Core inflation rates as a tool of price analysis

Today the safeguarding of price stability is generally acknowledged to be the primary objective of monetary policy. Its attainment presupposes the comprehensive and painstaking analysis of price changes. The main purpose of such analysis is to identify the longer-term price trend and to evaluate its compatibility with the stability norm. Even excluding possible imprecisions in measurement, the statistically determined rate of inflation is not completely adequate to this purpose since it is frequently subject to random, transitory fluctuations. For this reason recourse is often had to what are known as core inflation rates, which are supposed to reflect the underlying price trend. The following article examines some of the techniques commonly used to measure these rates and presents empirical results for the Federal Republic of Germany. It is shown that both inflation as measured at the consumer level and the general price trend declined from mid-1997 to the end of 1998. Since then, the statistically recorded rate of inflation has been rising; it was significantly higher than the price trend, especially at the end of the observation period. At the same time, the calculation of core inflation rates entails considerable difficulties. This notwithstanding, such price indicators may be used to derive additional information relevant to the practical design of monetary policy, provided that due caution is exercised when interpreting them.
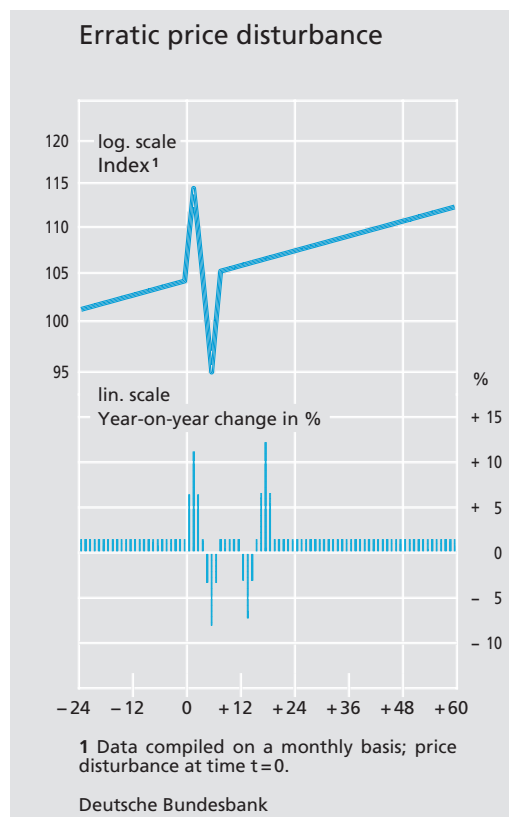
The limits of traditional price analysis

Focus on annual change in consumer prices

The careful analysis of price movements at different economic levels and in different markets is a major concern of central banks, which are committed to safeguarding the value of money. Ultimately, attention tends to focus on price trends at the consumer level. It is customary to use year-on-year changes in consumer price indices as a measure of inflation, i.e. of changes in the value of money. Thus the ECB Governing Council measures price movements in the euro area in terms of the year-on-year increase in the Harmonised Consumer Price Index. In Germany the most commonly used measure is the annual rate of inflation for the consumer price index.[1]

General price trend not directly observable

The purpose of price analysis in describing and interpreting changes in the rate of inflation is to provide a reliable estimate of the current general price trend in the economy and to identify sure signs of inflationary or deflationary risks early on. A forward-looking monetary policy oriented towards the medium term cannot dispense with this information. Still, the longer-term price trend cannot simply be inferred from the statistically measured rate of price change, since the latter – even assuming moderate overall inflation – is subject to a number of heterogeneous influences and is comparatively volatile. Fluctuations in the rate of price change are often the result of temporary price movements that are at least partly random in nature. These transitory price movements are not directly related to the underlying process of price formation; not rarely, they obscure what is essential and make it difficult to assess measured rates of inflation.

Erratic price disturbance

1 Data compiled on a monthly basis; price disturbance at time t = 0.

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Thus price analysis would undoubtedly benefit from the availability of an indicator that is as free as possible of temporary price movements. The term "core inflation rate" is the now commonplace designation for this indicator. Up until now, however, no consensus has been reached on the definition of such a rate.[2] Instead, different practical approaches have been developed over time in order to filter out the price trend from the rate of inflation measured by the official statistics. This

Wide variety of methods for identifying price trend

1 While the Harmonised Consumer Price Index is designed to offer a comparable standard throughout the European Union, the national price index has the advantage of being more representative.
2 The study by S. Roger, Core Inflation: Concepts, Uses and Measurement, Reserve Bank of New Zealand Discussion Paper Series G 98/8 contains a discussion of the different views on core inflation. M. Wynne, Core Inflation: A Review of Some Conceptual Issues, European Central Bank, Working Paper No. 5, 1999 also deals with this problem at length.

article describes some of these methods and presents the various core rates for Germany that have been calculated using them. These calculations are based on the period from the beginning of 1996 to spring 2000.

Transitory price influences

Different kinds of transitory price fluctuations

Before proceeding further, it is important to define what precisely is to be understood by a transitory fluctuation in the rate of inflation. Although there are a wide variety of such fluctuations, it is still possible to classify them into a few basic categories. In this context, it is useful to keep in mind what effects such changes have on the annual rate of inflation, i. e. the year-on-year change in the index, and on the level of the price index.

Erratic price disturbances

One type of short-term fluctuation has its origin in the pronounced price disturbances within individual commodity categories, which give the official rate of inflation its unsteady character. After a certain amount of time, the effects associated with these disturbances recede. The classic example of such short-term fluctuations are exceptional movements in the price of seasonal food (e. g. fruit or fresh vegetables) owing to unusual weather conditions. A delayed harvest, for example, initially results in a scarcity of produce and a price increase, and thus – *ceteris paribus* – to a rising rate of inflation. If the following harvest is good, then the price may decline significantly for a time, possibly even falling below its old level. Once the unusual weather effects have subsided, the price will return, *ceteris paribus,* to the time path that
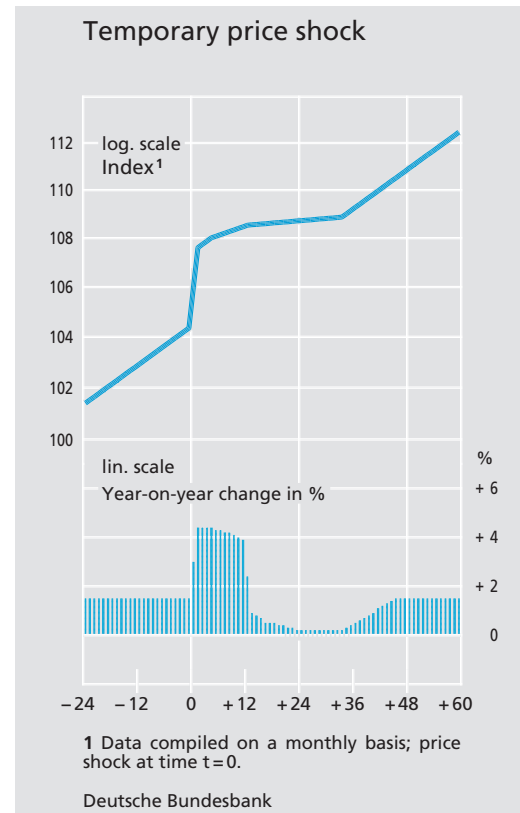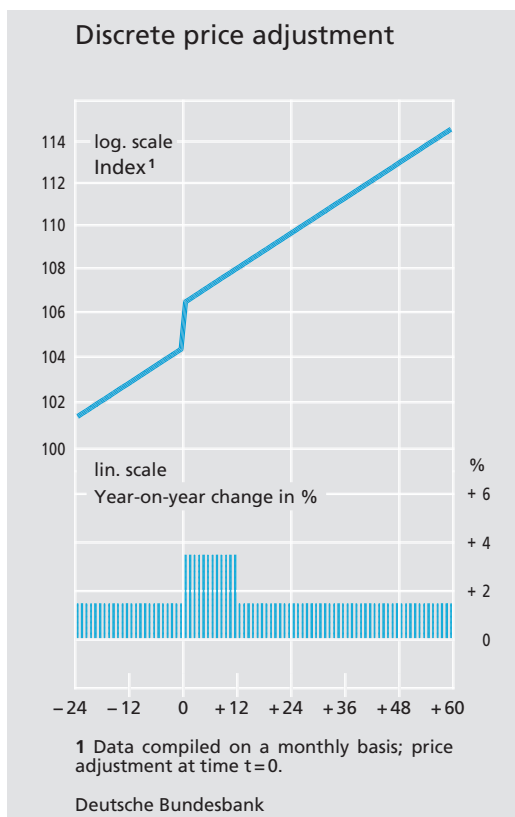
would have obtained in the absence of the shock. Both the annual rate of inflation and the price level are affected by this process only over the short term; neither of them is permanently changed as a result.

Temporary shocks

Price shocks such as those induced by, say, a crop failure (to use another agricultural example) have effects similar to those of short-term fluctuations. In this case, however, it takes longer for the price level to return to its original state. Jumps in oil prices and other abrupt shifts in the terms of trade fall under this category, too.

Sudden, long-term changes in price

Long-term changes in price also pose difficulties for price analysis insofar as they occur with relative suddenness and substantially affect household budgets. Examples of long-term

Temporary price shock

1 Data compiled on a monthly basis; price shock at time t = 0.

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Discrete price adjustment

log. scale
Index[1]

lin. scale
Year-on-year change in %

1 Data compiled on a monthly basis; price adjustment at time t = 0.

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price changes include adjustments of administered prices such as transport charges, postage for letters, and prescription charges. These are usually introduced at very irregular intervals, but, when they occur, the price changes involved are often relatively large. The result is a shift in the price level, which is reflected in a corresponding rise in the observed rate of inflation for the next twelve months. If there are no further price adjustments, the rate of inflation will continue to move horizontally, as before, while the price level itself will be higher over the long term: a so-called "base effect" occurs. The same effect would accompany a rise in the value-added tax (as was last the case in April 1998) or a rise in other indirect taxes (as occurred most recently on April 1, 1999 with the introduction of the ecological tax or on January 1, 2000 with its increase).

Still, it is also important to recognise the danger that even temporary inflationary pressures may become permanent. If, for example, changes in the rate of inflation were to initiate what are known as "second-round" effects, e.g. through changes in price expectations or through the demand for a full adjustment for inflation in wage negotiations, the price trend could also be affected. It is especially important to distinguish between transitory effects and longer-term price trends in such a situation. Core inflation rates may be helpful in this respect. A central bank committed to price stability has the responsibility to communicate its views on temporary fluctuations in price developments to the general public and to forestall misconceptions.

Danger of transitory price movements becoming permanent

Statistical methods of calculating core inflation rates

Some methods of calculating core inflation rates are presented below. This article focuses on the "statistical" approaches, which are widely used.[3] It is easier to understand these methods if their principles of construction are compared with those of the official price indices. The German consumer price index is conceived as a Laspeyres index.[4] It represents the arithmetic mean of the price relatives for

3 Another method for calculating core inflation rates is closely tied to certain economic models. Long-term relationships between macroeconomic variables, which are derived from these models, are used to identify core inflation. For a survey of the different approaches, see, for example, the articles in the BIS anthology, Measures of Underlying Inflation and Their Role in the Conduct of Monetary Policy, Proceedings of the Workshop of Central Bank Model Builders, February 1999, Basel.
4 For more details, see Deutsche Bundesbank, Problems of inflation measurement, Monthly Report, May 1998, pages 51–64.

the goods and services contained in the basket of goods, this mean being weighted according to expenditure share in the base period. The conventional measure of the annual inflation rate is, accordingly, the weighted average of the rates of change for individual prices; the construction of the index allows the weights to be extrapolated on the basis of relative price changes. If the price of a component is subject to strong fluctuations over the short term, then the measured rate of overall inflation will also reflect the corresponding changes, albeit in mitigated form. Thus the basic idea behind this statistical procedure is to calculate a modified rate of inflation, which excludes or at least minimises the effects of those components subject to relatively strong price fluctuations.

Complete exclusion of volatile components

Exclusion of food and energy

The best known of the statistical procedures – and the one that suggests itself most readily – is the exclusion method. On such an approach, commodity categories whose prices show above-average volatility are completely and systematically removed from the overall index. The products most often excluded are (fresh) food and energy. The monitoring of such an indicator represents common practice in the United States. The European Central Bank also regularly cites in its Monthly Bulletins an inflation rate that has been calculated in a similar manner. Given the strong fluctuations in price to which they are subject, it seems reasonable to wish to eliminate luxury items such as tobacco or cof-
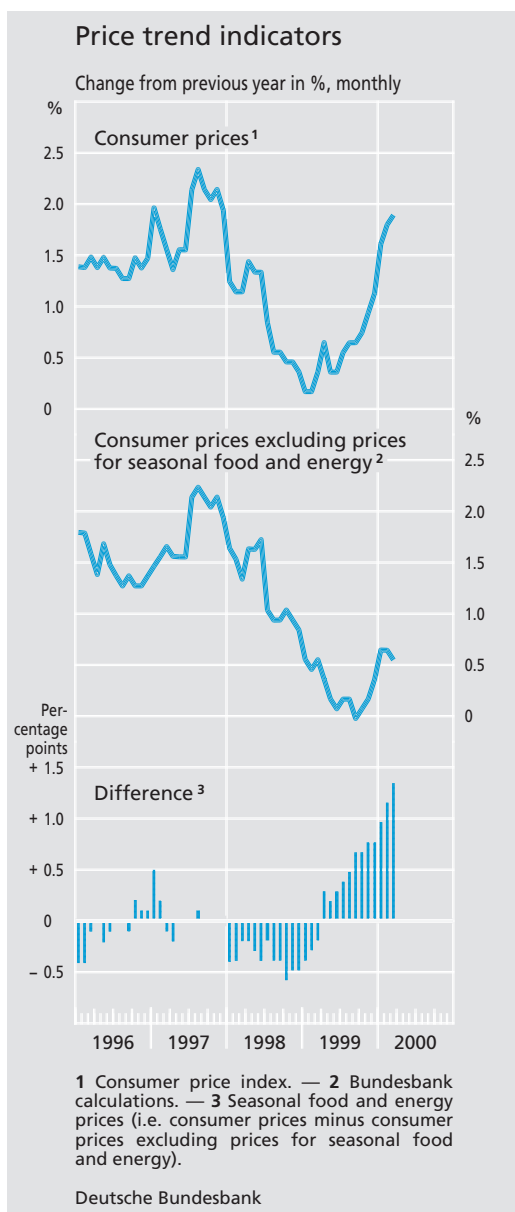
fee and package tours as well. The chart on page 50 shows an annual rate of inflation calculated for Germany in which seasonal food and energy are "weighted out" of the consumer price index. These components comprise approximately 11 ½ % of total expenditure underlying the basket of goods.

This measure of core inflation varies closely with measured inflation. Both indicators declined from mid-1997 to the end of 1998. This fact suggests that it was not only the price of oil – which fell during this period – that determined the total movement; the rates of price change for other components, such as industrial goods and rents, also declined or rose only moderately. This trend continued at first, as energy again became more expensive at the beginning of 1999 and the overall rate of inflation – aggravated by the first stage of the ecological tax reform – rose anew. The core inflation rate reached a trough only in autumn of last year; up to the end of the period under review, it remained significantly below measured inflation.

Results for Germany

Core rates that are calculated in the manner previously described may be useful in estimating the general price trend. The interpretation of inflation data is complicated, however, not only by the kind of price fluctuations to which seasonal foods and energy are subject; a variety of other factors also affect measured inflation. This is already suggested by the fact that the measure of core inflation presented here is relatively discontinuous. The standard deviation indicates that the core rate is more variable than the official rate of inflation. This is hardly consistent with the conception of a

Problematic assumptions

Price trend indicators

Change from previous year in %, monthly

1 Consumer price index. — **2** Bundesbank calculations. — **3** Seasonal food and energy prices (i.e. consumer prices minus consumer prices excluding prices for seasonal food and energy).

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core inflation rate being "good" if it shows a fairly smooth progression over time. The extraction of particular volatile components does not lead to the desired result *per se*. Moreover, not all the goods that have been classified under such relatively broad major categories as "food" or "energy" need be volatile to the same degree.

If the origins of volatility are to be uncovered, it seems advisable to break the basket of goods down into additional components and to analyse price movements within these sub-categories. To this end a breakdown into 104 categories has been assumed below. The principles of this decomposition are laid down in the COICOP classificatory scheme for goods (Classification of Individual Consumption by Purpose), which serves as a foundation for consumer price statistics. The sub-categories used represent the "triple-digit" members of the COICOP. Since this classification was first used with the introduction of the basket of goods from 1995 on,[5] the following observations remain confined to the period from January 1996 to March 2000. Consequently, the extreme adjustments in price that took place in eastern Germany at the beginning of the 1990s are not considered here.

A more detailed breakdown of the basket of goods

If the standard deviation for each rate of price change is taken as a measure of the volatility of the individual components, then the sub-categories "liquid fuels (light heating oil)" and "petrol and lubricants for privately owned vehicles" are particularly subject to strong fluctuations. As might have been expected, "fruit" and "vegetables" prove equally volatile. Other components also contributed, however, to fluctuations in the measured rate of inflation. "Pharmaceutical products" (which are clearly dependent on variations in prescription fees) and "coffee, tea, cacao" may be cited here as typical ex-

Standard deviation for the components

5 The basket of goods had previously been broken down using a classification scheme involving receipts and expenditure.

amples. By contrast, the sub-categories "fish, fish products" and "solid fuels" follow a more or less smooth time path, although the relatively rough exclusion method mentioned earlier had eliminated them *tout court* from the basket of goods as belonging to the volatile components.

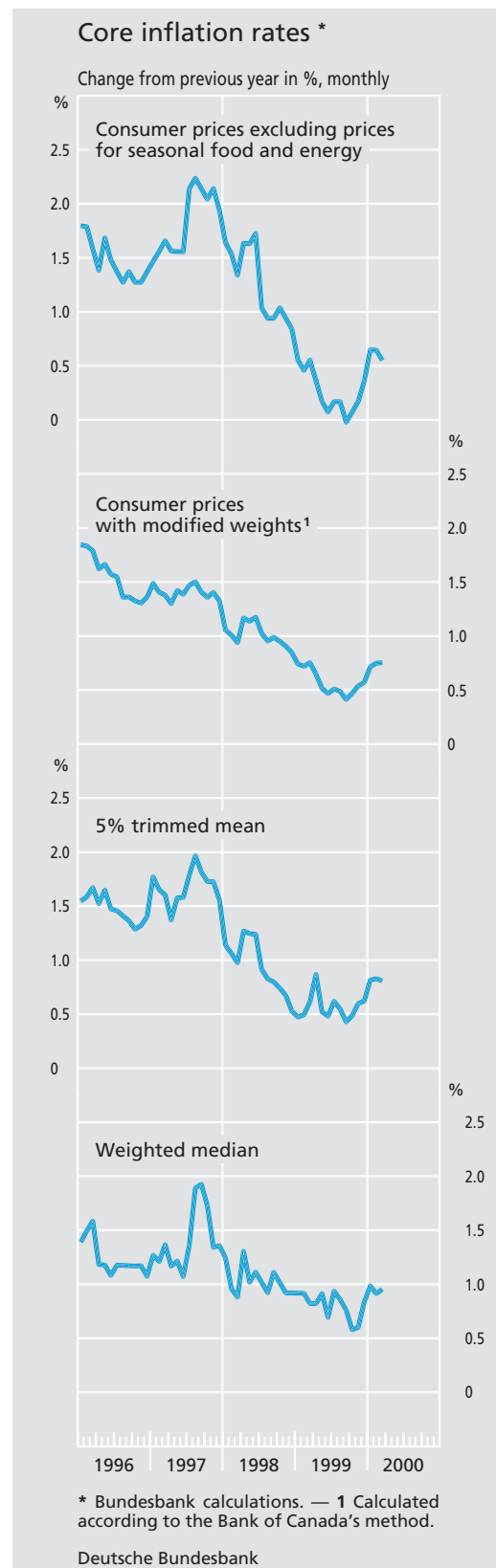## Application of modified weights

Permanent exclusion of components results in loss of information

The exclusion method may be refined by defining volatile components at a more disaggregated level. Even then, however, an important problem remains. The total and permanent exclusion of components presupposes that price fluctuations are purely transitory in nature and never contain information relevant to the underlying price trend. This can hardly be determined *a priori,* however. Thus the exclusion method carries with it the latent danger that the inflationary trend implicit in the component will likewise be eliminated and that attempts to interpret the general price trend will consequently be distorted.

Weighting according to relative price variability ...

In order to prevent such losses of information to the extent possible, the Bank of Canada applies a method that may be understood as a more sophisticated version of the relatively "naive" exclusion method.[6] Although this method uses all components of the basket of goods when calculating the core inflation rate, the effect of volatile components on the overall index is reduced by using weights that

6 See Bank of Canada, Monetary Policy Report, November 1997, page 7 and T. Laflèche, Statistical Measures of the Trend Rate of Inflation, Bank of Canada Review, Autumn 1997, pages 29–47.

Core inflation rates *

Change from previous year in %, monthly

Consumer prices excluding prices for seasonal food and energy

Consumer prices with modified weights[1]

5% trimmed mean

Weighted median

1996 1997 1998 1999 2000

* Bundesbank calculations. — 1 Calculated according to the Bank of Canada's method.

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are linked to the relative price variability of individual goods and services in the basket of goods. In practical terms, this means that the expenditure weight of each component in the basket of goods is divided by the standard deviation in its relative price change (calculated as the difference between the inflation rate of the sub-component and the overall index). The higher the standard deviation (i.e. the volatility) in the component, the lower the adjusted weight.[7]

... reduces effects of volatile components

If such a core inflation rate is calculated for Germany, then the weight of "liquid fuels", for example, would be reduced by over 90 %. By contrast, the sub-categories "maintenance and repair of privately owned vehicles"and "bread and cereal products", which exhibit very low fluctuations in relative price throughout this observation period, would double their weighting. The chart on page 51 shows the core inflation rate, as calculated according to this method. Although the standard deviation for the rate of inflation is one-third lower than that of measured inflation, the core rate is still subject to relatively pronounced fluctuations.

Trimmed means

Flexible exclusion method

In the approaches hitherto examined, historical price fluctuations generally serve as a basis for calculating the core inflation rate. Since, however, these fluctuations cannot simply be assumed to persist unchanged into the future, there is no guarantee that the calculated core inflation rate will continue to exclude temporary price shocks. A method is often employed to remove these defects

which is extremely flexible in its definition of the components to be excluded: the trimmed mean approach. This approach does not focus on the behaviour of individual components over a longer time-period but may be used to track a component at any point in time and in relation to other components. A given percentage of those components which have changed the most or the least in comparison with the other components and which consequently lie at the tails of the price-change distribution for the individual sub-categories are not taken into account when calculating a trimmed mean. A new weighted average is derived for the remaining components. It is possible to calculate several versions of trimmed means in this way. The weighted median represents a special case, in which nearly 50 % is removed from both tails and only the rate of price change which is located in the "centre" of the cross-sectional distribution is retained.[8]

Time varying exclusion

Which components are to be excluded when calculating core inflation or how large the weights to be applied should be need not be decided *a priori* in the case of trimmed means. This depends solely on the price-change distribution and may thus vary over time. Thus the same good may be taken into account once when calculating the core rate and excluded another time. It is difficult, however, to determine the "correct" trim or cut-off level. Various optimisation methods have been developed in the research literature, all of which have failed either to yield a clear-cut

7 For the details of the calculation, see the model calculation provided in the annex.
8 For details, see the annex.

Price trend indicators for Germany

Change from previous year in %

Item	1999					2000
	Year	1st qtr	2nd qtr	3rd qtr	4th qtr	1st qtr
Measured rate of inflation						
Consumer prices [1]	0.6	0.3	0.5	0.7	1.0	1.7
Statistical core rates of inflation [2]						
Consumer prices excluding seasonal food and energy	0.3	0.6	0.2	0.1	0.2	0.7
Consumer prices with modified weights [3]	0.6	0.8	0.6	0.5	0.5	0.8
5 % trimmed mean	0.6	0.5	0.6	0.6	0.6	0.8
Weighted median	0.8	0.9	0.8	0.9	0.7	1.0

1 Consumer price index. — **2** Bundesbank calculations. —
3 Calculated according to the Bank of Canada's method,
see annex.

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Basic idea behind trimmed means

result or to be regarded as uncontroversial. The determination of the optimal trim would also require a substantially longer observation period than was available for this study.

The assumption underlying trimmed means is that extreme changes in price at the tails of the distribution are the result of transitory shocks. In the absence of such shocks – so the argument runs – all enterprises would regularly and steadily adjust their prices to changes in input costs such as wages and in other factors such as inflation expectations. Thus these movements represent, on average, the general price trend. If a sector is, however, subject to a disturbance in cost or demand (i.e. an idiosyncratic shock), then only a few companies are affected at first. If the shock is sufficiently large, these companies will adjust

their prices to reflect the new circumstances as far as market conditions permit. They will then diverge from the majority of price changes and "stretch" the distribution. If these shocks are concentrated too much to one side, a skewed distribution may result. In such cases or in those cases where many outliers exist, the conventional measure of inflation, i.e. the arithmetic mean weighted according to expenditure share, is no longer the best estimator of the central tendency, i.e. the general price trend; the traditional measure is, in fact, very sensitive to outliers.[9] A trimmed mean may, under certain circumstances, better reflect the general price trend.

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9 From a statistical point of view, the estimator is no longer efficient; in other words, it no longer exhibits the minimum variance.

Cross-sectional distribution of price change not normal

As has often been pointed out for different countries, the rates of price change for individual goods are, in fact, not normally distributed. The distribution is often skewed and usually contains a large number of outliers. This is also true of Germany.[10] The distribution is skewed at virtually every point in time, at times shifting strongly to the left, at times showing a pronounced shift to the right. A slight skew towards the right may be discerned on average. At the same time many outliers may be observed. In each case the kurtosis or curvature, which provides a measure of the relative frequency with which outliers occur, lies above the value that might be expected in a normal distribution.

Trimmed means for Germany

The chart on page 51 shows the trend in the weighted median and in the 5% trimmed mean. In the latter case 5% is removed from each tail of the distribution for a total of 10%, a percentage equivalent to the core inflation rate calculated earlier in connection with the exclusion method. The trend in the 5% trimmed mean is very similar to that in the measured inflation; the fluctuations are, however, not as severe. By contrast, the weighted median clearly diverges from the measured inflation in many cases. The weighted median is also half as variable as the official inflation rate, when measured in terms of the standard deviation. Both core rates reflect at the current end a price trend that lies below the measured inflation.

Often-trimmed components ...

It is only legitimate to equate a core inflation rate calculated using trimmed means with the price trend if the extreme price movements in the excluded sub-categories are, in fact, caused by random, temporary factors. In order to determine whether this is the case, components which are often excluded when calculating core inflation have to be examined more closely. As it happens, "data-processing equipment" and "liquid fuels" are almost always trimmed. The categories "telephone and telefax machines" and "coffee, tea, cacao" are very often trimmed as well.

Trimming is relatively symmetric in the case of heating oil and beverages; in other words, these goods are subject at times to very high price increases but at other times to relatively low ones. It seems likely that most price movements are transitory in nature and their exclusion would then seem only natural. Nevertheless the almost total exclusion of data-processing goods and telephone machines should be viewed critically. These products show a declining price trend over the entire observation period, which reflects technical progress. If prices, in general, are rising, such a product almost always lies at the lower tail of the distribution and is virtually eliminated through trimming.[11] Movements in the prices of these goods are not, however, transitory. If they are excluded, then the resulting figure can hardly be considered a measure of the average price trend. It is a not inconsiderable shortcoming of trimmed

... whose trimming is not always necessary

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10 Although the period being used is relatively short, the West German data suggest similar properties for a substantially longer observation period. For more on this, see B. Landau, Kerninflationsraten: Ein Methodenvergleich auf der Basis westdeutscher Daten, Diskussionspapier der Volkswirtschaftlichen Forschungsgruppe der Deutschen Bundesbank (forthcoming).
11 This type of phenomenon may not only be observed over shorter time periods such as the one being considered here; the analysis of longer periods reveals the same phenomenon.

means that they are incapable of distinguishing exceptionally long-lasting price trends from transitory price movements but exclude both indiscriminately.

Adjustment of tax effects

Shifts in price level caused by changes in indirect taxes …

Shifts in price level which are the result of a rise in indirect taxes pose a special problem for price analysis. In the last few years, indirect taxes were raised comparatively often in Germany, as well. The methods that have been presented for calculating measures of core inflation come to terms with this problem in different ways.

… are handled differently, depending on method

The exclusion method automatically eliminates the effects of such indirect taxes, which are directly captured in the components to be eliminated. In the previous example, these effects were represented by rises in the mineral oil and electricity taxes and by the effects of changes in the value-added tax, which apply to specific components. This method, which uses relative price variability as an additional weight, is able to identify tax effects only if they are restricted to a subset of goods in the basket, occur relatively often and are sufficiently pronounced. The same is true of the trimmed mean approach. Both these methods are incapable of capturing the transitory effects of a rise in the value-added tax, since such a tax increase would affect a large number of the goods in the basket. Instead, the trimmed mean approach eliminates those components that are indifferent to a rise in the value-added tax and thus behave in a

statistically "extreme" fashion, compared with the majority of other components. [12]

The method of specific adjustment

Thus other methods are necessary if the effects arising from changes in indirect taxation are to be eliminated. The method of "specific adjustment" is one often used procedure; here the arithmetical "first-round" effects of changes in the rate of taxation are simply ignored. Such an approach, however, is not without its own problems since it assumes a full and immediate pass-through to consumer price inflation. The timing and magnitude of the pass-through, however, largely depend on the point at which it occurs in the business cycle. Thus, during periods when aggregate demand is strong and the labour market is tight, it seems more likely that the effects of the value-added tax will be passed on than in a situation of excess capacity. As can be seen from this example, adjustment for tax effects will usually include a certain amount of subjective judgement.

Corrections cut both ways

Corrections for taxation effects cut both ways in principle. On the one hand, changes in indirect taxation increase the volatility of measured inflation considerably. A possible effect on the medium-term price trend can be ruled out *ex ante* as long as only first-round effects are accommodated. Thus, when communicating with the general public, reference should be made to the temporary effect of such tax changes on the rate of inflation. On

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12 If, when calculating a core inflation rate for several countries (as occurs, for example, in the case of European monetary union), the basket of goods is broken down according to goods as well as regionally, then the trimmed means can also identify the effects of a rise in value-added tax for a specific country.

the other hand, taxes have in the past almost always been raised and only in a few isolated cases were they lowered. If, when calculating the core rate, tax effects are filtered out, the result is an inflation trend that is necessarily lower, on average, than average measured inflation for the same observation period. Over time the difference between the adjusted price level and the official index will become increasingly larger. The fact that the core inflation rate diverges from measured inflation over the long run suggests that this indicator has not correctly captured the price trend. In the end what households experience is overall inflation, and they must ultimately come to terms with it, regardless of whether prices have risen on account of a fiscal measure or on account of other factors. In addition, if the objective of price stability is defined in terms of the measured rate of inflation, a central bank may call its credibility into question by relying too heavily on a core inflation rate that is, on average, inappropriately low.

Summary and conclusion

Distinction between transitory and permanent movements difficult to draw

The use of core inflation rates reflects a widely perceived need to filter out changes that have no lasting effect on measured inflation. It is, however, often difficult to know in advance which changes in price are to be deemed transitory and which are to be deemed permanent. None of the methods for calculating core inflation rates that have been entertained here can fully resolve this ambiguity. Instead, it has become evident

that temporary fluctuations may all too easily be confused with permanent change or, conversely, that changes which had initially been regarded as permanent proved *ex post* to be only temporary. For this reason, measures of core inflation are not always able to exhibit certain properties that it would be desirable for them to possess: Core inflation rates, for example, need not be less volatile than measured inflation nor are they always able to improve the forecast of inflation. Moreover, the derivation of these rates involves a considerable degree of subjective choice.[13]

Pitfalls and opportunities presented by core inflation rates

Nevertheless, core inflation rates are undeniably useful in estimating the trend rate of inflation since they make it easier to detect special movements. They also assist central banks in communicating more clearly with the general public. They are a tool for extracting transitory change from the measured inflation rate but no panacea. The reasons for temporary fluctuations in price are much too varied to allow for a single method to capture them all. One solution might be to combine various approaches. However, the calculated core rates might in some cases extend over a considerable range, yielding a rather confused picture. At all events, it is important to be acquainted with the problems associated with the different methods and to recognise the constraints to which these methods are subject. All in all, there is much that speaks in favour of a cautious approach towards core inflation rates as part of a general price analysis.

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13 A detailed analysis of the different methods may be found in B. Landau (2000), *op. cit.*

Annex

Selected approaches to calculating core inflation rates

A hypothetical basket of goods, containing eight components, will be used in the following to illustrate the basic idea underlying the different procedures for calculating measures of core inflation.[14] Let the prices for these goods be subject, at a given point in time, to the following year-on-year changes, which are arranged in the table on page 58 in order of ascending magnitude.

The weighted arithmetic mean, and thus the measured inflation rate, is calculated as follows:
$-2.5 \times 0.1 - 1.0 \times 0.1 ..... + 6.0 \times 0.1 + 9.0 \times 0.05 = 1.6\%$.
When calculating a core inflation rate where the weights are modified according to relative price

variability, the standard deviation in the change in relative price must first be obtained (these figures are simply provided in the example). In order to calculate the new weights, the old weights must then be multiplied by the reciprocal of their standard deviation and renormalised so that the sum of the weights again equals 1. The result is the new weighted average:
$-2.5 \times 0.17 - 1.0 \times 0.17 ..... + 6.0 \times 0.085 +$
$9.0 \times 0.021 \approx 0.9\%$.

The corresponding core inflation rate is approximately three-quarter percentage point lower than the measured annual rate of inflation.

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14 The following exposition is based on T. Laflèche (1997), *op. cit.*

Hypothetical basket of goods

Item	Components							
	A	B	C	D	E	F	G	H
Change in %	− 2.5	− 1.0	0.5	1.0	1.5	2.0	6.0	9.0
Weight [1]	0.10	0.10	0.15	0.10	0.15	0.25	0.10	0.05
Data needed to calculate a core inflation rate with modified weights								
Standard deviation	1.00	1.00	2.00	2.00	2.00	2.00	2.00	4.00
1/standard deviation	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.25
New weight	0.100	0.100	0.075	0.050	0.075	0.125	0.050	0.013
Normalised weight	0.170	0.170	0.128	0.085	0.128	0.213	0.085	0.021
Data needed to calculate trimmed means								
Cumulative weight	0.10	0.20	0.35	0.45	0.60	0.85	0.95	1.00
Weights trimmed by 5 % at each tail	0.05	0.10	0.15	0.10	0.15	0.25	0.10	0.00

1 "Weight" does not stand for the weight of the base year but for the relative share in the basket of goods, i. e. the weight of the base period as extrapolated on the basis of relative price changes.

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When deriving other statistical measures, it is advisable to cumulate the weights of the basket of goods first. When calculating a 5 % trimmed mean, for example, 5 % must be removed from both tails of the distribution. Since the smallest year-on-year change (– 2.5 %) given in the example has a weight of 10 % in the basket of goods, it must be partially eliminated by lowering its weight to 5 %. The highest rate given in the example (9.0 %) is eliminated completely. Finally, a new weighted average must be calculated, which in the final stage is normalised (i. e. the weights have to sum up to 1) by dividing it by the sum of the remaining weights (in this case 90 %):
$(-2.5 \times 0.05 - 1.0 \times 0.1 \ldots + 6.0 \times 0.1)/0.9 \approx 1.4\%$.

The weighted median, another indicator for measuring price trends, is derived from the rate of change for that component at which the cumulative weight reaches 50 %. In the present example this is the fifth component so that the core rate, calculated in accordance with the above method, would amount to 1.5 %.