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# *Studies on Statistics*

**Seasonal and other Recurrent Influences on  
Short-Term Economic Indicators**

BUNDESREPUBLIK  
DEUTSCHLAND



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58

STATISTISCHES  
BUNDESAMT

2602



~~(58.3360)~~

58/2602c

PUBLISHERS: W. KOHLHAMMER · STUTTGART

No. 5 · Published in April 1958

Title of the Original:

"Störungen der kurzfristigen Wirtschaftsbeobachtung  
durch jahreszeitliche und andere wiederkehrende Einflüsse"

published in "Wirtschaft und Statistik", 9th Year, New Series, Volume 4, April 1957

Translated at the Federal Statistical Office, Wiesbaden, by Erika Noering

Already published : Consumers' Expenditure

Index of the Net Value of Industrial Production

Grouping of Commodities

Considerations on the Census Programme 1960

Under preparation : The Statistical Unit in Economic Statistics

German Sample Surveys



(54.3360)

58/2602 e

# SEASONAL AND OTHER RECURRENT INFLUENCES ON SHORT-TERM ECONOMIC INDICATORS<sup>1)</sup>

## PROBLEMS TO BE CONSIDERED

The comparability of current short-term statistics (i.e. statistics in which information is collected at shorter than annual intervals, namely semi-annually, quarterly, monthly, etc.) may be disturbed from period to period or from date to date by a number of influences, which - to facilitate matters - are generally referred to as "seasonal influences", though this is not quite an adequate term. To begin with, it is the purpose of this study to DEFINE these influences. Then it will be considered whether and in which way it may be possible to SEPARATE the seasonal and other recurrent influences affecting the economic cycle or to "ADJUST" statistical series for the effects of same. In the first line, it is intended to give a general view of the problems involved in the topic, and additionally to provide clues to the possibilities of having them solved, but not to suggest final solutions.

Time series derived from short-term statistics reflect the product of a great number of factors, part of which act in the same and part of which in the reverse direction. If it is attempted in theory to separate these factors, three types are generally distinguished:

1. Factors which cause a relatively steady upward or downward movement of the series under consideration such as the general economic development and other relatively continual tendencies insofar as they exercise an influence upon the course of the time series considered. The joint effects of such factors are responsible for the general and comparably steady basic direction of the series, which may be positive, negative, or positive and negative in turn. This basic direction is frequently referred to as the "TREND" of the series. ("Business cycles" will not be referred to in this context.)
2. Factors which cause sudden breaks in the movement of the series. Such breaks are caused by SINGLE EVENTS or by EVENTS WHICH OCCUR MOST IRREGULARLY, and which are frequently - though not always adequately - traced back to the effects of so-called "exogenous" powers. In this connection, reference should not only be made to natural catastrophes (such as floods, earthquakes), but also to legislative or administrative measures, technical or economic innovations, not to forget wars with their influences and reactions upon the economy.

Whether a development may cause a "sudden break" or not depends also upon the length of the period under consideration. A tendency, for instance, which gains ground in the course

of three years, may in a way be regarded as a trend if account is taken of this period alone; but if the period under consideration comprises ten years, the effects of the deviating tendency within the period of these three years would be regarded as a "sudden break", provided that before and after this event the general development may be called continual.

3. Factors which disturb the comparison of a time series over the short run. In this connection, "short run" refers to periods up to one year, so that the factors in question are those the effects of which disturb the comparisons between semi-annual, quarterly, and monthly figures as well as between figures collected at still shorter intervals. These disturbing factors may be due to rhythmically (at least annually) recurring events. They cause deviations which are usually referred to as "SEASONAL FLUCTUATIONS". But "the seasonal fluctuations" are only part of the influences which disturb comparisons over the short run. IRREGULARITIES OF THE CALENDAR, which may lead to differences in the length of periods compared, also affect the comparison of a series from period to period.

The above mentioned classification of the various types of factors which are decisive for the movement of time series involves quite a number of more or less serious problems. However, it is not the purpose of this essay to discuss these in detail. Within the scope of this study it is only intended to consider the short-term deviations in the time series mentioned under 3. and the factors by which they are caused. The general problems which are involved in an analysis of time series and part of which are indicated in the above classification are interesting only insofar as they affect this partial sector directly.

THEORETICALLY, it should be possible to separate the factors to be considered relatively explicitly, for their dependence upon the calendar or their rhythmical (i.e. relatively regular) recurrence are properties, which clearly distinguish them from the other factors. However, it will not always be quite so easy to explain unobjectionably to which factors the so-called "seasonal fluctuations" are due in each individual case. The difficulties and problems involved in the questions, which concern the practical CALCULATIVE separation of the factors disturbing the comparisons and their "elimination" are even more serious. The idea to eliminate the mentioned disturbing factors by appropriate calculations suggests itself quite easily, for just the rhythmical fluctuations may be quite strong in certain circumstances. Thus they frequently complicate the interpretation of the individual figures considerably - as for instance in a comparison with adjacent figures in the same series or with figures in other series - and therewith the analysis of time series over the short run.

<sup>1)</sup> This essay is the slightly modified version of a memorandum prepared at the Federal Statistical Office as a paper for discussion of the topics concerned at the Conference of European Statisticians in Geneva.

For the "elimination" of the irregularities of the calendar and the rhythmically recurrent fluctuations quantitative conceptions of the effects of the factors by which they were caused are needed. These conceptions are frequently indispensable also for short-term forecasts, which, too, can be complicated considerably by the existence of such disturbing factors. Accordingly, much is in favour of having the consequences of the irregularities of the calendar and of the seasonal fluctuations separated and, if possible, also eliminated. This attempt is frequently made in economic research work, though it should not be taken for granted that all people who make such calculative "adjustments", and particularly "adjustments for seasonal fluctuations", are fully aware of the meaning and the consequences of these operations. Above all, there appears to be some confusion on the knowledge which is provided by the remaining series after these factors have been eliminated, and quite frequently it is in a way regarded as an illustration of "the pure economic development" (at least insofar as this can be reflected by the series under consideration), which is only disturbed by the occasional appearance of "exogenous" factors.

The questions to be discussed can be divided into the two large groups shown below, though it is true that it will never be possible to separate these completely:

problems which are due to the irregularities of the calendar;

problems involved in the so-called "seasonal fluctuations".

In detail the following questions are to be investigated:

1. What are the general characteristics of the irregularities of the calendar, and how do they affect the comparison of short-term time series?
2. What are seasonal fluctuations, and what are their underlying causes?
3. What are the pre-requisites for the elimination of seasonal and other recurrent influences upon time series, and how should the "adjusted" series be interpreted?

Question 3. leads over to two other questions, which should also be taken into account:

4. How are the methods generally used in the "elimination" of seasonal and other recurring influences to be judged?
5. Is it reasonable and justified according to the preceding considerations that the statistical offices currently "adjust" short-term series in some way or other and then publish these adjusted series?

All these questions will be considered in detail in the following outlines.

## I. INFLUENCES WHICH ARE DUE TO THE IRREGULARITIES OF THE CALENDAR

### A. General Characteristics

The irregularities of the calendar arise from the facts that the individual months of the year have not the same length and that the number of Sundays, feast-days, week-ends, etc. varies among the months. Independently of the effects of all other factors referred to in the previous section, the movement of a short-term series is influenced already by the effects of these irregularities alone. They do not only disturb the comparison between the adjacent figures in the same series, but also, say, the comparison between the figures which relate to a given month in different years.

The extent of the differences between various time periods, which are caused by irregularities of the calendar, can be seen from the schedules given below. To begin with, those discrepancies have been shown which are due to nothing but the VARYING LENGTH OF THE MONTHS:

1. Comparison between a NORMAL YEAR and a LEAP-YEAR  
COMPLETE NORMAL YEAR compared with complete leap-year: 100:100.3  
First HALFYEAR of a normal year compared with first halfyear of a leap-year: 100:100.6  
First QUARTER of a normal year compared with first quarter of a leap-year: 100:101.1
2. Comparison between the FIRST HALFYEAR and the SECOND HALFYEAR  
in normal years: 100:101.7  
in leap-years: 100:101.1
3. Comparison between the VARIOUS QUARTERS of a year (first quarter = 100)  
in normal years: 100:101.1:102.2:102.2  
in leap-years: 100:100.0:101.1:101.1
4. MONTHS having 31 days in their relation to shorter months  
days: 31 30 29 28  
ratio: 100:96.8:93.5:90.3

The differences from month to month can become even larger when the NUMBER OF WORK-DAYS IS USED AS A BASIS, namely that number of days which is obtained after deduction of Sundays, festival days, and public feast-days<sup>2)</sup>. In the second schedule, the months with the highest number of work-days have been compared with the months with the lowest number of work-days for each of the years 1950 to 1956. In addition, it has been shown to which extent the varying number of work-days can exercise an influence upon the comparison over a longer run.

2) As the relevant regulations are not quite uniform throughout the Federal Republic of Germany, account has been taken in this context of the "ecclesiastical" feast-days in Hesse.

	1950	1951	1952	1953	1954	1955	1956
a) <u>Comparison between the months</u>							
the following months had the <u>highest number</u> of work-days							
work-days	III, VIII 27	VIII, X 27	III, X 27	VII, X 27	III, VII 27	III, VIII 27	VIII, X 27
the following months had the <u>lowest number</u> of work-days <sup>+</sup> )							
work-days	IV 23	V 23	VI 23	V 23	II, IV, V, VI 24	II, IV, V, VI 24	V 23
months with the lowest number of work-days = 100							
months with the highest number of work-days	117.4	117.4	117.4	117.4	112.5	112.5	117.4
b) <u>Comparison between the quarters</u>							
1) the <u>1st quarter</u> = 100							
1st quarter	100	100	100	100	100	100	100
2nd quarter	93.5	98.7	93.5	94.7	94.7	94.7	94.8
3rd quarter	102.6	104.0	102.6	103.9	103.9	103.9	101.3
4th quarter	97.4	101.3	98.7	100	101.3	101.3	98.7
2) <u>corresponding quarter 1950</u> = 100							
1st quarter	100	97.4	100	98.7	98.7	98.7	100
2nd quarter	100	102.8	100	100	100	100	101.4
3rd quarter	100	98.7	100	100	100	100	98.7
4th quarter	100	101.3	101.3	101.3	102.7	102.7	101.3
c) <u>Comparison between the half-years</u>							
1) the <u>1st half-year</u> = 100							
1st half-year	100	100	100	100	100	100	100
2nd half-year	103.4	103.4	104.0	104.7	105.4	105.4	102.7
2) <u>corresponding half-year 1950</u> = 100							
1st half-year	100	100	100	99.3	99.3	99.3	100.7
2nd half-year	100	100	100.6	100.6	101.3	101.3	100

+) In June 1957, there were only 22 work-days. Accordingly, the difference between this month and the month having the highest number of work-days increases to 22.7 %.

It goes without saying that the irregularities by which each individual series is affected are not the same and not equally strong. There are series the course of which is influenced by the NUMBER OF THE CALENDAR DAYS varying from month to month, examples being certain series of demographic data (births and deaths). Economic data depend relatively seldom upon the length of the months alone, though it is true that also in this field there are events which are bound to the day, namely milk production, uninterrupted production (e.g. in the chemical industry), part of the foodstuffs consumed, and other items of private consumption. However, the interrelationships in this field may be assumed to be different. Above all, it is frequently found that the NUMBER OF WORK-DAYS influences the production result of certain industries. For other economic sectors and facts, NUMBER and DATES OF PAY-DAYS, main PURCHASING DAYS, or main CONSUMPTION DAYS may be of special importance. For restaurants, the number of WEEK-ENDS and FEAST-DAYS within a month will be more significant than the number of work-days.

It will not always be easy to decide whether and in which way a series is subject to influences which are due to the irregularities of the calendar. Thus it may be assumed that turnover in industries with a longer production period will to a wider extent de-

pend upon the number of work-days in the PREVIOUS months than from the number of work-days in the month UNDER OBSERVATION. In these cases it will scarcely be possible, clearly to recognize the influences which are due to the calendar.

Finally there are economic data which are not at all affected by the irregularities of the calendar. The salary, for instance, which an employee receives is not higher in the months with 31 days than it is in the months with 30, 29, or 28 days, provided that it has not been altered for other reasons.

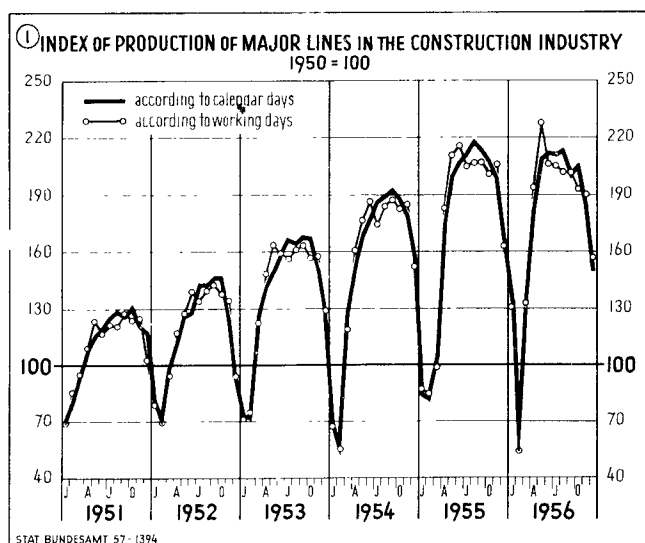
#### B. Pre-Requisites and Possibilities for the Elimination of Influences which Are Due to the Irregularities of the Calendar

It is now to be investigated whether and in which way it is possible to eliminate the irregularities of the calendar by relevant calculations so as to make the short-term series observed look as if not affected by these influences. This means that the figures of the series are to be converted in such a way that the comparison between them is no longer disturbed by deviations which are caused by the irregularities of the calendar ALONE. In a certain sense it may be said that this would be a "conversion to time units of comparable length", though the term "length" must not neces-

sarily relate to the number of calendar days alone.

The FIRST PRE-REQUISITE for such "adjustments" is that the time series to be adjusted are ACTUALLY SUBJECT TO INFLUENCES DUE TO THE CALENDAR. Accordingly, it would be senseless for our purposes to convert series on the monthly income of salaried employees or on the payments of rent to months of the same length. These facts are ex definitione "independent of the calendar", so that such a calculatory operation would be the very manipulation to bring influences due to the calendar into the series. May be that the first pre-requisite appears trivial, but if it is not taken into account, we may obtain results which can have a certain sense, but not THAT sense which has been aimed at.

An example has been given in Chart 1 where a production series in the construction industry has been converted to months of the same length. The "length" of the months has been specified by the number of work-days. It can be seen at a first sight that on the whole the series takes a smoother course before the "adjustment" than it does afterwards. This may be due to the fact that in the construction industry

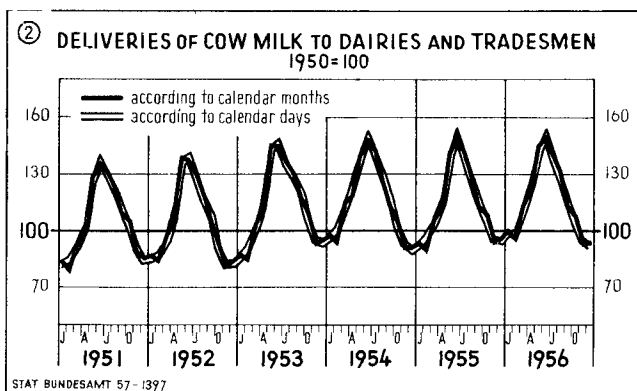


losses due to feast-days are widely compensated by performing such work in advance or subsequently. Influences due to the irregularities of the calendar are thus suppressed from the very beginning (see also page 5); if it is intended to "eliminate" them though they do not exist in reality, it must be expected that the result does not make much sense from the point of view of the aim to be accomplished. We see from the example that the conversion gives rise to distinct peaks not existing before which are due to the dates of the feast-days during the months of March through May or June respectively. In November<sup>3)</sup>, there appear to be less distinct additional peaks. The converted series informs us that for reasons due to the irregularities of the calendar the work actually performed per work-day in certain months surmounts that performed in the adjacent months. This information is certainly interesting, but it was not intended to "adjust" the series for the purpose of obtaining THIS information.

<sup>3)</sup> See footnote 6), para 2.

The SECOND PRE-REQUISITE for each adjustment is that the influences due to the calendar can be QUANTIFIED. If this cannot be done or only to an insufficient extent, we must or should satisfy ourselves with relevant verbal references. An example for an influence which is certainly effective, but can scarcely be expressed numerically is the influence of Sundays and feast-days (or of the preceding Saturdays respectively) on the consumption of meat (or the expenditure on meat).

The desired quantification is possible in all cases of sufficient PROPORTIONALITY between a number of days fixed in a certain way and the result under observation. It goes without saying that this proportionality must hold ceteris paribus. It exists in all cases where a statistical figure changes always proportionately to the length of the period to which it is related or to the sum of a certain type of days in this period, provided that ALL other influences are constant. Thus it may be assumed, for instance, that ceteris paribus the monthly production of milk is directly proportional to the number of calendar days per month. In this case, a calculation per calendar day would make sense and be completely sufficient for the elimination of the influences which are due to the



calendar (see Chart 2). There are other cases where we may find a proportionality between the number of WEEK-days and the statistical figure under consideration. In this case it appears advisable to apply the calculation per "working day" explained in the next section. Calculations per "consumption" or "sales days" are justified if may be expected that the consumed or sold quantities of certain goods are proportional to the number of days during which these goods are exclusively or mainly consumed or sold. In the above mentioned example concerning the consumption of meat, which also depends upon the number of Sundays or feast-days per month, a proportional interrelation in the strict meaning of the word is certainly not existent, because meat is consumed not only on major consumption days or bought on the preceding days respectively. Matters are different if we consider the number of "Sonntagsrückfahrkarten" (Sunday return tickets)<sup>4)</sup> which are sold per month. In this case, it would be justified to adjust the series for Sundays and feast-days.

<sup>4)</sup> In Germany, a "Sonntagsrückfahrkarte" is a special kind of railway ticket, which is sold only for week-ends or feast-days respectively and the days preceding them.

It would certainly be important and interesting to investigate whether the numerous short-term series are influenced by irregularities of the calendar. In addition, it should be examined which group of days (calendar days, work-days, consumption days, etc.) is relevant for the form of an individual time series. Apart from that, it should be considered in which cases the proportionality between the number of relevant days and the fact under observation is high enough to justify a simple adjustment for calendar, working, consumption, etc. days. In those cases where effective interrelations are available, but an obvious proportionality cannot be recognized, it should be investigated whether there is another possibility to quantify the influences with a sufficient degree of reliability, in order to obtain the desired adjustment of the initial series for influences of the calendar also in these cases. In this connection it could be thought of a calculation scheme with different weights for the individual days, though it may not be quite easy in all cases to find an adequate weighting scheme. However, it is not intended to discuss the methodical problems involved in such operations within the scope of the present study.

Finally it should be said that the INITIAL SERIES should always be published in addition to that series which has been adjusted for the influences of the calendar, for there are quite a number of cases where nothing is sensible to be used but the initial series alone. Accordingly, the converted figures cannot replace the initial ones; they are only intended to facilitate their interpretation.

#### C. Considerations on the Problems Involved in the Computation of Production Data and Production Indices on the Basis of "Working Days"

In the publication of industrial statistics it is endeavoured to eliminate the influences exercised by the irregularities of the calendar upon the index of the net value of industrial production by means of a so-called "calculation according to working days". These manipulations serve the same aim which was considered in the previous section. It is intended to eliminate fluctuations in the individual series which are due to the varying number of working days. It has been tried to find a simple criterion which can be read directly from the calendar without further manipulations, and this is the reason why in general the number of working days has been regarded as being equal to the number of calendar days minus Sundays, festival days and public feast-days. However, this principle has not been applied to industries with an uninterrupted production; in these sectors the number of working days is identical with the number of calendar days. Between these, there is a group of sectors where for technical reasons production is continued on Sundays and feast-days, though on a curbed scale. In these sectors, half of the Sundays and feast-days are regarded as working days.

Since in most sectors it may be expected *ceteris paribus* that the proportionality between the number of working days thus defined and the production result is sufficient, this procedure has already been

applied for a longer time and has proved satisfactory. It might even be improved by regarding the Saturdays which in most sectors are free of work in the afternoon as half working days, too. In addition, there may be good reason to consider whether it is possible to separate and eliminate the influences of the calendar in a more adequate way by using hours as a basis, and not whole days and half days. The required hours could perhaps be derived from tariff agreements. For this purpose it would be necessary, however, to have on hand information on the distribution of the working time to the individual work-days, for otherwise it would not be possible to estimate the effect of Saturdays or other work-days, which are free of work wholly or in part, upon the monthly working time.

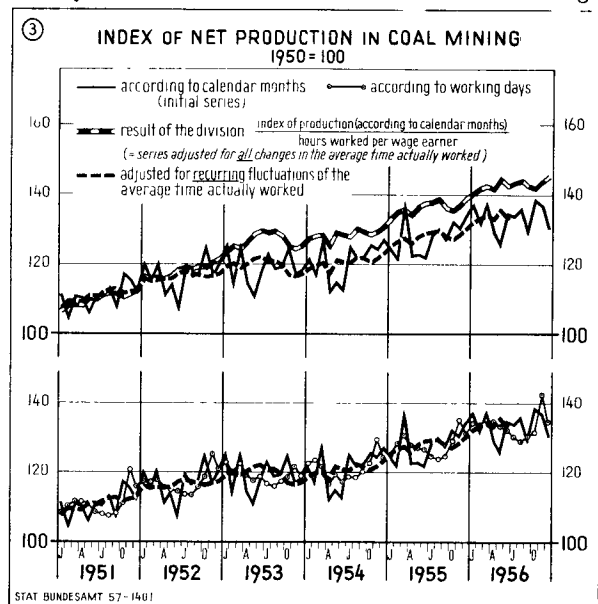
All these endeavours centering around the gradual improvement of the calculation scheme would mark a step forward on the way towards the assumed proportionality between the working time and the production result, and this would in turn improve the figures obtained. In this connection, "working time" refers to the number of "POSSIBLE" hours per person employed according to the TARIFF AGREEMENTS. This working time differs from the time ACTUALLY worked in the establishments, and this difference is due to extra hours and hours worked on Sundays and feast-days. In cases of short-time work, strikes, etc., we may also be faced with quite another difference. Accordingly, fluctuations of the production which are due to a varying frequency of extra hours or to strikes etc. remain to be recognizable also after the adjustment. If the varying frequency of extra hours is interrelated with business cycles, it is certainly adequate that they remain effective also in the adjusted series. In this case, matters are similar to strikes and short-time work: we are faced with influences which are not caused by the calendar.

However, matters are different in those cases where the number of extra hours depends indirectly upon the irregularities of the calendar, which - as already explained before - is possible with the production in the construction industry (work performed in advance or subsequently in order to compensate the losses due to the feast-days free of work). In these cases two influences due to the calendar - namely losses which were caused by feast-days on the one hand and additional production which was also due to feast-days on the other - widely compensate each other. The "adjustment" leads to the fact that one of these two components - namely the production loss caused by feast-days - is eliminated. This elimination makes recognizable the effect of the second component, which means that we have achieved the opposite of what we wanted to achieve. This is caused by nothing but the fact that the requirement of proportionality has been neglected. As the influences due to the calendar cancel themselves out to a far-reaching extent, it is impossible that the production result fluctuates proportionally to the number of working days or working hours respectively<sup>5)</sup>.

<sup>5)</sup> This naturally refers only to months including feast-days themselves or having feast-days in close vicinity. For other months it may be sensible to make a calculation according to working days also in the case under consideration.

The above mentioned way towards further improvement of the calculations according to working days by using as a basis fractions of days or hours respectively cannot be a remedy in these cases either. If proportionality does not exist, we cannot obtain it by such refinements.

These difficulties could be overcome by relating the initial figures not to the number of "POSSIBLE" hours per person employed according to the TARIFF AGREEMENTS, but to the number of hours ACTUALLY WORKED per person employed. These operations would automatically eliminate all influences of the calendar, and in addition to these quite a number of other factors, too. In this connection we may quote some regularly recurring influences such as the varying frequency of illness and leave or the peaks of extra hours caused by the increased number of orders received during certain seasons. In addition, these calculations would also eliminate from the initial series the effects of single events such as strikes, hours reduction, etc., though there is no doubt that this would be a disadvantage. In case of hours reduction, which is sudden (and the effects of which are not set off by an increased number of extra hours), this method would result in the fact that the adjusted series shows a sudden break at the date of the hours reduction and that - beginning with this break - it remains above the initial series. Accordingly, the effects of hours reduction upon the production result would be eliminated. The same would occur - though not quite so quickly - in cases of a steadily growing tendency in favour of hours reduction<sup>6)</sup>. As long as



6) A relevant example has been given in Chart 3. We can see how the adjusted series - marked by the symbols used for indicating "rails" - moves gradually away from the initial series. It has been attempted to balance this divergency by taking into account the "trend" in the development of working time. The result was the series "adjusted for the recurring fluctuations of the time actually worked" (broken line). It is not intended to discuss the methodical problems involved in the determination of the working time "trend" within the scope of this article.

The series calculated on the basis of working days shows annually recurring peaks in November, which indicate that extra hours were worked in order to compensate the number of feast-days beginning in November.

a method which can be used for avoiding this effect has not been found, the annual production result, for instance, would be higher according to the adjusted figures than it is in reality. This would certainly be a consequence not at all desired in respect of the aim to be accomplished, namely to eliminate seasonal and other recurring influences in order to obtain a series "adjusted for recurring fluctuations of the working time".

However, this problem does not turn up only in those cases where the time ACTUALLY worked per person employed is used in the adjustment. It has already been said that the method employed so far in the calculation per working days can be improved by shifting the basis to "possible" fractions of days or hours in accordance with the TARIFF AGREEMENTS. This effects an increase in the degree of proportionality, so that more adequate results may be expected at least for that period in which such a shift was made. If measures for hours reduction are taken, it must be expected that the improved scheme, too, will gradually grow worse again, because in each sector concerned the number of "possible" hours according to the tariff agreements will steadily decrease. If it is now attempted to secure the requirement of proportionality by currently adapting the calculation scheme to the new conditions, the above mentioned consequence must necessarily turn up again. The smaller is the number of hours accounted for in the scheme, the smaller do the divisors become, which are used in the calculation, and the wider does the distance become between the adjusted and the initial series. However, if the scheme is not altered, it grows more and more unrealistic, but the adjusted series remains comparable with the initial series at least in respect of their levels. In order to get out of this dilemma, it should be attempted to find methods which permit of a current adaptation of the calculation scheme to the changing conditions in such a way that, say, the "adjusted" annual figures do not deviate from the actual volume of production.

This problem might be solved by employing a calculation according to working WEEKS. The first step in this procedure corresponds to a conversion according to working days (or working hours respectively), which must CONTINUOUSLY BE ADAPTED to the changing working times according to the tariff agreements. The figures resulting therefrom relate to the number of whole or half working DAYS or working HOURS respectively per calendar month, which in each instance are "possible" according to the tariff agreements. The discrepancies between the converted and the initial series, which are due to changes in the working time according to the tariff agreements, will be overcome by the second step in the calculation, namely by multiplying the converted figures with the number of whole or half working days (or hours respectively) per WEEK, which are "possible" according to the tariff agreements, and which have also to be currently adapted to actual conditions.

In those cases, too, where it is decided to use a constant scheme there remain quite a number of ques-



tions to be solved, which are due to hours reduction. For instance, endeavours are made to accomplish the adjustment of wages for hours reduction by regarding every (or every second, third, or fourth Saturday as a paid FEAST-DAY or an additionally paid DAY-OFF. In other words, it is necessary to consider the question whether in a calculation per working day a free Saturday should generally be regarded as a "feast-day" or a "day-off" and thus be treated in the calculation like a work-day. This latter solution would be quite appropriate if the free Saturday is granted by the shift, for in such a case the "possible" working time does not decrease, which corresponds with the practice normally applied to other leave, for it is worked in the establishments on each Saturday.

Similar problems must be taken into account also in the so-called productivity calculations, in which the production result is related to the work performed. In this connection it is also significant to draw a clear line between the time ACTUALLY WORKED and the working time PAID.

## II. INFLUENCES WHICH ARE DUE TO "SEASONAL" FACTORS

### A. General Characteristics and Causes of the so-called Seasonal Fluctuations

It is said that a development is superimposed by "seasonal fluctuations", when the relevant time series shows deviations which recur rhythmically. These deviations may occur in all series in which figures become available at least at semi-annual intervals. There are fluctuations which follow one another at annual intervals, an example being the annual peaks of turnover in the various lines of retail trade before Christmas. In addition, there are a number of rhythmical fluctuations which recur at shorter intervals. The semi-annual agglomerations of interest payments on bonds, which are caused by the due dates fixed for the payment of interest, the particularly high payments of income taxes during one month of each quarter (due dates fixed for tax payments), the increase in certain types of consumers' expenditure at the end of each week or the high number of traffic accidents in rural areas at the week-end, and finally the peaks which recur daily at about the same time in the consumption of electricity may be quoted as examples. It does not appear quite adequate to use the (somewhat unfortunate) term "seasonal fluctuations" with all types of rhythmical deviations which are observable at a certain time per day or at certain days per week or per month respectively, for the term "season" relates or should relate to certain PERIODS OF THE YEAR, and not to any other periods of time. It should be endeavoured to clarify this terminological question. To facilitate matters, however, we have continued using in the present study the familiar term "seasonal fluctuations", even though the following considerations relate to all types of rhythmical fluctuations.

The ideal would be that the so-called seasonal fluctuations occur each year at the same date and

without changing their intensity. This constant intensity can be both absolute and relative (e.g. in relation to the level of the series). In the former case, the seasonal fluctuations lie inside a band (measured perpendicularly) of unvarying absolute width, while in the latter case the width of the band changes with the general movement of the series. (In a logarithmic scale, the amplitude would remain constant also in this case.) In such an ideal case, the centre line of the band would be identical with the movement of the time series, the latter being affected only by "trends" and "non-recurrent and random events". However, such an ideal case will scarcely or never occur in practice for reasons which will be explained later.

But what are the causes to which seasonal fluctuations are due? As a rule they can be traced back to a complex of causes which may be quite complicated, and from which certain individual causes may be clearly recognizable. The factors which originally use to cause the fluctuations which recur at regular intervals may be classified as follows:

1. NATURAL CAUSES which are coherent with the course of the year, or, in other words, with the orbit of the earth around the sun. In this connection, reference should first be made to the different length of day-light during the course of a year. In addition, this group includes the influences of the changes in the climatic conditions, which are due to the seasonal rhythm. They are reflected by fluctuations of the temperature, by varying frequency and type of precipitations (it snows only in winter), and perhaps also by particularly heavy storms in certain seasons (spring and autumn storms at the sea-shore). A casual consideration of the causes included in this category - causes which may become effective separately, but also together - already reveals that the degree of their regularity is quite different. This refers to both the promptness of their occurrence and their intensity. Entirely regular and necessary is nothing but the seasonal change between long and short days. The movement of temperature is already much more irregular. It may certainly be expected that it is warmer in summer than it is in winter, but we can never say for certain during which of the winter months frost will set in, nor is it possible to make a prognosis on the intensity of the cold weather, which will put a stop to water transport or out-door work. Strictly speaking, it is not absolutely necessary either that the fall in temperature is sudden and heavy. The intervals at which the other causes such as precipitations, storms, etc. turn up in the course of the seasons are even more irregular, so that there is good reason to ask whether it is justified at all to have them included in the "regularly recurring events".

2. INSTITUTIONAL CAUSES are due to facts which were established by men, examples being the time periods covered by the fiscal or by the scholastic

years, the dates of regularly recurring fairs and exhibitions, the usual pay-dates of gratuities, the due dates fixed for interest or tax payments, the determination of public feast-days, and quite generally the fact that in accordance with legal or tariff provisions it is not or not so much worked nor sold on Sundays and feast-days as it is on week-days, etc. Provided that these institutionally determined facts actually recur each year at nearly the same date, their effects are, in principle, not different from those of the natural causes. However, there is the essential difference that the former are the results of more or less arbitrary human decisions and can just as easily be cancelled, shifted to another date, or replaced by other regulations.

The number of factors which disturb short-term comparisons is increased by the complex of influences which have been dealt with in Part B of this essay, and which are due to the IRREGULARITIES OF THE CALENDAR. As they stand, they cannot be compared with the natural or institutional causes mentioned before, though they must by no means be neglected in the analysis or elimination of seasonal fluctuations. In principle, the irregularities of the calendar should always be analysed and eliminated before the "seasonal" influences are attempted to be isolated.

The basic causes mentioned before show quite different effects. They can directly affect the figures which are to be measured, but they can also become effective indirectly through other facts, e.g.:

#### 1. BIOLOGICAL EVENTS

The natural causes such as the climate exercise their influence, say, through the biological event of growth upon the level of the agricultural production and the time at which it becomes available. Another example is the influence which natural factors exercise through the frequency of diseases varying from season to season upon the extent of the labour force.

#### 2. HUMAN CONDUCT

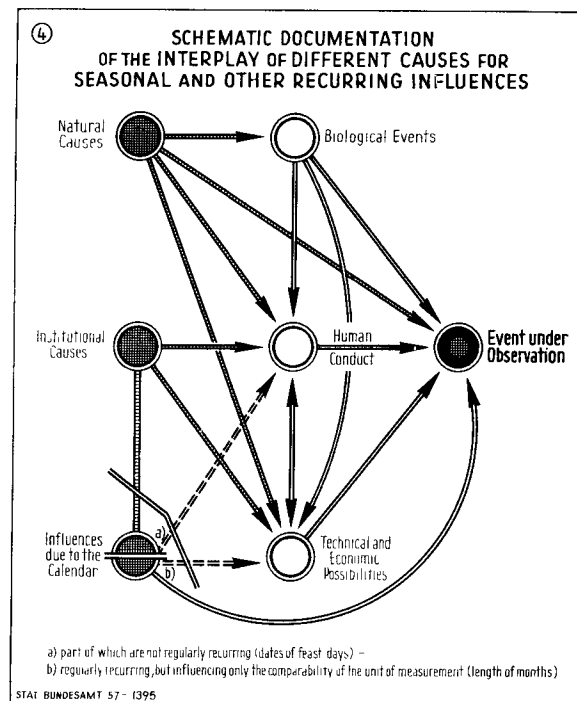
In this connection mention should be made of regularities such as taking leave during the summer months or during those winter months for which sufficient snow may be expected. In addition, customs and habits such as making gifts at certain feasts, purchasing certain wearing apparel in certain seasons, or participating in carnival festivals come to mind. Such a conduct becomes effective if and because certain natural or institutional facts are existent. Matters are similar in the reaction of people to influences of the weather by the selection of clothing, the heating of dwellings, etc., and in their reaction to regularly recurring special incomes such as gratuities.

### 3. TECHNICAL AND ECONOMIC POSSIBILITIES

Natural and institutional factors are reflected also by the scope of technical and economic possibilities, on which they exercise an influence. For instance, natural influences affect production possibilities in the construction industry (interruption of out-door work caused by heavy frost), and in certain lines of retail trade the possibilities of sales are clearly influenced by the institutionally determined dates of feast-days.

The natural and institutional influences and the influences due to the calendar may simultaneously affect several of the events or facts referred to above. The INSTITUTION of leave, for instance, which in respect of the period of the year at which it is taken is subject to NATURAL influences in connection with HUMAN habits, may lead to an obvious decrease in the PRODUCTION POSSIBILITIES on the labour intensive sectors during the summer months (business holidays, etc.). Vice versa, it is quite possible that technical and economic possibilities exercise an influence upon human reactions.

Chart 4 is to illustrate these argumentations. It shows, how the natural and other "basic causes" affect the recorded facts through biological events, human conduct and influences upon technical and economic possibilities, and how these individual elements may



be interrelated with one another. Special reference has been made to the influences due to the calendar because of their above mentioned and partly deviating characteristics. As the text, the scheme does not claim to be comprehensively inclusive nor to have fixed the limits between the various factors quite unobjectionably. It is only intended to show, how complex the causes can be from which the so-called "seasonal fluctuations" originate, and to which dis-

turbing influences the short-term series is subject.

These considerations may now be concluded by an illustrative example on retail turnover in clothing during the month of July. To begin with, this type of turnover is influenced by the institutional fact that the seasonal closing-out sale of summer articles takes place or begins in July. In addition it is of importance how the date of the closing-out sale and the dates of the pay-days, which also depend on institutional decisions, are related to each other. Natural influences as for instance the climatic conditions before and during the sales period are most decisive, too. If weather was warm and summer-like during the months of May and June, the majority of bathing costumes will have been sold out before the closing-out sale is started. But if weather was cold and rainy during these months and gets hot in July, the majority of bathing costumes will probably be sold during the closing-out sale. Part of the institutional causes become effective together with influences which are due to the calendar. Apart from that it should be borne in mind that the time measure varies from month to month; July, for instance, is a "long" month. The basic causes referred to above exercise their influences through human conduct (e.g. through the habit to prefer acquiring certain clothing in summer and particularly during the seasonal closing-out sale or the tendency to purchase more readily after pay-days) and through technical and economic possibilities (which are coherent with the number of sales days in July) upon the level of turnover. These types of turnover may also be influenced through biological events. In rural areas, for instance, turnover in clothing depends upon the income of farmers which fluctuates rhythmically according to the harvesting period.

The effects of the interrelations set forth above and illustrated in the scheme will vary with the facts on which information is collected, for the importance of the individual factors may be quite different from case to case. In addition, the interrelationship between the individual factors which become effective and the fact to be measured can be both flexible and inflexible. For instance, the beginning of frosty weather and the level of production in the construction industry are closely interrelated with each other, while there is only a vague interrelationship between the out-door temperature and the number of people going to the pictures. The less rigid are the effective interrelationships between a basic cause and the fact under consideration, the less distinct and the more irregular may the rhythmical fluctuations be in the end.

In this connection, mention should be made of the difficulties which are brought about by the "seasonal fluctuations" when PRICE SERIES are to be COMBINED TO PRICE INDICES. If price movements are to be recorded separately, the price series are combined by means of constant weights. But if actual turnover during the year is subject to heavy seasonal fluctuations, there is the danger that the constant quantity pattern ceases to be realistic in certain months. This is an

index problem which is closely connected with the topic of the present study and which is worth considering, and particularly in connection with the computation of price indices for the deflation of quarterly and semi-annual figures resulting from national accounts, though it is true that relevant investigations conducted at the Federal Statistical Office have revealed that the quantitative importance of this question must not be overestimated.

#### B. Pre-Requisites for the Elimination of Regularly Recurring Rhythmical Fluctuations

It may be said that more or less distinctly it is the opinion of many people that an "adjustment for seasonal fluctuations" aims at the complete elimination of the regularly recurring deviations in a time series. It is desired to obtain a remaining series which shows nothing but the effects of the trend and of random and non-recurring events. If the trend is eliminated additionally the "remaining component" must not be influenced by anything but the non-recurrent and random effects. However, THIS is an aim which can only be achieved under very restrictive conditions. In theory, the regularly recurring deviations in the time series can only be eliminated completely if the influence of all factors which are individually effective can be quantified. If this can be done, the series which remains after the application of a suitable calculation method must actually be free of all rhythmical deviations. But it may be said that owing to the complicated interrelations already explained before, it will only be possible in very few individual special cases or not at all to quantify all factors which exercise any influence.

But if it is intended nevertheless to make an adjustment for seasonal fluctuations in the strict sense of the word, it becomes necessary to search for compromise solutions. In this connection it could first be thought of a REGRESSION ANALYSIS, according to which the movement of certain independent variables is the explanation for the monthly figures of the series. These independent variables would also include those which are directly connected with factors by which seasonal fluctuations are caused. If the seasonal fluctuations of these variables were removed (e.g. simply by the calculation of averages), we should be faced with the fact that the influence upon the dependent variable under consideration were constant from month to month; in other words the corresponding time series would no longer be subject to seasonal fluctuations. But when compared with the possibilities which exist in practice, this method appears to be rather hypothetical, too, and again it must be said that a complete elimination of fluctuations can be achieved by this method only in certain circumstances. Among other factors, this is due to the fact that the coefficients of the regression equation are based on averages, which absorb part of the peculiarities of the individual years.

If exceptional cases remain unconsidered, it may be assumed that a complete adjustment for seasonal fluctuations in the above sense can scarcely be

realized. But if the claims are reduced or the aim somewhat altered it is quite possible to find calculation methods which facilitate the analysis of the rhythmical fluctuations and the whole analysis of time series. In this connection mention should in the first place be made to the method of calculating "SEASONAL INDICES". This method corresponds to the measurement of the development between two dates in ONE single year on the basis of the AVERAGE development between the corresponding dates in SEVERAL years. If the average development reflected by the seasonal index (which, though not quite correctly in all cases, is regarded as "normal") is eliminated from the initial series, the remaining series can be free of seasonal fluctuations only in exceptional cases. Such an exceptional case exists when the following requirements have been met:

1. The natural and institutional factors as well as the factors due to the calendar must each year become effective at the same time and be equally intensive.
2. The biological, technical and economic events through which the original seasonal factors exercise an influence upon the time series considered must each year become effective at the same time and in the same combination and must take the same direction and be of equal intensity.
3. It must be possible to eliminate the trend and the influences of all one-time and random effects already before the seasonal index is computed, so that they are no longer able to influence the picture of the average development between the various dates.

It may scarcely be expected that all these pre-requisites, and particularly the pre-requisite mentioned under point 3., can be found in many cases, and not even approximately. Accordingly, the remaining series will seldom be quite free of seasonal influences, and their effects will correspond to the extent to which they are below or above the "normal" development<sup>7)</sup>. In addition, the picture of the trend and the one-time events which should remain after the "adjustment" for seasonal fluctuations, can also be distorted by the fact that these influencing factors have slipped into the computation of the seasonal index to a more or less wide extent.

But despite all these considerations, the conversion of a series by means of a seasonal index must not be rejected on the whole. But before starting such a calculation, we should make sure that we do not get too far away from the requirements mentioned above, and in addition we should not refer to the remaining series as "adjusted for seasonal fluctuations". Apart from that, the remaining series must not be regarded as final either, but it should be considered which factors could still be effective.- The next section<sup>7)</sup> This can certainly be a desired effect in those cases where seasonal effects above or below the average are desired to be included in the random or one-time events.

contains some examples which illustrate the problems involved in "adjustments" for seasonal fluctuations by means of the usual methods, which should only be used with great care.

But if sufficient care is taken, the adjustment by means of a seasonal "normal" remains a reasonable and somewhat indispensable implement for the analysis of time series. Apart from this, a seasonal index alone can already provide significant information. In short-dated forecasts it supplies expectations, which together with other clues may facilitate the look into the future.

#### C. Critical Remarks on the Methods Generally Used in the Elimination of Seasonally Recurring Influences

##### 1. Comparison with the "corresponding month in the previous year"

This method is simply a month to month calculation of the rate of growth in comparison with the corresponding months in the previous year. If these rates of growth are compared with one another, we obtain a picture which frequently illustrates the development under consideration much more distinctly than the initial series itself. This is an adequate method particularly in those cases where the computation of a seasonal index appears not to be justified. But again care must be taken in the interpretation of the results. A change in the series of the rates of growth, for instance, must not necessarily indicate a change in the direction of the general tendency reflected by the initial series. There are still further possibilities of a misinterpretation, which can be seen from the following schematic example.

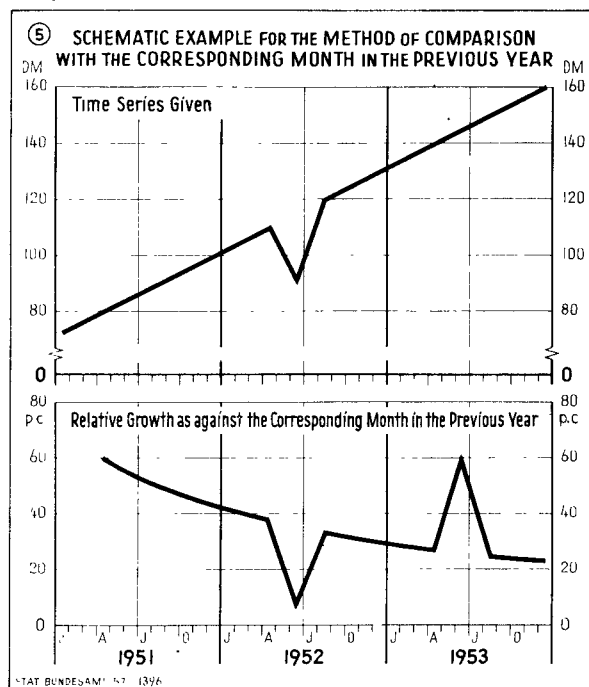


Chart 5 shows, how ONE single occurrence in the quite steady course of an initial series is TWICE reflected in the relevant series of the rates of growth

when compared with the corresponding month in the previous year. In that year in which the single occurrence appeared, the development of the rates of growth reflects it accurately. In the year following, which in reality is not affected by this occurrence, the series of the rates of growth deviates once again, though in the reverse direction. Such a reaction may quite easily lead to a misinterpretation, because inconvenient influences of single occurrences are easily neglected in practice, so that unsound results are obtained.

Though according to the example this method of making comparisons with the corresponding month in the previous year does not appear very satisfactory, it must be borne in mind that this method, which can still be improved, offers most interesting and valuable possibilities for the analysis of time series. It frequently provides information by simple means, which cannot be more reasonable and precise when much more complicated methods are used.

## 2. The "elimination" of seasonal fluctuations by means of seasonal indices

The methods generally used in the elimination of seasonal fluctuations are:

1. the so-called "method of link relatives" (persons), the calculation of which is relatively clumsy;
2. the application of moving averages; in this procedure the absolute or relative deviations of the initial values from the moving average are used for estimating the average seasonal movement.

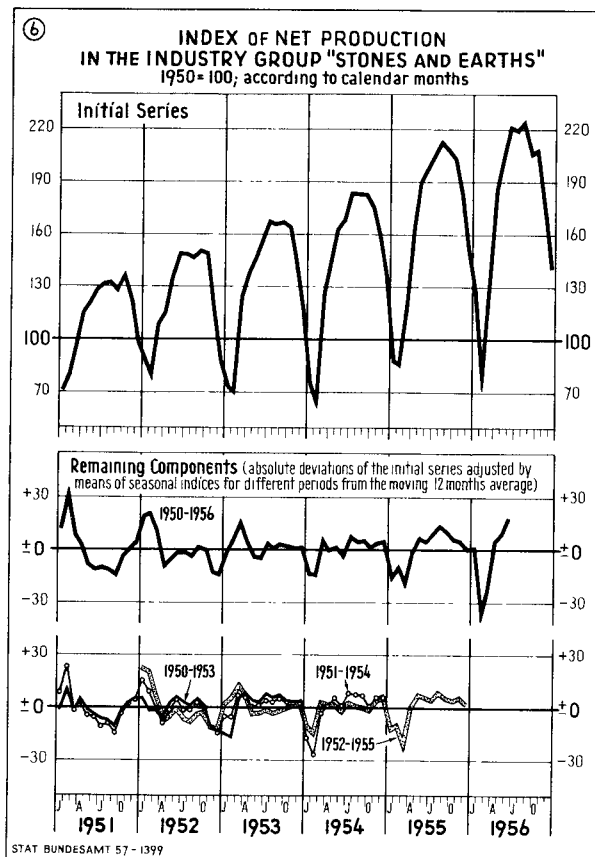
To facilitate matters, the following examples have mainly been computed according to the second method, and account has been taken of the ABSOLUTE differences between the initial series and the trend. The "remaining component" represents, in each instance, the deviations of the series "adjusted for seasonal fluctuations" from the trend, which in this example is represented by a moving average of twelve months. The problems involved in this type of a "trend" calculation will not be discussed in detail within the scope of this article<sup>8)</sup>, for it is not intended in this context to explain the calculation methods as such, but to study the question whether it is adequate in each case to use them for "adjusting" series for seasonal fluctuations. This is the reason why in the first line it has been shown how easy it is to obtain misleading results if the usual methods are employed without regarding them critically beforehand. Accordingly, the following examples have been chosen in such a way that certain risks become clearly recognizable. But this emphasizing of the negative side must not be taken for an absolutely negative criti-

8) The calculation of moving averages of twelve months, for instance, involves a calculative shift forward or backward of the effects of certain events, which is not justified in all cases, and which is particularly distinct in cases where the general development is interrupted by a sudden "break" or "crack". Another danger is that in certain series the moving average may still contain some seasonal effects.

cism. It is only meant as a warning.

- a) The results may involve a great number of problems if the seasonal fluctuations are of changing intensity

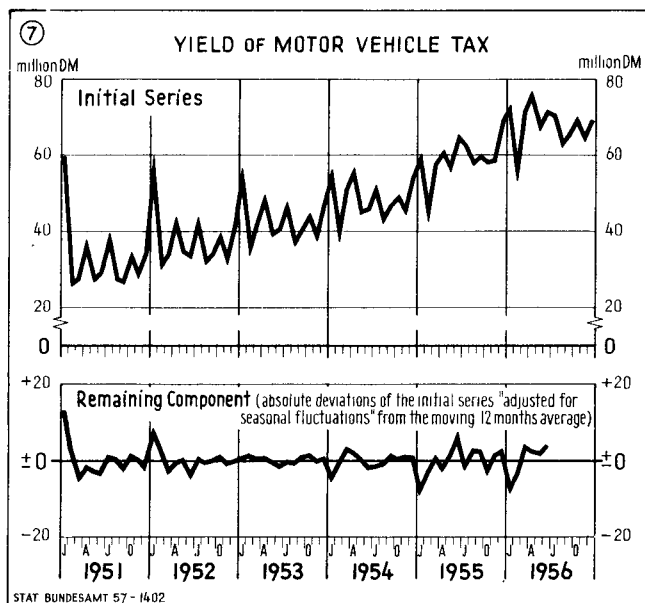
It can be seen from Chart 6, how from year to year the fluctuations of the production in the industry group "Stones and Earths" grow more and more intensive. If the seasonal fluctuations are eliminated by methods generally used for this purpose, we obtain a seasonal "normal", which in a way must be regarded as an "improper average". When compared with the deviations of the initial series, the "normal" curve deviates too widely during the first years and too slightly in later years. Thus we obtain - after adjustment by means of the computed seasonal index - a remaining component which is still far from being free of effects of seasonal factors particularly during the first and during the last years. At the beginning, the seasonal fluctuations are reflected by the remaining component in the reverse direction (as long as they are below the average of the period under consideration), and later-on it is vice versa. Thus it may be said that to a certain extent the remaining component becomes the image of the growing intensity of the seasonal deviations.



In our example, this is not only the case when the most simple method (computation of an index on the basis of the ABSOLUTE deviations from the trend) is used, but also - though not so distinctly - when the index calculation is started from the RELATIVE deviations from the trend, or when use is made of the method of link relatives which may appear more adequate in this case.

- b) The results are influenced by a time shift of the influencing factors

If the dates at which the various factors become effective shift, the component remaining after the elimination of the seasonal influences may still show deviations which are closely connected with the facts to be eliminated. A relevant example has been given



in Chart 7. It shows how a gradual change in the payment habits of motor vehicle tax (changing over from annual to quarterly advance payments) alters the distinct seasonal fluctuations in such a way that their elimination by means of the usual methods involves serious problems. If this is not taken into account, we obtain a "remaining" component which is clearly affected by the continual structural change.

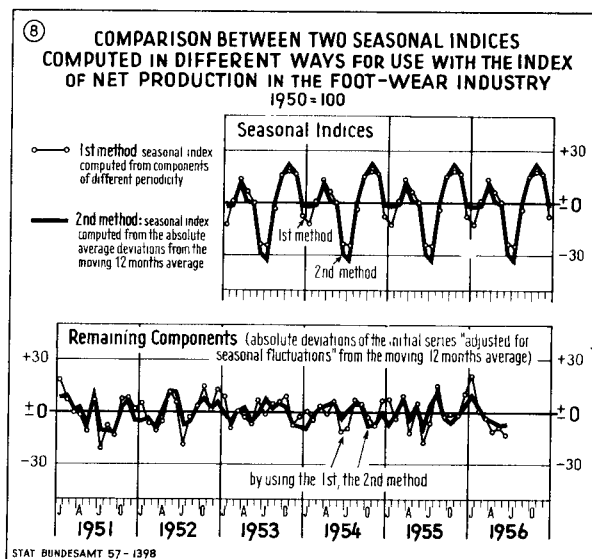
Similar consequences must be expected if it is intended to "adjust" a series which - with a view to the effects of seasonal factors - relates to a very heterogeneous sector, an example being the index of the net value of industrial production. In this index, industries have been combined which in part are subject to completely different seasonal influences. If the proportions of the individual industries shift, certain fluctuations will be reflected more strongly on the total average, while others will be weakened. This means that the rhythm of the total index is altered, and this in turn may exercise an influence upon the remaining component in a similar way to that described in the previous example. These effects of general structural shifts could be reduced by starting the adjustment for seasonal influences from the production indices of the individual industries, and not from the total index.

Problems which are coherent with the time shift of influencing factors arise also from an endeavour to "adjust" retail turnover which depend upon the dates of feast-days. Any index calculation which does not account for the fact that the MOVABLE FEAST-DAYS do not, in each year, fall to the same month must lead to improper averages and therewith to a bias of the remaining component. As the movable festivals can

only fall to two different months, we can evade this difficulty by combining the two months concerned. Another possibility would be to calculate two indices, one for those years in which Easter is in March, and one for those in which Easter is in April. However, this procedure requires that longer series are available<sup>9)</sup>. But even if this is done, it is still impossible to eliminate those influences which are clearly recognizable in some series and which are due to the varying date of a festival INSIDE the same month. For instance, the movement of retail turnover in chocolates and sweets shows clearly that great part of the Easter business falls to the month of MARCH when Easter is in early APRIL.

- c) The results may be influenced by the method and the time basis selected

For the production of footwear two seasonal indices were computed in different ways (Chart 8). Similar to the two examples given before, one of these indices was based on averaged absolute deviations from the trend. The other index was computed by means of several moving averages, so that the seasonal fluctuations were in a way split up into several components of different periodicity in a similar way as it is the case in the "harmonic analysis". Though it is true that - after the combination of the individual components of the second method - the indices thus computed reflect the basic seasonal movement relatively uniformly, part of the remaining series deviate from one another to quite a considerable extent. These differences indicate that the knowledge provided by a "remaining" component and therewith also by an "adjusted" series may be very doubtful, which is also due to the dependence upon the calculation method.



In certain circumstances, it is possible that the remaining components vary considerably with the TIME PERIOD on which the seasonal calculation is based. A relevant example has been given at the bottom of

9) The use of longer series does not at all offer advantages only, for according to their nature they are to a wider extent subject to influences of gradual structural shifts in the way mentioned before than it is the case with shorter series.

Chart 6, though it must be taken into account that the calculation of the individual seasonal incidences could only be based on a smaller number of years.

Whether and to which extent these dangers may be reduced by the use of more complicated methods can only be said from case to case<sup>10)</sup>. It will scarcely be possible to establish generally valid rules.

ONE recommendation, however, may be regarded as generally valid: Before a series to be adjusted for seasonal fluctuations by means of a more or less mechanical calculation method is approached, it should be attempted, if possible, to eliminate certain fluctuations already beforehand by making use of the material available in each instance. The varying number of working, calendar, or consumption days, etc. are the first to come to mind (see also Section II B), but it should be stressed again that an elimination of these influences must not be mistaken for an elimination of SEASONAL fluctuations. It is only intended to remove, if possible, the disturbances which are caused by the irregularities of the calendar before other calculations which aim at "eliminating" the actual seasonal fluctuations are begun.

In addition, there are other possibilities which should be utilized before purely mechanical methods are employed. It would, for instance, be possible to eliminate quite a number of fluctuations from the development of deliveries of cow milk by making use of the information which is available on milk production per cow, after the conversion according to calendar days has been made. (In these proceedings, the long-run development of these yields would have to be eliminated.) The somewhat mechanical part of the elimination of seasonal fluctuations will then have to be made only for the remaining fluctuations. Due account would thus have been taken of the fluctuations (due to seasonal factors reflected by the "productivity" of cows) eliminated in advance, and this at their accurate date and with their actual intensity. This might have reduced the danger to obtain improper averages, and the "remaining component" may no longer provide such a wide range for misinterpretations.

As another example the possibility of an "advance adjustment" of index series of industrial production by means of the average working hours per worker may come to mind, a procedure in which the problem of hours reduction must not be neglected. (This possibility has already been discussed earlier in the text.) In this way it would be possible, already to adjust the index series of production relatively adequately for the influences of some events which recur regularly though not always at the same date and with the same intensity as, for instance, the dates of Sundays and feast-days, the varying frequency of leave, illness, and extra hours, etc., before the seasonal in-

<sup>10)</sup> There are certainly methods in which account is taken of the peculiarities of the individual series in a more adequate way. The procedures which appear to be particularly adequate are those based on the regression analysis, though it is true that the purpose which they serve is not so comprehensively inclusive as that described on page 9; see "Monatsbericht der Bank deutscher Länder", 3/1957, p. 40 ff.

dex is computed.

### III. COMMENTS ON THE CURRENT CALCULATION AND PUBLICATION OF SERIES "ADJUSTED FOR SEASONAL FLUCTUATIONS" BY THE STATISTICAL OFFICES

The computation of "seasonal indices" as well as the imperfect attempt to eliminate seasonal fluctuations may be quite adequate implements in the analysis of time series for the purpose of procuring reasonable information. But these implements, as they stand, must not be employed with each individual time series. Examples of an unreasonable application of methods for the "elimination of seasonal influences" have been given in the previous section. If in a certain case such calculations are considered to be adequate, we are faced with the problem to select that method which promises to provide the information required, simultaneously taking into account the peculiarity of the series concerned. Both the decision whether to make an "adjustment" and the selection of the "best" method may be arbitrary to a considerable extent. This may result in a far-reaching dependence of the results upon the method selected, and this is the reason why in many cases the figures cannot be used in a reasonable way unless the calculative operations are thoroughly known.

It is not at all adequate, simply to refer to a series which has been divided by a "seasonal index" as a series "adjusted for seasonal fluctuations". This is misleading and technically wrong, for it is quite possible in certain circumstances that the "adjusted" series contains all regularly recurring rhythmical deviations of the initial series in the same extent in which these real seasonal deviations are above or below the average of several years. Without any further and thorough investigation it cannot be said that the remaining series shows the general tendency of development interrupted by single and random events (or the single and random events alone after the elimination of the "trend"). The impression that it does, can easily arise if such series are simply referred to as "series adjusted for seasonal influences". In addition, the use of series already adjusted may easily induce the user to neglect important problems of evaluation.

If the decision were reached to publish certain series which have been "adjusted" by a seasonal index, these series must in all events be accompanied by the initial series and a description of the method used. On the one hand, there are many purposes for which the non-adjusted initial figures are more adequate than the so-called "adjusted" ones. On the other hand, the user of statistics should be able to make other calculative adjustments for seasonal fluctuations if these appear more adequate to him for his own research work.

In addition, it should be considered whether the publication of "adjusted series" could be replaced by the publication of references to seasonal influences and influences due to the calendar which may have become effective. Insofar as this appears justifiable,

these references could also be given in quantitative terms. As regards series with actually distinct and regularly recurring fluctuations it should be considered to have them accompanied by seasonal "normals". This solution would not give rise to some of the objections mentioned before.

Before a final answer can be given to the question concerning the current publication of "adjusted" series, the available short-term series have to be investigated in order to find out whether and to which extent they are influenced by irregularities of the calendar and by seasonal factors. Then it would have to be investigated in each individual case and in accordance with the criterions described in the present study whether the effects of these influences are so as to permit of their "elimination" by the methods usually employed for this purpose. It may already be said on this stage that many series will not stand this test. In such cases it would have to be consider-

ed whether there are other methods which might provide more adequate results. When in individual cases reasonable possibilities for the adjustment of series cannot be found, it goes without saying that a statistical office must not make calculations of this type nor publish the results which in certain circumstances may be misleading. It appears better to refrain from trying to derive too great an amount of information from the short-term development, and the analysis should be based upon longer periods.

Finally it should be said that current conversions of a greater number of short-term series require time and money. Even in those cases where such conversions appear sensible and adequate, it must be examined beforehand whether this work can be done with the available facilities in a way which does not affect the required actuality of the initial figures.

Dr. Gerhard Fürst / Dr. Hans Spilker