The information content of survey data on expected price developments for monetary policy

Inflation expectations play a key role in shorter-term price developments and in the impact of monetary policy. One way of measuring them is to directly ask market participants for their assessment of the outlook for prices. The following article describes how the qualitative data from the European Commission's Consumer Survey and the surveys of professional experts conducted by Consensus Economics can be used to derive measures of expected price developments.

The time series computed from the survey data not only yield valuable information about future risks to price stability but may also be used to gain new insights into the link between inflation and inflation expectations. The empirical studies presented in this article underscore the importance of inflation expectations for shorter-term price developments. Furthermore, they indicate that the expectations of a significant fraction of the professional experts and households surveyed are strongly influenced by earlier forecasts and past price developments. This behaviour strengthens the "stickiness" of inflation processes and thus also the need for monetary policy makers to adopt a forward-looking approach.

Importance of indicators for monetary policy

Necessity of monetary policy indicators

One of the basic problems with which monetary policy practitioners have to contend are the long and variable time-lags in the transmission of monetary policy impulses to aggregate demand, output and prices. As the main impact of interest rate changes on consumer prices is not felt until one to two years later, all central banks have to rely on indicators which show the price trend and the impact of monetary policy measures as early and reliably as possible.

Special role of the money stock

Given their incomplete knowledge of the structural interrelationships and transmission path of monetary policy measures, central banks generally rely on a wide range of indicators to analyse the economic situation. Owing to particularly good signalling properties certain variables may play a prominent role. For instance, the broadly defined monetary aggregate M3 occupies a special position within the Eurosystem's monetary policy strategy, which is underscored by the definition of a quantitative reference value for M3 growth. This special role is attributable, firstly, to the realisation that in the long term – i.e. once all adjustment processes have been completed – inflation is a monetary phenomenon, and, secondly, to the empirical finding that a stable long-run relationship exists between the money stock M3 and the price level in the euro area.

Other economic and financial indicators

Recognising that additional information from other sources is needed for assessing the price outlook over the short to medium term, the ECB Governing Council decided to supplement its basic orientation to monetary growth with a second pillar in the form of a broadly based assessment of risks to price stability. Within the context of this second pillar the ECB Governing Council analyses a variety of additional information on the economic and financial situation. This comprises indicators of both the supply and demand-side pressures, various price and cost variables plus certain information extracted from financial market prices. For the purpose of analysing future price pressures, the Governing Council also looks at growth and inflation forecasts drawn up by other institutions and projections made within the Eurosystem.[1]

Survey data on expected price developments

Price indicators include not only consumer prices, their components and their intermediate levels but also measures of expected price developments derived from surveys. The use of survey data is an alternative to other indirect methods of measuring price expectations, which generally rely on certain critical assumptions.[2] On the other hand, the quality of survey data depends very much on the size of the sample, the wording of the questions and the motives of the respondents.

Available surveys

There are various Europe-wide surveys that can be used for computing price expectations. These notably include the business and consumer surveys compiled on behalf of

1 The role of the projections is explained in: ECB, The two pillars of the ECB's monetary policy strategy, Monthly Bulletin, November 2000; see in particular the box on page 43 f.
2 For the pros and cons of indirect measures of expectations, see Deutsche Bundesbank, Financial market prices as monetary policy indicators, Monthly Report, July 1998, pages 49 to 66.

the European Commission, the surveys of professional experts carried out by the London-based institute Consensus Economics, and the Survey of Professional Forecasters conducted by the ECB.[3]

Time horizon and number of observations

This article examines the information content of these survey data for monetary policy purposes. The analysis focuses on expectations of price changes over the next twelve months as gleaned from the EU Consumer Survey and the price forecasts for the same period of time ascertained by Consensus Economics. The advantage of the Consensus Forecasts over the expert forecasts gathered by the ECB is that the Consensus data stretch back to the late eighties; this makes it possible to construct time series containing a sufficient number of observations for analytical purposes. The surveys of enterprises compiled by the European Commission are disregarded because they are geared to producer prices and consequently are to be interpreted more as firms' pricing intentions rather than as expectations of general price developments. However, internal studies have shown that they can be a useful aid in forecasting producer prices over the shorter term.

Description of the survey data used

EU Consumer Survey of expected price developments

A harmonised consumer survey relating, among other things, to assessments of past and future price developments is conducted monthly in the member states of the European Union. The surveys are carried out by national institutes; in Germany, for instance,

this task is performed by the *Gesellschaft für Konsumforschung (GfK).*

Size of the sample and type of questions asked

The EU survey data are characterised by a large sample size (up to 2,500 households surveyed per country) and a detailed breakdown of responses by category. There are six categories for each response, shown in the table on page 38. The available data give the percentages of the respondents in each response category. Owing to the large sample size and the selection criteria applied by the polling institutes, it may be assumed that the basket of goods relevant for the surveyed households more or less corresponds to the basket of goods of the average household used by statistical offices to measure consumer price movements. The survey data may thus be interpreted as an assessment of the direction of change of the respective national consumer price index.[4]

Conversion method

A method developed in the literature, which is described in detail in the Annex, can be used to convert the percentage shares of responses in each category into absolute expectation values for future price developments.

Pattern of price expectations for selected countries

The chart on page 39 shows the pattern of price expectations culled from the EU survey

3 There are also a host of country-specific surveys, for example in Germany those of the Centre for European Economic Research *(Zentrum für Europäische Wirtschaftsforschung, or ZEW).* The inflation expectations gathered by ZEW cover a forecast horizon of six months and are based on a survey of around 350 financial experts from banks, insurance companies and selected business firms.
4 See Reckwerth, J. (1997), Inflation and output in Germany: the role of inflation expectations, Discussion paper 5/97, Economic Research Group of the Deutsche Bundesbank, page 13.

Questions and response categories of the EU Consumer Survey on price developments	
How, in your view, have prices moved during the past 12 months?	How, in your view, will prices move in the coming 12 months?
Fallen slightly	Fall slightly
Hardly changed	Stay roughly the same
Risen slightly	Rise less sharply than before
Risen moderately	Rise by roughly the same amount as before
Risen sharply	Rise more sharply than before
Don't know	Don't know
Deutsche Bundesbank	

data for the three largest euro-area countries. In the diagrams, the expectations formed in the corresponding month of the previous year (t-12) are compared with the actual rates of increase in the respective national consumer price index in month t.[5] The difference between the two series at time t measures the "forecast" error.

Calculation of an aggregated series for the euro area

In order to have a measure at hand for the entire euro area, the obvious step is to aggregate the price expectations calculated for the individual countries to form a euro-area series. The countries' respective shares in euro-area consumer expenditure in 1999 are used as weights.[6] The fourth diagram in the chart on page 39 shows the pattern of aggregated price expectations relative to measured inflation. Finland and Austria are included in the

aggregated figure only from mid-1997 owing to their later accession to the EU.

At first glance, the expectations computed from the EU data seem to trail the actual price trend more or less strongly. Thus the surveyed households systematically underestimated inflation during the phase of accelerating rates of price increases up to mid-1991 but then distinctly overestimated it during the period of decelerating rates of price increases lasting from mid-1992 to mid-1993. Since March 1999, price expectations have risen virtually parallel to currently observable price developments and since September 2000 have been slightly above the 2 % mark. On the other hand, it should be noted that the downward trend in the inflation rate between mid-1993 and the beginning of 1999 was anticipated correctly. This would indicate that not only a backward-looking component but also other explanatory factors play a role in the formation of expectations.

Expectations and actual price developments

One potential weakness of surveys of households such as the EU Consumer Survey is that there is little economic incentive for the respondents to state their expectations correctly. Some critics therefore recommend that surveys should be conducted exclusively among professional forecasters who also sell

Consumer surveys versus expert surveys

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5 Since survey data for Germany as a whole are only available from the beginning of 1997, west German data were used until the end of 1996 and pan-German data from January 1997.
6 These total 32.4 % for Germany, 22.5 % for France, 18.2 % for Italy, 9.1% for Spain, 5.8 % for the Netherlands, 3.2 % for Austria, 1.9 % for Finland and Portugal, 1.2 % for Ireland and 3.9 % for the former currency union between Belgium and Luxembourg.

their forecasts on the market.[7] However, other authors point out that professional forecasters, especially, could have tactical motives for deviating from their "true" forecasts when providing information.[8]
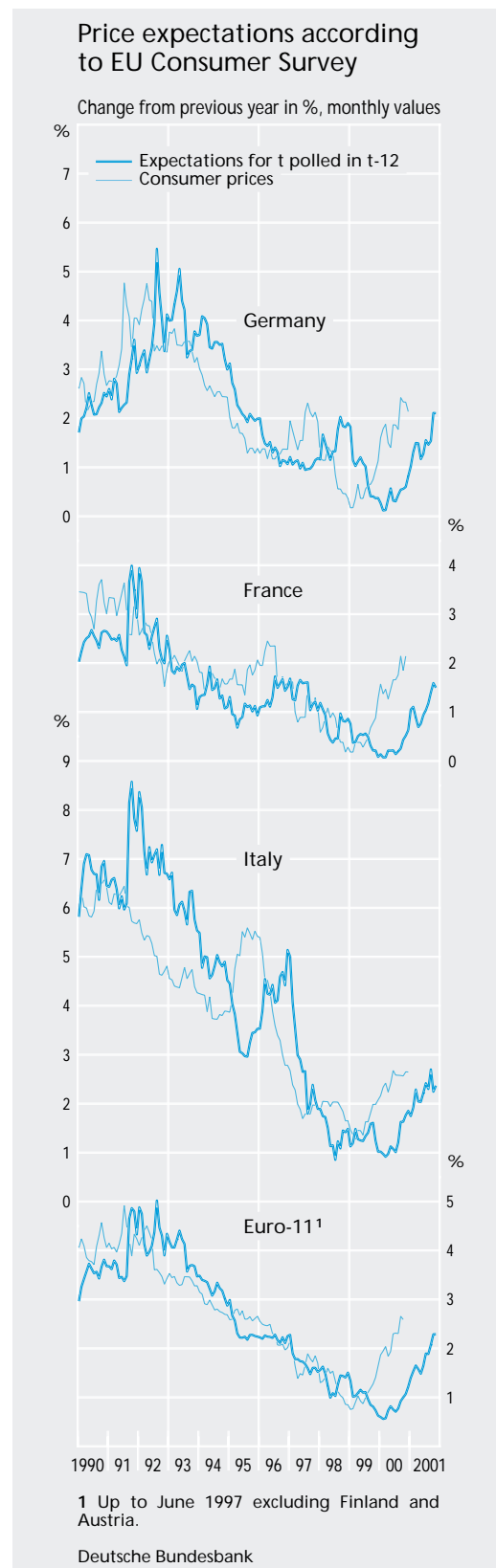
Expert survey by Consensus Economics

The London-based institute Consensus Economics has been conducting surveys since autumn 1989 in which renowned professional experts are asked for their assessment of the outlook for key macroeconomic variables in over 20 industrial countries. For each of the largest industrial countries, including Germany, France, Italy, Spain and the Netherlands, an expert panel is consulted which is recruited from representatives of the most important banks, securities trading firms, economic research institutes and other economic agencies in the country concerned. For a number of other countries, including the rest of the euro-area countries, Consensus Economics publishes forecasts based on information provided by ten leading international institutions.

Time horizon of the Consensus forecasts

However, the problem with the regular monthly Consensus survey is that the forecasts are made in each case for the current year and the following year and thus do not have a fixed forecast horizon. The Quarterly Consensus Forecasts are therefore more interesting for analytical purposes; they give the country experts' assessment for each of the following six (or sometimes even seven) quar-

7 See: Keane, M. P. and D. E. Runkle (1990), Testing the Rationality of Price Forecasts: New Evidence from Panel Data, American Economic Review, Vol. 80, No. 4, page 715.
8 See: Lamont, O. (1995), Macroeconomic Forecasts and Microeconomic Forecasters, NBER Working Paper No. 5284.

Price expectations according to EU Consumer Survey

Change from previous year in %, monthly values

— Expectations for t polled in t-12
— Consumer prices

Germany

France

Italy

Euro-11[1]

1 Up to June 1997 excluding Finland and Austria.

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averages, which explains the steadier path of the series.[10]

The Quarterly Consensus Forecasts showing here the survey data for Germany of December 11, 2000 *		
Change from previous year in %		
Forecast horizon	Consumer prices	
2000 1st qtr	[1]	1.8
2nd qtr	[1]	1.6
3rd qtr	[1]	2.0
4th qtr		2.3
2001 1st qtr		2.2
2nd qtr		2.0
3rd qtr		1.6
4th qtr		1.3
2002 1st qtr		1.3
2nd qtr		1.5

* Source: Consensus Economics, Consensus Forecasts, December 2000, page 3. — **1** Official figures.

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ters. The table on page 40 shows the results of the last survey of this type, dating from December 11, 2000, for the rates of change of German consumer prices.[9]

Price forecasts for selected countries

The Quarterly Consensus Forecasts are available for Germany, France and Italy from November 1989 and for Spain and the Netherlands from December 1994. These data can be used to construct time series of the price developments expected by the surveyed experts for fixed time horizons of between one and six quarters. The chart on page 41 shows the forecasts of the rate of consumer price increases four quarters ahead, i.e. a forecast horizon which matches the time horizon of the price expectations calculated from the EU Consumer Survey. In contrast to the chart on page 39, the rates shown here are quarterly

Computation of an aggregated series

If the forecasts available for the euro-area countries are aggregated to form a joint series, the result is the pattern depicted on page 42. Since the quarterly forecasts for Spain and the Netherlands are only available from autumn 1994, the transition from the EMU-3 series to the EMU-5 series occurs in the fourth quarter of 1995. To enable a direct comparison to be made, the lower diagram in the chart shows the pattern of price expectations resulting from a corresponding aggregation of the EU survey data.

Consensus Forecasts and actual price trends

One striking feature is that the professional experts polled by Consensus Economics failed to correctly anticipate either the deceleration of inflation in the first half of the nineties or the further sharp slowing of inflation rates in the run-up to monetary union. The overestimation of the actual rate of price increases by the Consensus forecasts was particularly marked in the case of France but also – in certain phases, most notably at the turn of 1998-9 – in Germany. Nor was the most recent turning point in price trends predicted correctly, which was, however, caused by exogenous factors (the oil price shock).

9 These figures are the arithmetical means of the individual forecasts submitted by the surveyed experts for Germany.
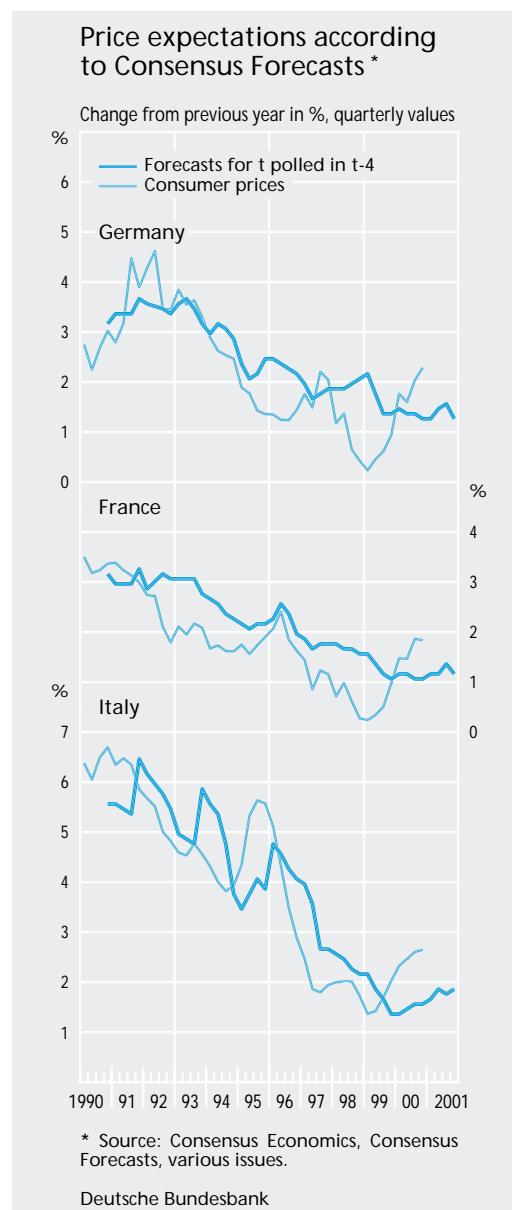**10** Since the beginning of 1994, the quarterly forecasts have been polled in March, June, September and December. In 1992 and 1993 these surveys were taken in February, May and November; in 1990 and 1991 they were taken in February, July and November. The two missing observations for the second quarter of 1990 and 1991 were approximated by interpolating the preceding and following observation.

*Comparison
of predictive
power*

In order to compare the predictive power of the Consensus Forecasts with that of the EU survey data, use may be made of statistical measures such as the mean absolute forecast error, the root mean square error or Theil's inequality coefficient, which gives the forecast error relative to the static forecast ("no change in the inflation rate"). The table on page 43 summarises the values of these measures for the survey data considered here. It indicates that the mean absolute forecast error of the aggregated Consensus Forecasts was marginally smaller than the corresponding value for the EU survey data. Broken down by country, the Consensus Forecasts for Germany and Italy outperform the consumer price expectations much more clearly. In the case of France, by contrast, the expert forecasts show a larger absolute forecast error than the expectations of price changes calculated from the EU Consumer Survey.

*Expectation
indicators and
monetary policy
strategy*

The central banks in the Eurosystem have a vested interest in observing and analysing the survey data described here since they can provide valuable clues as to how the private sector assesses the outlook for prices. However, this should not lead us to conclude that these data are suitable for use as benchmarks or even as intermediate targets of monetary policy.[11] Rather, it seems appropriate to analyse them within a broader context together with other indicators. By contrast, gearing monetary policy decisions primarily to private-sector forecasts would be problematic, if only because such forecasts are themselves influenced by expectations regarding the future monetary policy course.[12]

Price expectations according to Consensus Forecasts *

Change from previous year in %, quarterly values

* Source: Consensus Economics, Consensus Forecasts, various issues.

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[11] See, for instance: Svensson, L. (1999): Inflation targeting as a monetary policy rule, Journal of Monetary Economics, Vol. 43, pages 607–654; and Bofinger, P. (2000), *Inflation targeting: Was kann die EZB daraus lernen?,* in: Deutsche Bank Research, EWU Monitor, No. 83, April 27, 2000.
[12] See Bernanke, B. S. and M. Woodford (1997), Inflation Forecasts and Monetary Policy, NBER Working Paper No. 6157.

Aggregated price expectations for the five largest euro-area countries *

Change from previous year in %, quarterly values

Consensus Forecasts [1]

Forecasts for t polled in t-4

Consumer prices

Consumer price expectations

Expectations for t polled in t-4

Consumer prices

1990 91 92 93 94 95 96 97 98 99 00 2001

* Up to the third quarter of 1995 excluding Spain and the Netherlands. — **1** Source: Consensus Economics, Consensus Forecasts, various issues, Bundesbank calculations.

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The link between inflation, inflation expectations and real economic activity

The use of survey data for analytical purposes

Survey data on expected price developments have an additional information content over and above their indicator function. In the following, selected examples are used to demonstrate how the survey data presented in this article may be used to gain new insights into the influence of inflation expectations on price developments and to find out more about how the surveyed households and experts form their expectations.

Role of inflation expectations in the transmission process

There is a broad consensus among economic scholars and practitioners alike that private-sector inflation expectations play a key role in the monetary transmission process. [13] This key role is based on two factors: the importance of inflation expectations for the level of short-run real interest rates, and the fact that inflation expectations are an important determinant of price formation in the product and labour markets and thereby exert a direct influence on general price developments.

Inflation expectations, wage agreements and price developments

Developing this idea further, some new theoretical studies derive the influence of inflation expectations on the overall price level directly from the price-setting and wage-setting behaviour of firms and trade unions. [14] A key ingredient of these models is the assumption that the level of wage settlements depends on the expected price development and the degree of utilisation of production capacity. Moreover, it is assumed that firms react to changes in wage costs by correspondingly adjusting their prices for goods and services. In the aggregate, these assumptions lead to a behaviour equation which establishes a relationship between the inflation rate $\Delta P/P$, inflation expectations $E(\Delta P/P)$ and the output gap, $(Y-Y^*)/Y^*$:

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[13] See, for example, ECB: Monetary policy transmission in the euro area, Monthly Bulletin, July 2000, page 43 ff.
[14] These approaches are discussed in: Goodfriend, M. and R. King (1997), The New Neoclassical Synthesis and the Role of Monetary Policy, in: B. Bernanke and J. Rotemberg (eds.), NBER Macroeconomics Annual, Cambridge, MA, pages 493 to 530.

Comparison of the predictive power of Consensus Forecasts and price expectations from the EU Consumer Survey

Estimation period: 4th qtr of 1990 to 4th qtr of 2000

Price expectations according to	EMU-5 [1]	Germany	France	Italy
Mean absolute forecast error				
Consensus Forecasts	0.51	0.61	0.63	0.82
EU Consumer Survey	0.52	0.77	0.53	1.06
Root mean square forecast error				
Consensus Forecasts	0.60	0.76	0.72	0.93
EU Consumer Survey	0.64	0.91	0.68	1.29
Theil's inequality coefficient [2]				
Consensus Forecasts	0.85	0.72	1.00	0.73
EU Consumer Survey	0.92	0.88	0.94	1.06

1 Consisting of Germany, France, Italy, Spain and the Netherlands. Up to the third quarter of 1995 excluding Spain and the Netherlands. — **2** The Theil inequality coefficient given here indicates the forecast error of the survey data relative to the naive extrapolative forecast $(E_t\pi_{t+4} = \pi_{t-1})$. Values smaller than unity imply that the forecasts of the surveyed households and experts outperform the naive extrapolative forecast.

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$$(1) \quad \frac{P_t - P_{t-1}}{P_{t-1}} = E_t\left(\frac{P_{t+1} - P_t}{P_t}\right) + a\left(\frac{Y_t - Y_t^*}{Y_t^*}\right) + b(s_t)$$

Exogenous factors

The variable s is a proxy for all other factors relevant to firms' price formation, such as the path of oil prices and other commodity prices. In an open economy it must be borne in mind, in particular, that the price level of domestically produced goods and services deviates from the consumer price level relevant to employees. If the development of consumer prices is used as the measure of inflation in equation (1), the prices of imported consumer goods need to be included among the exogenous factors which appear on the right-hand side of equation (1).

Since the average duration of wage agreements in the United States and Europe is be-tween one and two years, equation (1) is usu-ally interpreted as a model for price develop-ments over a time horizon of one year.[15] This time frame is consistent with the horizon of the survey data on expected price develop-ments described above. In principle, there-fore, expectations regarding price changes culled both from the EU survey and from the Consensus inflation forecasts may be used for empirically testing the inflation model de-scribed by equation (1).[16]

Time horizon of price develop-ments

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15 See Rudebusch (2000), page 4, who estimates a modified version of equation (1) using US survey data. Rudebusch, G. D. (2000), Assessing Nominal Income Rules for Monetary Policy with Model and Data Uncertainty, Working Paper No. 14, ECB Working Paper Series. **16** See the estimations in Gerberding, C. (2001), Inflation and inflation expectations, Discussion paper, Economic Research Centre of the Deutsche Bundesbank (forthcoming).

*Testing the
inflation model
empirically*

One reason for using the Consensus Forecasts is that they are published, receive media attention and are therefore also likely to affect the formation of expectations by wage bargainers. The table on page 45 gives an overview of the estimation results for inflation equation (1) estimated on the basis of the Consensus Forecasts of consumer price developments in Germany, France and Italy. The variable used as the measure of the output gap is the deviation of real output from its longer-term trend growth, which was determined beforehand using a simple trend estimation for the period between the first quarter of 1975 and the fourth quarter of 1999.[17] The rate of change of import prices was included as an additional exogenous variable.

*Comparison of
estimation
results for
Germany,
France and Italy*

With adjusted coefficients of determination of between 86 % and 90 %, the explanatory content of the approach is very satisfactory. The estimated coefficients have a plausible order of magnitude and are significantly different from zero. The coefficient of inflation expectations is highly significant, and in no case is it very far from unity. There are considerable country-specific differences regarding the speed and strength of transmission of real economic impulses to prices. Whereas in Germany and France prices only reacted after a time lag of one year to changes in the output gap during the period under review, the main impact of a corresponding rise or fall in capacity utilisation in Italy on inflation made itself felt in the same year. In addition, the reaction of prices to a change in output relative to potential was twice as strong in Italy as in Germany and France. Consequently, caution should be exercised when using an aggregate

inflation model for all three countries, at least until there are clear signs of a stronger convergence of national inflation processes.[18]

Determinants of inflation expectations

The empirical study thus confirms the importance of inflation expectations for shorter-term developments of consumer prices. This highlights the question of which determinants serve as an orientation for market participants in the formation of their expectations. This question is not only of theoretical interest but also has important practical implications for monetary policy. If the central bank does not succeed in anchoring inflation expectations at the desired low level, it must combat the "excessive" expectations by pursuing a restrictive monetary policy course. The attendant real costs in the form of output and employment losses would then in turn jeopardise public acceptability of a monetary policy geared to price stability.[19]

*Importance of
expectations
formation for
monetary policy*

The spectrum of expectations formation models discussed in the literature ranges from simple, purely backward-looking "rules

*Spectrum of
expectations
formation
models*

17 The (logarithmic) real GDP is regressed on a linear time-trend and its square. The squared trend gives the estimation of the potential an extra degree of freedom without having to specify a particular point in time for the change in the trend.
18 It is only possible to estimate an unbiased aggregate equation if either the parameters of the disaggregated equations are identical or if the respective shares of each country in the aggregated variables remain constant throughout the period. It is apparent that neither condition is met in the present case. See: Wesche (1998), *Die Geldnachfrage in Europa,* Heidelberg, page 61.
19 Some US economists call this dilemma the "expectations trap". See: Christiano, L. J. and C. Gust (2000), The expectations trap hypothesis, Economic Perspectives, Federal Reserve Bank of Chicago, Vol. 25, pages 21 to 39.

Estimation results for the relationship
between inflation and inflation expectations
based on Consensus Forecasts

Estimated equation

$$\Delta_4 p_t = c_1 E_t^s(\Delta_4 p_{t+4}) + c_2 \tilde{z}_t + c_3 \tilde{z}_{t-4} + c_4 \Delta_4 pim_t + c_5 \Delta_4 pim_{t-4} + c_6 + \varepsilon_t^\pi$$

$\Delta_4 p_t$	: Year-on-year rate of change in the consumer price index (CPI)
$E_t^s(\Delta_4 p_{t+4})$	: Consensus Forecasts of the rate of change in the CPI one year ahead
$\tilde{z}_t$	: Output gap (average over the past four quarters)
$\Delta_4 pim_t$	: Year-on-year rate of change in import prices

Quarterly data, estimation period: 1st qtr 1990 to 4th qtr 1999
Estimation method: two-stage least squares [1]
Newey-West correction of standard errors [2]

Results	Germany	France	Italy
Coefficient of expected price developments (Consensus Forecasts)	1.04 *** (0.11)	0.91 *** (0.11)	0.82 *** (0.11)
Coefficient of current output gap	–	–	0.53 *** (0.18)
Coefficient of output gap lagged by one year	0.19 *** (0.02)	0.20 *** (0.04)	–
Coefficient of current rate of change in import prices	0.11 *** (0.03)	0.14 *** (0.04)	0.09 *** (0.03)
Coefficient of rate of change in import prices lagged by one year	–	0.07 *** (0.02)	0.08 *** (0.03)
Adjusted coefficient of determination	0.89	0.86	0.90
Test of overidentifying restrictions, p values [3]	0.46	0.41	0.68
First-order autocorrelation coefficient [4]	0.50	0.44	0.61
Fifth-order autocorrelation coefficient [4]	– 0.01	– 0.27	– 0.32

***(**/*) denotes significance at the 1% (5 %/10 %) level; values in brackets denote the HAC consistent standard errors (Newey-West). — **1** The instruments used are lagged values of the endogenous and explanatory variables. — **2** Carried out because the overlapping of the endogenous variables by up to four quarters may cause autocorrelation of the first to (at most) the fourth order. — **3** Test of orthogonality of the residuals against the instruments used; see Davidson, R. and J. G. MacKinnon (1993), Estimation and Inference in Econometrics, New York, page 235 f. — **4** The standard error according to Bartlett is $1/\sqrt{T}$, that is 0.16 for T equal to 40.

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of thumb" to the theory of rational expectations formulated by Muth.[20] One of the best-known rules of thumb is the hypothesis of adaptive expectations, which states that economic agents revise their expectations in the light of past expectation errors. The weakness of the simple backward-looking approaches is their assumption that only past price developments and earlier forecasts are used to form expectations while other influences are disregarded; this can create systematic errors. In his definition of "rational" expectations, by contrast, Muth assumes that the subjective expectations of economic agents match the predictions of the relevant economic theory.[21] An essential feature of Muth's definition of rational expectations, therefore, is that economic agents do not make systematic errors.

Taking account of information problems...
The assumption that economic agents possess full knowledge of the transmission process is doubtless an extreme case that cannot be maintained outside a prolonged steady state of equilibrium. Many critics have emphasised the importance of information problems and have stressed the need to take into account the costs of making optimal forecasts and also to explicitly model learning processes.[22]

...points to assumption of partly rational and partly adaptive expectations
With regard to the inflation model presented here, some authors have supposed that only a certain fraction of agents make optimal forecasts in the statistical sense, whereas others rely on simple, purely backward-looking rules of thumb.[23] The reasoning behind this is that the additional utility of optimal forecasts compared with an adaptive adjust-

ment of expectations is likely to be small, at least for a certain fraction of market participants. If that is the case, adaptive expectations could be "near"-rational, or could be perfectly rational at least for those agents for whom the costs of obtaining and processing information exceed the additional utility of optimal forecasts.[24]

Analysis of the survey data for Germany...
Behavioural differences of this type can be represented using an expectations formation model which contains both a forward-looking "rational" component and a backward-looking component in the form of an adjustment of expectations for earlier forecasting errors. The empirical relevance of this model can be tested using the available survey data. The table on page 47 provides an overview of the estimation results for the Consensus Forecasts and the consumer price expectations ascertained in Germany. In both cases the forward-looking and backward-looking elements of expectations formation both turn out to be significant. However, the relative weight of the forward-looking component is greater in the expert forecasts, which probably owes something to the fact that that this group of people have a greater incentive to consider

20 Muth, J. F. (1961), Rational expectations and the theory of price movements, Econometrica, 29, pages 315 to 335.
21 In Muth's own words: "Expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory." Muth (1961), op. cit., page 316.
22 See Pesaran, M. H. (1989), The limits to rational expectations, Oxford, chapter 3.
23 See Roberts, J. M. (1997), Is Inflation sticky?, Journal of Monetary Economics, 39, pages 173 to 196, and Gali, J. and M. Gertler (2000), Inflation Dynamics: A Structural Econometric Analysis, NBER Working Paper No. 7551.
24 This argument goes back to Akerlof, G. A. and J. L. Yellen (1985), A Near-Rational Model of the Business Cycle with Wage and Price Inertia, Quarterly Journal of Economics, 100, Supplement, pages 832 to 838.

Estimation results for the structure of expectations formation based on survey data for Germany

Estimated equation: $E_t^s \Delta_4 p_{t+4} = c_1 \Delta_4 p_{t+4} + (1-c_1)[E_{t-5}^s \Delta_4 p_{t-1} + c_2(\Delta_4 p_{t-1} - E_{t-5}^s \Delta_4 p_{t-1})] + \varepsilon_t^\pi$

$E_t^s(\Delta_4 p_{t+4})$: Expectations for the rate of change in CPI in four quarters (t+4) polled in t
$\Delta_4 p_{t+4}$: Actual year-on-year rate of change in CPI in t+4
$(\Delta_4 p_{t-1} - E_{t-5}^s \Delta_4 p_{t-1})$: Latest forecast error known at time of survey

Quarterly data, estimation period: 1st qtr 1991 to 4th qtr 1999
Estimation method: two-stage least squares [1], Newey-West correction of standard errors [2]

Results	Consensus Forecasts	EU Consumer Survey
Share of forward-looking component (c_1)	0.32 *** (0.11)	0.23 ** (0.09)
Share of backward-looking component ($1-c_1$)	0.68 *** (0.11)	0.77 *** (0.09)
Extent of error correction (c_2)	0.24 * (0.13)	1.18 *** (0.15)
Adjusted coefficient of determination	0.80	0.90
Test of overidentifying restrictions, p values [3]	0.42	0.20
First-order autocorrelation coefficient [4]	0.77	− 0.13
Ninth-order autocorrelation coefficient [4]	0.24	− 0.01

***(**/*) denotes significance at the 1% (5%/10%) level; values in brackets denote the HAC consistent standard errors (Newey-West). — **1** The instruments used are lagged values of the explanatory variables. — **2** Carried out because the data structure may cause autocorrelation of the first to (at most) the eight order. — **3** Test of orthogonality of the residuals against the instruments used; see: Davidson, R. and J. G. MacKinnon (1993), op. cit., page 235f. — **4** The standard error according to Bartlett is $1/\sqrt{T}$, that is 0.17 for T equal to 36.

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the matter in depth than do the ordinary households polled in the EU survey.

...reveals differences in the structure of expectations formation

Another finding is that the surveyed households orient themselves much more strongly to the current inflation rate than do the German experts surveyed by Consensus Economics. By contrast, the Consensus Forecasts are characterised by the relatively large weight given to past forecasts, which can be construed to mean that the surveyed experts only gradually adjust their assessment to new information. A "rational" reason for this could lie in the considerable uncertainty that generally surrounds the reliability of available data and of the forecasting models used.[25]

Outlook

Summary of results

The results presented here underline the importance of price expectations for the short to medium-term development of goods prices. Furthermore, they suggest that, when forming their expectations, the surveyed households and professional experts are guided by past price developments and earlier forecasts but, at the same time, also incorporate additional information into their assessment.

Implications for monetary policy

From a monetary policy perspective, the existence of a backward-looking component in the formation of expectations is important

25 See Deutsche Bundesbank, Financial market prices as monetary policy indicators, Monthly Report, July 1998, page 57.

because this component retards the speed at which the economy adjusts to changes in the underlying conditions. The resultant "stickiness" of inflationary processes, once they have set in, reinforces the need for monetary policy makers to adopt a forward-looking stance.[26] At the same time, evidence of a forward-looking component in the formation of expectations has important monetary policy implications. If at least a certain fraction of market participants behave in a forward-looking manner, the efficacy of monetary policy measures depends not least on those par-

ticipants' expectations regarding the goals and future course of central bank policy. In such an environment the central bank must do its utmost to convince market participants of its determination to adhere to a stability-oriented course. The tasks of clearly defining the ultimate objective and announcing a comprehensible and transparent monetary policy strategy play a key role in this context.

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[26] See Batini, N. and A. Haldane (1999), Forward-looking rules for monetary policy, Bank of England Working Paper No. 91.

Annex

Description of the method used to quantify EU Consumer Survey data

The tendency responses from the EU Consumer Survey were quantified using the distribution function approach originally developed by Carlson and Parkin, which was specially extended by Batchelor and Orr for the British segment of the EU Consumer Survey to deal with more than three response categories.[27]

The basic concept of the distribution function approach is that every respondent forms a subjective probability distribution with a density function for the expected change in the price index on which he bases his response. It is further assumed that an aggregated density function covering all respondents can be derived from the subjective density functions. With the central limit theorem in mind, it is usually assumed that the aggregated density function follows a normal distribution or a logistic distribution. Since earlier studies have shown that both alternatives lead to very similar results, a

logistic distribution is assumed for computational convenience.[28]

Under these assumptions, the respective shares of respondents in the individual response categories can be assigned to corresponding areas below the distribution of the aggregated density function (or values on the cumulative density function) which reflect the respective probabilities.[29] The expected value of the density function specified in this way may then be interpreted as the mean expected inflation rate of all respondents.

It must also be borne in mind when quantifying the EU survey data, however, that the answer categories "Rise less sharply than before", "Rise by roughly the same amount as before", and "Rise

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[27] See Batchelor, R. A. and A. B. Orr (1988), Inflation Expectations Revisited, in: Economica, Vol. 55, pages 317 to 331, and Carlson, J. A. and M. Parkin (1975), Inflation Expectations, in Economica, Vol. 42, pages 123 to 137.
[28] See Reckwerth (1997), op. cit., page 15 f.
[29] The responses in the "Don't know" category are redistributed proportionately among the other categories.

more sharply than before" establish a link between the rate of price increase expected for the future and the rate recorded in the past . For the conversion procedure, this implies that the mean expected inflation rate $E_t\pi_{t+12}$ is the product of the mean assessment of price developments over the past 12 months π_{t-1}' and a factor x_t which reflects the change in the assessment of future price developments relative to past price developments (calculated using the cumulative density function): [30]

$$(2)\ \pi^e_{t+12} = \pi'_{t-1}x_t$$

This raises the question as to which measure is to be used for the average assessment of past price increases, π_{t-1}'. One possible method that springs to mind would be to use the information on the assessment of past price movements from the first part of the question. However, this solution is hampered by the fact that the response categories "Risen slightly", "Risen moderately" and "Risen sharply" place the assessment of past price movements, in turn, in relation to the rate of price increases perceived as "moderate". In order to be able to use the responses from the first part of the question, additional assumptions must therefore be made as to what the surveyed households consider to be a moderate rate of price increase. [31]

To overcome these problems, it was assumed for simplicity when calculating the series used here that the surveyed households correctly assessed price developments over the past 12 months. This assumption appears not to be all that problematical insofar as the rate of change in consumer prices is a variable that is published on a monthly and timely basis in the countries considered.

Despite the fact that the catalogue of questions and possible answers is standardised, the wording of the questions and response categories in France and Spain display certain national peculiarities. [32] Due account was taken of these discrepancies during the conversion process.

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30 For the exact derivation of this term see Reckwerth (1997), op. cit., page 56 ff.
31 See Batchelor/Orr (1988), op. cit., page 322 f.
32 See Gerberding (2001), op. cit., Annex A1.