component of a time series. However, they can only partly be quantified and eliminated from the unadjusted series by means of a regression equation. A recent concrete example of the changes in working-day variations is the fact that October 3 was first declared a public holiday last year to mark the unification of the two German states, and that June 17 has ceased to be a non-working day with effect from the present year.

To take due account of these special features, the procedure currently employed by the Bundesbank to eliminate seasonal fluctuations incorporates an initial stage in which the unadjusted figures are adjusted for working-day variations. Where series are subject to marked working-day variations, this

¹ See the Statistical Supplements to the Monthly Reports of the Deutsche Bundesbank, Series 4, Seasonally adjusted economic data. The monthly figures published in these supplements are all adjusted for seasonal and working-day variations.

² For the methodological details see "Seasonal adjustment as a tool for analysing economic activity" in Monthly Report of the Deutsche Bundesbank, Vol. 39, no. 10, October 1987, page 30 ff.

36 normally improves the quality of the seasonally adjusted figures and consequently their analytical value. It is mainly for this reason that, since November 1987, the Bundesbank has published figures on changes in real GNP after adjustment for seasonal and working-day variations, but not the corresponding absolute values. The work is now so advanced that figures adjusted for seasonal and working-day variations can regularly be compiled for the individual expenditure components as well. This means that the data on GNP are better verified, with the result that absolute figures will be published henceforth, too. Moreover, expenditure component figures which have been adjusted for seasonal and working-day variations can be incorporated more readily in the analysis of business activity, which is based on corresponding data for other economic parameters (for example, industrial output or retail turnover). The following example will illustrate the value of statistics which have also been adjusted for working-day variations. During the period of external adjustment in the mid-eighties, the export figures for goods and services which had been adjusted for seasonal but not for working-day variations showed a sharp rise in the second quarter of 1986 (+ 2½ % compared with the first quarter). However, this rise was mainly due to the comparatively large number of working days. After adjustment for seasonal and working-day variations, in fact, exports as defined in the national accounts fell significantly during the period concerned, an outturn which tallies with the corresponding data from the foreign trade and services statistics.

The informative value of an analytical instrument that is widely applied in the Anglo-Saxon countries, notably the United States, is likewise improved by the use of figures which are adjusted for seasonal and working-day variations. In those countries the change from the previous quarter in seasonally adjusted figures is often extrapolated to yield an annual rate, and is regarded as a reflection of the current pace of business activity. As far as the economy of western Germany is concerned, where working-day variations are possibly more significant than in other countries, analyses of seasonally adjusted figures alone may lead to false conclusions. For example, the decline in (only seasonally adjusted) real GNP in the third quarter of 1989, compared with the second quarter, was not – as was asserted in various quarters – the outcome of an interruption in western Germany's economic growth; in actual fact, after adjustment for seasonal and work-

ing-day variations, overall output rose at an annual rate of more than 3% during the period concerned. Publishing comprehensive data on the national accounts which are adjusted for both seasonal and working-day variations therefore meets the statistical needs of the international community as well.

The method of adjustment for working-day variations

The first step in the combined adjustment procedure for seasonal and working-day variations is the establishment of *separate working-day factors for the individual expenditure components* of GNP from suitable *monthly* indicator series. This method had to be adopted because working-day variations do not show up so reliably in quarterly time series for methodological reasons. This is because, over a quarter, monthly fluctuations in the number of working days partly cancel out, with the result that their absolute deviations from the multi-year average are generally lower in terms of quarterly periods than in terms of months. The working-day variations, which are correspondingly less pronounced, cannot be separated from the other components of the time series as reliably in the quarterly figures as in the monthly series. For that reason, adjustments for working-day variations based on quarterly data tend systematically to underestimate the impact of the working-day variations. Another point to note is that the fluctuations in the number of working days mostly have only an attenuated effect on the calendar factor. For example, in quarters subject to significant working-day variations, i.e. a 2% to 4% deviation in the number of working days from the mean, the calendar component assumes a magnitude of 1% to 2%. In specific months in which the number of working days falls below or exceeds the average by more than 10% the calendar component assumes a value of over 6%. The quarterly calendar factors of the indicator series ascertained from the monthly figures³ are weighted according to the pattern of the expenditure component concerned to form a single calendar factor; using this, original figures which have been adjusted for working-day variations are calculated, and these – in contrast to the old procedure – are then adjusted for seasonal fluctuations. The data adjusted for seasonal and working-day variations obtained in this way can be converted, in turn, into purely seasonally adjusted data by adding the calendar component. In this way, a consistent correlation between, say, the purely seasonally adjusted private consumption figures

³ To estimate the monthly calendar component, the values of the irregular component (i.e. the relative deviations of the provisionally seasonally adjusted series from the trend), which still contain the systematic effects of the calendar, are explained in a regression equation by the deviation of the working days from the average of the month concerned. With the help of the regression equation, it can then be calculated how high the calendar effect is to be rated for the deviation ascertained in a given month of the number of working days from the average number of work-

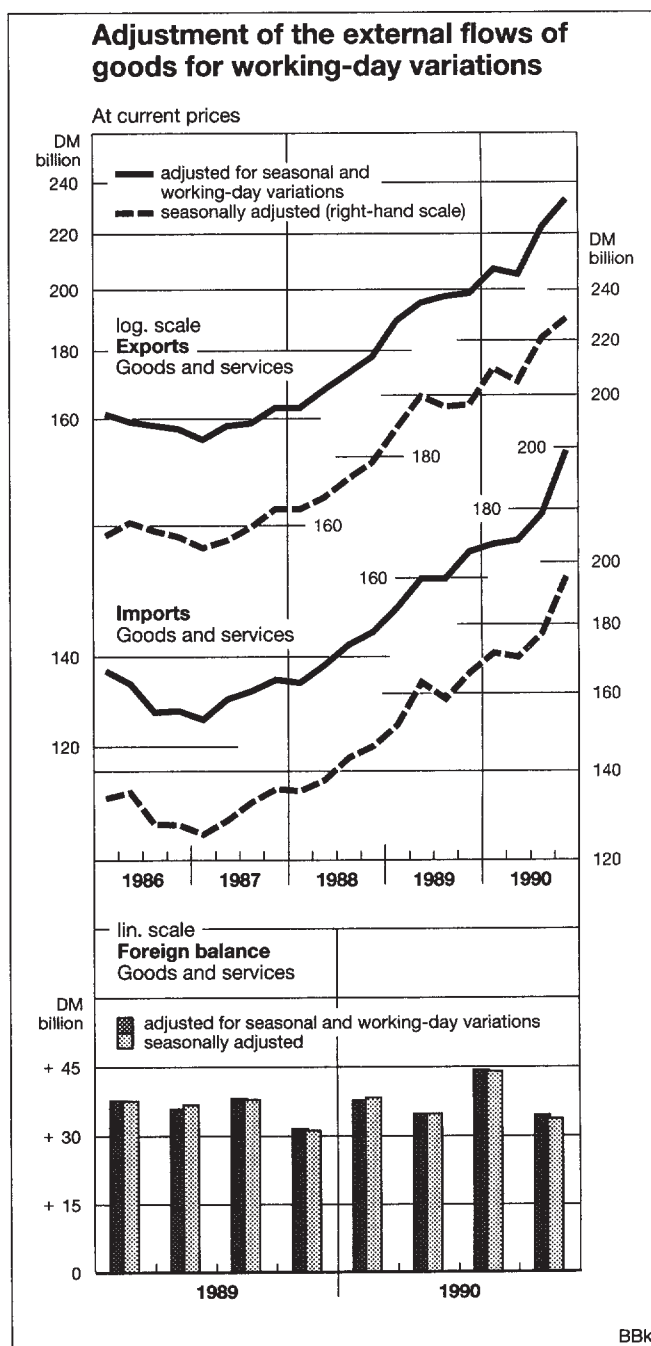
ing days in that month. A calendar component of, say, 3% means that output is 3% above the level which is to be expected in the month concerned, given an average number of working days. Thus the value after adjustment for working-day variations is calculated by dividing the unadjusted figure by the calendar factor of 1.03. To calculate the corresponding quarterly calendar component, the quarterly aggregates of the figures after adjustment for working-day variations or the unadjusted figures are related to each other.

and parts of the national accounts (such as disposable income and households' saving), for which only seasonal but no calendar effects have been identifiable so far, can now be ensured. It is generally assumed that the calendar factors for data at current prices and data at 1985 prices do not differ.

Adjustment of the individual expenditure components of GNP to account for working-day variations

External flows of goods

Estimates of the calendar coefficients for *exports and imports of goods and services* are based on extensive and reliable statistics. For example, the unadjusted monthly figures from the foreign trade statistics are available for merchandise transactions, and monthly data from the services account are on hand for exports and imports of services. The Deutsche Bundesbank has been eliminating seasonal and working-day variations from these flows of goods for a long time. It should be borne in mind in this context that sales to and purchases from eastern Germany, which have risen sharply since the middle of 1990 but for which no separate adjustment for seasonal and working-day variations has been possible so far, are included in exports and imports, respectively, in the national accounts – unlike the situation in the balance of payments statistics. Compared with the seasonally adjusted figures published up to now, the series on exports and imports of goods and services which are additionally adjusted for working-day variations show a smoother curve, as the adjacent chart illustrates. One statistical criterion of this, among others, is that the mean deviation of the figures adjusted for seasonal and working-day variations from the smoothed series during the reference period from 1980 to 1990 is smaller than that of the figures which were simply adjusted for seasonal fluctuations (see the table on page 38). For instance, the surge in exports in the second quarter of 1989 was largely due to working-day variations, while the decline during the subsequent summer months was apparently entirely due to the comparatively low number of working days. After adjustment for seasonal and working-day variations, nominal exports in the third quarter of 1989 actually rose by more than 1% over the second quarter. In the case of the *foreign balance*, by contrast, there are scarcely any significant differences between the series which were adjusted for seasonal fluctuations only and those



which were also adjusted for working-day variations. The calendar influences on exports and imports are therefore largely in the same direction and apparently more or less of the same magnitude. The fact that the differences between the foreign balance adjusted for both seasonal and working-day variations and the foreign balance calculated on the basis of corresponding data from the current account are strictly limited (except for those based on the most recent figures observed)⁴ is, among other things, an argument in favour of the adjustment for working-day variations outlined here.

⁴ Owing to the reorganisation of the reporting procedure, the monthly figures of the foreign trade statistics in the course of 1988 were not fully comparable with earlier statistics. Particularly in 1990, but to some extent as early as 1989, the different way of recording flows of goods to and from eastern Germany led to marked discrepancies between the figures from the GNP calculation and the corresponding data from the current account.

In the case of *expenditure on machinery and equipment*, adjustment for working-day variations is based, firstly, on the domestic turnover of the German capital goods industries (excluding vehicle manufacture), as recorded in the monthly statistics for mining and manufacturing, and, secondly, on the figures of the foreign trade statistics on imports of the products in question.⁵ The calendar factors established for these series are weighted in line with the variable quarterly share they have in capital goods demand in Germany, with imports becoming increasingly important. While in 1990, for example, just under one-third of real expenditure on machinery and equipment came from abroad, ten years earlier this proportion had been just under one-fifth. Overall, the figures on expenditure on machinery and equipment which have been adjusted for seasonal and working-day variations show a pattern which, in the light of the course of business activity, appears to be more plausible than the pattern resulting from figures which have only been seasonally adjusted. For example, the seasonally adjusted nominal 6% and real 5½% increase in the second quarter of 1989, compared with the first quarter, indicates a surge in investment. It was followed in the subsequent quarter by a period of virtual stagnation, but – as the outcome of the adjustment for working-day variations shows – this occurred not as a result of a cyclical trend but simply on account of working-day variations. The figures which were also adjusted for working-day variations indicate that there was a consistently high level of investment throughout 1989, which continued in 1990.

The calculation of the calendar component for *construction investment* is based on the monthly calendar factors established for the output of the construction industry and the number of hours worked in the finishing trades. The equivalent information on the “other construction work”, which comprises a variety of very different activities (for example, the manufacture of structural steel products, architectural services, administrative costs) and now accounts for almost 30% of the total real construction investment, is not available. It has been assumed for the moment that the effects of the calendar in this case can be illustrated by calculating a mean from the calendar factors established for the construction industry and the finishing trades. The weighting is derived from the extent to which the “suppliers”

Mean deviations of the expenditure components of GNP from the smoothed series *

in %

Item	Ascertained on the basis of data at current prices		Ascertained on the basis of data at 1985 prices	
	Adjusted for seasonal and working-day variations	Seasonally adjusted	Adjusted for seasonal and working-day variations	Seasonally adjusted
Private consumption	0.43	0.48	0.66	0.70
Government consumption	0.86	0.86	0.75	0.75
Investment in machinery and equipment	1.38	1.42	1.41	1.45
Construction investment	2.85	2.97	2.87	3.00
Exports	1.23	1.63	1.12	1.54
Imports	1.25	1.52	1.01	1.23
Memorandum item				
Gross national product	0.56	0.69	0.52	0.67

* Percentage deviations of the quarterly figures from a five-period moving average, calculated for the reference period from 1980 to 1990 without taking account of the plus or minus signs. BBK

contribute to real construction investment. Although a further adjustment to take account of working-day variations seems less meaningful, given the sharp fluctuations in the seasonally adjusted quarterly figures on construction investment during the past few years, fluctuations which were caused by unusually varied weather (a severe winter at the beginning of 1987, mild winters in 1989 and 1990), it should not be underestimated for analytical purposes. For example, after adjustment for seasonal and working-day variations the figures for the last quarter of 1984 indicate a further sharp decline in real construction investment, and this is consistent with the cyclical downturn in the construction industry at that time. The figures which had only been adjusted for seasonal variations, on the other hand, suggested a period of stagnation. The deviations were relatively pronounced at the beginning of 1986, too, when the effects of bad weather were accentuated by concurrent calendar influences.

Consumption

In the case of *private consumption expenditure* quantifying and eliminating working-day variations have proved to be comparatively difficult because there is absolutely no clear correlation between the number of working days and the level of consumption expenditure. For example, spending on rent, which on average accounts for about 15% of total private consumption, is entirely independent of the

⁵ Alternative calculations involving series which include, for example, vehicle manufacture yielded less convincing results.

number of working days. Expenditure on services such as entertainment (theatre, cinema, sporting events, etc.) or hotel and restaurant services is presumably more closely linked to the number and distribution of public holidays, i.e. it is in inverse proportion to the number of working days, although exact information is not available. Retail turnover, for which the number of trading days is essential, is clearly dependent on the number of working days. The deliveries from selected economic sectors⁶ to households are adjusted in our calculation by means of the calendar factor which has been established for retail turnover for some time. For example, this is the reason why purchases from builders merchants, which are statistically ascribed not to the retail trade but to other economic sectors but which have similar or the same opening hours as the retail trade, are likewise included. No statistically significant calendar influence could be found for the remaining expenditure with the result that the correspondingly weighted calendar component for total private consumption is largely determined by the calendar factor for retail turnover.

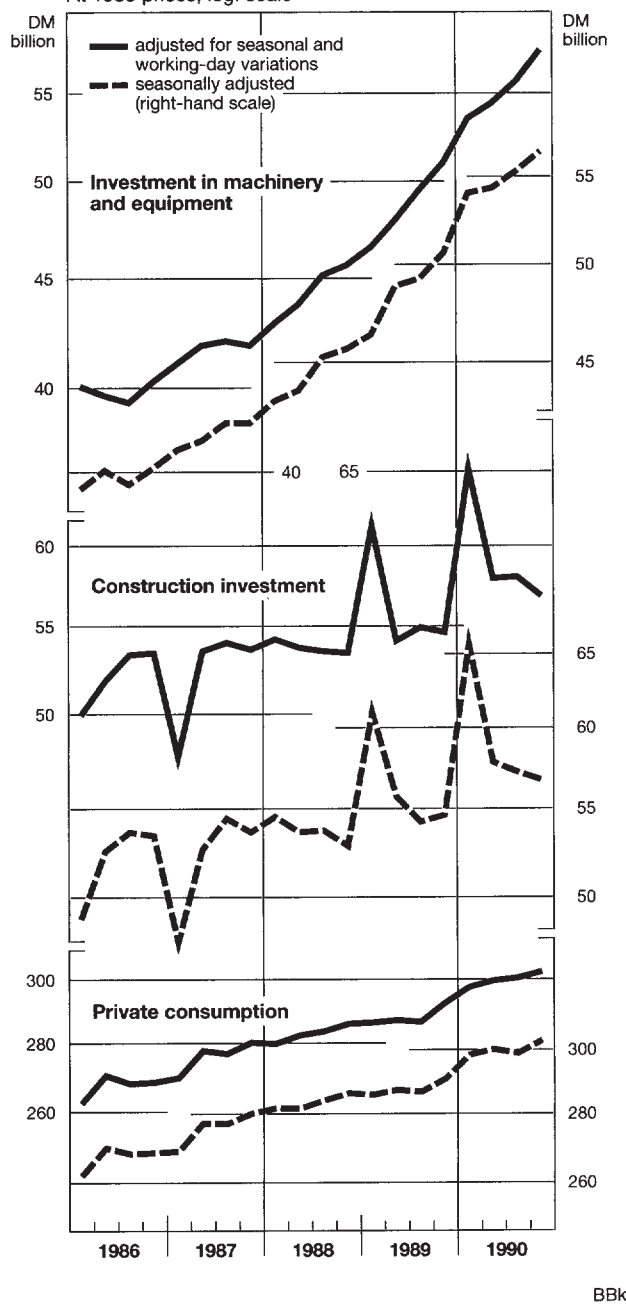
Deviations in the curves of data which have only been seasonally adjusted and of data which have also been adjusted for working-day variations are mainly affected by the different dates when Easter falls and the number of selling days. In 1988 Easter fell in the first quarter, and because it was a leap year, there was an additional day available for trading. While real private consumption during this period rose by a seasonally adjusted $\frac{1}{2}$ % compared with the final quarter of 1987, it declined after adjustment for seasonal and working-day variations (see the adjacent chart).

In contrast to the expenditure components of the national product outlined so far, surveys on *government consumption* provided no statistically reliable calendar influence, which in the end is not surprising because staff costs, which are virtually independent of the number of working days, account for more than half of government consumption. There was no connection between the purchases of the social security funds and the different number of working days either. Expenditure on medical care is mainly concerned here, and although it is affected by accounting arrangements, it is hardly influenced by working-day variations.

⁶ In addition to the services of the retail and wholesale trades the deliveries of the manufacturing sector, including the services of auto repair shops, and of the construction industry are included here. In 1988, the last year for which relevant figures are available, the goods and services provided by these sectors accounted for just over 57 % of private consumption expenditure.

Changes in major domestic expenditure components of GNP

At 1985 prices, log. scale



Gross national product

The basic concept of adjustment for seasonal and working-day variations would actually suggest establishing the *calendar component for the gross national product* by weighting the calendar factors determined for the individual expenditure components. However, such a strategy would encounter difficulties in that there is no information on any

40 calendar influences for the increases in stocks established as a residual on the basis of the most recent figures observed. Adjustment of the real and nominal national product for working-day variations is therefore still carried out separately from the calculation of the origin of the national product with the help of the monthly calendar factors established for the output of the producing sector and the construction industry. For the reasons already explained these are, in turn, converted to quarterly data and collated to a weighted calendar component on the basis of the share of selected sectors⁷ in the overall gross value added. After deducting the figures which have been adjusted for seasonal and working-day variations for private and public consumption, for total gross fixed capital formation and for the foreign balance from the correspondingly adjusted national product, data adjusted for seasonal and working-day variations on the *increases in stocks* remain, in turn, as a residual. However, the analytical value of this should not be overestimated. The fact that the absolute deviations from the changes in stocks, which are only seasonally adjusted, are fairly limited confirms the quality of both the results adjusted for seasonal and working-day variations for the national product and its expenditure components given in this article.

Starting with the Statistical Supplement, Series 4, April 1991, no. 4, the figures published for the expenditure side will be adjusted for seasonal and working-day variations, instead of for seasonal fluctuations only, as has been the case so far. On the other hand, the remaining data on the national accounts will continue to be adjusted for seasonal fluctuations but not for working-day variations.

⁷ Specifically, this concerns not only the manufacturing sector and the construction industry but also the wholesale trade, telecommunications and parts of the transportation sector.