ARTICLES

INFLATION EXPECTATIONS IN THE EURO AREA: A REVIEW OF RECENT DEVELOPMENTS

Inflation expectations are used by the ECB to gain an insight into the private sector's assessment of the outlook for future inflation and to evaluate perceptions about the credibility of monetary policy, as part of a set of indicators. They are important for indicating the confidence of the public in the ability of the central bank to deliver on its price stability mandate. Inflation expectations cannot be observed directly, but approximate measures can be derived indirectly from financial markets and by surveying professional forecasters. An analysis of the main factors influencing the various available measures in the euro area shows that temporary shocks to volatile components of inflation, such as those related to commodity prices, tend to affect short-term expectations, while longer-term measures of inflation expectations have been broadly insensitive to the propagation of temporary shocks. The fact that longer-term expectations have remained well-anchored at levels consistent with the ECB's definition of price stability demonstrates the credibility earned by the ECB as a central bank with price stability as a clear objective. The stability of inflation expectations has been particularly remarkable during the past three years, which have been challenging for monetary policy given the major shocks that have hit the euro area and the global economy. Well-anchored expectations have contributed to enhancing the effectiveness of monetary policy and will assist the ongoing economic recovery.

1 INTRODUCTION

Expectations are at the core of contemporary macroeconomic theory and play a key role in modern central banking practice.[1] Monetary policy involves anticipating future developments, monitoring and shaping private sector inflation expectations over the cycle, and providing a long-term nominal anchor for the economy. To this end, central banks must constantly form a view of the economic outlook in the medium term, taking into account the significant, long-lasting impact of their decisions on expectations. The maintenance of price stability in many countries in the last two decades is partly due to the full recognition of the pivotal role of expectations in macroeconomic behaviour and monetary policy conduct.

While price stability is the best contribution that monetary policy can make to sustainable economic growth, job creation and welfare,[2] the credibility of the monetary authority to consistently deliver stable prices is built and preserved over time. Such credibility is key to the process by which agents form expectations of future price developments and thus to the price formation mechanism itself. Central banks must constantly monitor the general public's perceptions about their commitment to maintaining price stability as a proxy for the likelihood that they will indeed accomplish their objective. In this respect, the anchoring of longer-term inflation expectations is a crucial indicator of a central bank's credibility. It is also a precondition for effective monetary policy conduct and, ultimately, for central banks' success in maintaining price stability.

In particular, when inflation is boosted by temporary shocks, monitoring expectations is key to assessing the risk that such temporary shocks may lead to longer-lasting effects on inflation via their impact on domestic price and wage setting. Ensuring that inflation expectations remain well-anchored, particularly in the medium to long run, is of key interest

1 A broad-based analysis can be found in the article entitled "Expectations and the conduct of monetary policy" in the May 2009 issue of the Monthly Bulletin.

2 For instance, when inflation increases, it becomes more difficult for private agents to disentangle changes in relative prices (knowledge of which is needed to allocate resources efficiently and enhance overall productivity in the economy) from changes in the general level of prices. High and unexpected inflation also inevitably leads to arbitrary redistribution of wealth and income. Moreover, it exerts a negative impact on capital accumulation and thus on long-run productivity, owing to the non-indexation of the tax system and higher interest rates. See the article entitled "Price stability and growth" in the May 2008 issue of the Monthly Bulletin for further discussion.

to policy-makers. For these reasons, inflation expectations are of great importance for the conduct of monetary policy and are closely monitored by the ECB.

In the last 10-15 years, it has become standard among central banks to communicate a quantified objective for price stability as part of their monetary policy strategy. Available studies clearly indicate that the announcement of an explicit price stability objective contributes to anchoring inflation expectations. In 1998 the Governing Council of the ECB defined price stability for the euro area as a year-on-year HICP inflation rate of below 2%. Following a thorough evaluation of the strategy in 2003, the Governing Council further clarified that it aimed to maintain euro area inflation rates "below, but close to, 2%" over the medium term. This definition has provided a very precise guide for markets and has clearly acted as a focal point for inflation expectations in the euro area.

Beyond the quantitative definition of price stability, the successful anchoring of longer-term inflation expectations also depends on the commitment of the monetary authority to fulfilling its mandate. The credibility of the ECB's commitment to fulfilling its mandate is deeply rooted in the institutional framework of EMU. The Treaty clearly establishes that monetary policy in the euro area is conducted by an independent central bank, which has been assigned the primary objective of maintaining price stability.

The credible commitment of the Governing Council to delivering price stability by implementing consistent and systematic policy action has helped to keep medium and longer-term inflation expectations firmly anchored, even in the wake of large, adverse shocks during the financial crisis.

Against this background, this article discusses recent developments in inflation expectations in the euro area (the table below provides an overview of the main available measures). It compares market and survey-based indicators, both at the short and medium to longer-term horizons, and explores how these

Summary of the main available measures of euro area inflation expectations

	Agents	Frequency	Start	Horizons
Survey-based measures				
European Commission consumer survey	Consumers	Monthly	1985	12 months ahead (asks for direction of change)
ECB Survey of Professional Forecasters (SPF)	Financial and non-financial institutions	Quarterly	1999	Point forecasts and probability distributions: - Current, next, calendar year after next (rolling one and two years ahead) - Five years ahead
Consensus Economics	Financial and non-financial institutions	Monthly (short term) and biannual (medium to longer term)	1990	Point forecasts - Current and next calendar years - Three, four, five and six to ten years ahead
Euro Zone Barometer (MJEconomics)	Financial and non-financial institutions	Monthly (short term) and quarterly (medium to longer term)	2002	Point forecasts - Current and next calendar years - Two, three and four years ahead
World Economic Survey (IFO)	International and national institutions	Quarterly	1991	- Six months ahead (asks for direction of change) - Current calendar year
Financial market indicators				
Break-even inflation rates	Financial market participants	Intra-day	2004	At present, three to about 30 years ahead
Inflation-linked swap rates	Financial market participants	Intra-day	2003	One to 30 years ahead

Note: Break-even inflation rates are estimated from February 2004.

are formed, focusing in particular on how measures at different horizons respond to different information. The article also reflects on the behaviour of the various available measures during the past three years, which have been challenging for monetary policy, as inflation initially rose on the back of the strong commodity price increases recorded in international markets, before falling sharply in the wake of the global economic and financial crisis which intensified with the default of Lehman Brothers in the autumn of 2008.

The article is organised as follows. Survey-based indicators of inflation expectations are discussed in Section 2, while Section 3 presents the indicators extracted from financial markets and looks into their influences. Section 4 analyses the behaviour of these indicators in recent years, and Section 5 offers some conclusions.

2 SURVEY INDICATORS OF INFLATION EXPECTATIONS

Various survey-based measures of inflation expectations are available, but those followed most closely by the ECB stretch beyond 12 months, such as the ECB Survey of Professional Forecasters (SPF), as well as those of Consensus Economics and the Euro Zone Barometer.[3]

Each of these surveys provides point forecasts of inflation expectations at various horizons, covering both the short and medium to longer term. In the SPF, however, respondents are also requested to provide a quantitative assessment of uncertainty surrounding the reported point forecasts. This assessment of uncertainty is reflected in the reported probability distributions of future inflation outcomes falling within given ranges. Furthermore, SPF respondents are invited to comment on the factors underlying their forecasts and the reasons behind the revisions, with respect to the previous SPF round.[4]

The information available from the SPF allows the computation of various measures of uncertainty surrounding the outlook. For example, the probability distribution provides information on the level of uncertainty surrounding the point forecast. It can be used to evaluate the probability of an inflation outcome above or below a certain threshold. Furthermore, the probability distribution may be used to assess the balance of risks associated with the point forecast. In addition, the standard deviation of the point forecasts of all respondents, commonly referred to as "disagreement", reflects the extent to which forecasters disagree with one another.

Generally speaking, medium-term expectations are most relevant for monetary policy, since they help in assessing the reaction of agents to different shocks in prices, as well as indicating the transient or more persistent nature of the shocks, as perceived by the private sector. The longer the horizon of expectations, the more they reflect the level of credibility accorded to monetary policy by economic agents as regards a central bank's commitment to achieving price stability. Other surveys of inflation expectations, such as the European Commission's consumer survey[5] and the IFO World Economic Survey, only ask about expectations for very short

3 A new survey of inflation expectations was launched by J.P. Morgan Securities Ltd in July 2009. The survey is conducted three times a year and asks for expectations of developments in near-term core inflation, as well as views on medium-term inflation (defined as average headline inflation between two and five years ahead) relative to the respective central bank's objective. The respondents are financial market participants, and the survey covers expectations for the euro area, the United States, the United Kingdom, Japan and Australia.

4 See the box entitled "Results of the ECB Survey of Professional Forecasters for the first quarter of 2011" in this issue of the Monthly Bulletin for more technical details on the ECB SPF and for information on the latest release. See also the box entitled "The forecasting performance of expert surveys" in the January 2011 issue of the Monthly Bulletin for an assessment of the forecast accuracy of expert surveys.

5 The European Commission's consumer survey is conducted at the national level, and the results for the euro area are compiled by aggregating country data. It is qualitative in nature, in that consumers are asked to indicate whether they expect inflation to rise, fall or remain unchanged. The results are summarised using the so-called "balance statistic", which shows the difference between the percentage of consumers thinking that consumer prices will increase and the percentage of consumers stating that prices will decrease or remain unchanged.

periods ahead and are therefore more likely to be affected by temporary shocks. They are therefore a less relevant measure for the purpose of monetary policy. Indeed, a cross-correlation analysis between the European Commission survey and actual inflation reveals that the highest correlation occurs at the same time or for lags of up to seven months, depending on the horizon considered, suggesting that this particular indicator of expectations contains information about horizons that are much shorter than the 12-month horizon to which the survey question refers.[6]

FREQUENCY OF UPDATES AND FORECASTING TECHNIQUES

Understanding the way in which survey indicators of inflation expectations are formed is not easy, as they are based on heterogeneous panels of forecasters who typically employ complex and varied forecasting tools based on different information sets. However, some indications of the factors likely to be influencing such measures of expectations can be drawn from the ad-hoc questionnaire that was conducted by the ECB in the autumn of 2008 in order to learn more about how SPF respondents make their forecasts.[7]

The ad-hoc questionnaire asked SPF respondents to clarify the role of expert judgement and the use of formal econometric models in the forecasts. The answers revealed that models are used extensively to produce the forecasts, but that expert judgement is added by the majority of respondents on top of the model-based forecasts. Furthermore, most respondents replied that their probability distribution is reported on the basis of judgement, with only one-fifth of the respondents generating the probability distribution from a model.

The ad-hoc questionnaire also revealed that the respondents use a wide variety of models to produce their forecasts. Time series models are used most when producing inflation forecasts. Traditional macro models based on supply and demand are also commonly used, particularly for medium and longer-term horizons. The majority of respondents reported that forecasts are updated according to a regular calendar: half of the respondents update their forecasts quarterly and around one-third monthly. Many also update their forecasts following data releases or in the wake of significant shocks.

According to the comments that respondents provide in the regular SPF with their inflation forecasts, the main factors influencing short and medium-term inflation views include: developments in commodity and oil prices, the euro exchange rate (mostly against the dollar), measures of economic slack (such as the output gap, capacity utilisation and the unemployment rate) and wage growth. In addition, changes in indirect taxes and administered prices have been increasingly quoted as factors influencing the inflation outlook in recent rounds. Although these factors directly refer to the SPF, they are likely to broadly apply to other surveys of forecasters, given the large size of the SPF panel and its mix of financial and non-financial institutions.[8]

6 See also the article entitled "Measures of inflation expectations in the euro area" in the July 2006 issue of the Monthly Bulletin.

7 See the document: "A summary of the results from the special questionnaire for participants of the ECB Survey of Professional Forecasters (SPF)", available on the ECB website at: http://www.ecb.europa.eu/stats/prices/indic/forecast/html/index.en.html.

8 The current SPF panel consists of almost 80 respondents from various European Union countries and, despite notable changes in the composition of the panel over time, 30 of them have been members from the very beginning. The respondents are professional forecasters from the financial (55%) and non-financial (45%) sectors.

3 FINANCIAL MARKET INDICATORS OF INFLATION EXPECTATIONS

For a long time, surveys were the main source of information on private sector inflation expectations for central banks, whereas the use of financial instruments required strong assumptions to extract inflation expectations, which made them less suitable for regular monitoring purposes. Over recent years, however, the strong development of markets for inflation-linked instruments, notably inflation-linked bonds, but also derivatives, such as inflation-linked swaps, as well as inflation caps and floors, to name but a few,[9] has significantly facilitated the calculation of inflation expectations embodied in financial asset prices. This section provides some examples of the information provided by inflation-linked financial instruments.

MONITORING SHORT-TERM INFLATION EXPECTATIONS USING INFLATION-LINKED SWAPS

Inflation-linked swaps are an outstanding source of information about private sector inflation expectations, particularly for short-term horizons. An inflation-linked swap is a contract, which involves an exchange of a fixed payment (the so-called "fixed leg" of the swap) for realised inflation over a predetermined horizon. Thus, through the construction of the contract, the fixed swap rate provides a direct reading of the market's expected inflation rate. They are available daily over a wide range of horizons.

An alternative financial market indicator is the break-even inflation rate, which is calculated as the yield spread between nominal and inflation-linked bonds. In contrast, inflation-linked swaps: (i) do not require the estimation of nominal and real term structures, thereby avoiding problems related to the limited number of bonds at short maturities; (ii) are less prone to liquidity distortions resulting from turbulence in financial markets than break-even inflation rates; (iii) are less affected by HICP seasonality than break-even inflation rates, and are therefore more suitable for monitoring inflation expectations at short horizons.[10]

Inflation-linked swaps, as with all market-based indicators of inflation expectations, may include an inflation risk premium component to compensate investors for the risks surrounding inflation expectations over the forecast horizon. Available euro area evidence suggests that such a premium increases with maturity, but remains very limited in size and variability at the horizons considered.[11]

In the specific case of the euro area, the inflation-linked swap market has grown rapidly since 2003, reflecting the increasing demand for inflation-linked instruments and the relatively limited supply of index-linked bonds in the euro area.[12] Indeed, the euro area is currently likely to be the most developed market for inflation-linked swaps in the world, which makes its information particularly suitable for monitoring developments in inflation expectations, most notably for short and medium-term horizons.

Given the fact that they have only recently been developed, there is little empirical evidence on the factors influencing inflation-linked swaps. To determine whether, when and by how much inflation-linked swaps are linked to monetary, real economy, price and financial factors, or a combination of any of them, a large set of

9 For an overview, see the article "Extracting information from financial asset prices" in the November 2004 issue of the Monthly Bulletin.

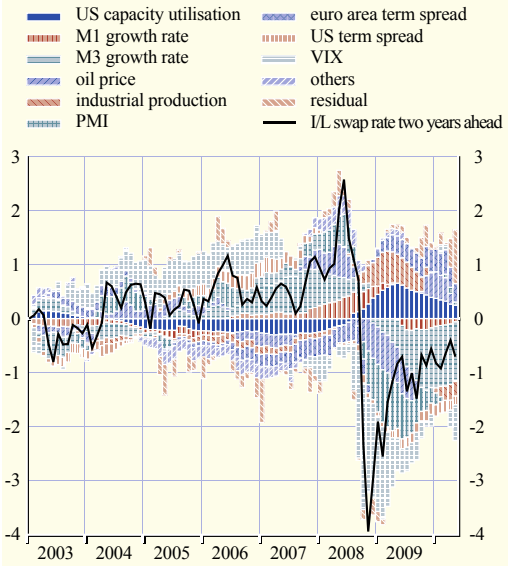
10 Break-even inflation rates can be adjusted for seasonal effects, but these are generally more difficult to remove at short horizons. See Ejsing, J., García, J. A. and Werner, T. (2007), "The term structure of euro area break-even inflation rates: the impact of seasonality", *Working Paper Series*, No 830, ECB.

11 See Garcia, J. A. and Werner, T. (2010): "Inflation risks and inflation risk premia", *Working Paper Series*, No 1162, ECB.

12 For an overview and some international comparison, see Garcia, J. A. and Van Rixtel, A. (2007), "Inflation-linked bonds from a central bank perspective", *Occasional Paper Series*, No 62, ECB, and references therein.

Chart 1 Determinants of inflation-linked swaps

(annual percentage changes; percentage points; monthly data)



Source: ECB calculations based on the methodology introduced in Ciccarelli and Garcia (2009).
Note: This chart shows the decomposition of inflation expectations as the sum of the contributions of the explanatory factors and the residual term. All variables are standardised. Historical values of the endogenous variable are interpreted as a departure from a baseline or reference path. The bars in the chart therefore reflect the departure of inflation expectations from their sample mean explained by the departure of each explanatory variable from its respective reference path (i.e. the sample mean). Contributions are based on the posterior means.

potential explanatory factors is evaluated using Bayesian model selection techniques.[13] Specifically, 28 directly observable economic and financial variables usually used to analyse developments in financial indicators of inflation expectations are considered. To provide an intuitive description of the main factors influencing the developments in inflation-linked swaps, Chart 1 shows the contribution of the factors most important to the dynamics of the inflation-linked swap rate at the two-year horizon, based on a linear regression model. The choice of such a horizon is motivated by data availability, but qualitatively similar results hold for other maturities.[14]

Two insights are particularly noteworthy. First, inflation-linked swaps suggest that there was a significant rise in inflation expectations at short-to-medium horizons over the first half of 2008, an increase that was sharply reversed following the intensification of the financial crisis in the autumn of 2008.

Second, the sharp downward revision to inflation expectations was largely motivated not only by the decline in oil prices, but also the sharp deterioration in confidence indicators, as well as by financial factors (such as the rise in stock market volatility as captured by the VIX index). Moreover, these factors, together with moderate growth in monetary aggregates, are also the main explanation for inflation expectations remaining subdued since early 2009.

MONITORING LONG-TERM INFLATION EXPECTATIONS

Beyond helping to monitor developments in short-term inflation expectations, inflation-linked instruments provide crucial information on longer-term inflation expectations. The remarkable development of the inflation-linked bond market in the euro area since 2004 has contributed to improving the reliability of the estimated break-even inflation rates based

13 To investigate the link between inflation expectations and their potential determinants, we assume: $ILS_t = aILS_{t-1} + bX_t + e_t$, where ILS_t denotes the inflation expectation measure (swap) and X_t represents the set of factors listed below. The potential explanatory factors considered are: (i) *monetary factors* (M1 and M3 growth); (ii) *commodity prices and exchange rates* (raw materials excluding energy, oil prices in USD, effective euro exchange rate, NEER); (iii) *price and cost indicators* (level and volatility of headline HICP and HICPex, as well as that of PPI, and wage growth); (iv) *economic activity indicators* (industrial production, unemployment rate); (v) *confidence indicators* (European Commission industrial and consumer confidence, PMI); (vi) *financial variables* (US and euro area term spread, US-euro area ten-year bond differential, bond market volatility, 12-month return in the S&P500 and the Euro 50 indices, stock volatility, VIX and VStoxx); (vii) *external environment* (CPI, industrial production, non-farm payroll data and capacity utilisation in the United States). For details on data transformation, see Ciccarelli, M. and Garcia, J.A. (2009), "What drives euro area break-even inflation rates?", *Working Paper Series*, No 996, ECB. To estimate the model coefficients and select the factors, the "stochastic search variable selection approach" is used (see George, E. and McCulloch, R. (1993), "Variable selection via Gibbs sampling", *Journal of the American Statistical Association*, Vol. 88, No 423, pp. 881- 889).

14 Note that, owing to the heterogeneity of the measurement units of the factors, all variables shown in the chart are standardised.

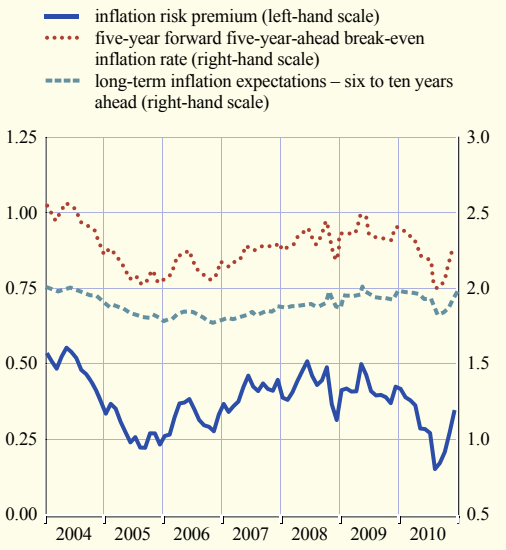
on the yield spread between nominal and inflation-linked bonds.[15] Indeed, using bond market data allows all the information on nominal and real term structures to be exploited.

The extraction of long-term inflation expectations from financial instruments is, however, further complicated by the presence of the inflation risk premia requested by investors as compensation for the risks surrounding baseline inflation expectations. Moreover, during the recent financial crisis, the presence of strong and time-varying liquidity distortions in the bond market has added difficulties to the interpretation of developments in long-term (forward) break-even inflation rates.

Monitoring long-term break-even inflation rates therefore requires a rich specification of the term structure. Euro area break-even inflation rates and inflation risk premia can be estimated using term structure models. In order to better identify the inflation risk premia, in line with recent term structure literature, inflation-linked bond yields are employed to pin down real yields, and survey inflation expectations from the ECB's SPF also help to identify expected inflation.[16] Based on that modelling approach, Chart 2 shows the decomposition of long-term forward break-even inflation rates by means of a no-arbitrage term structure model incorporating inflation-linked bond yields and long-term survey inflation expectations.[17] The chart illustrates some of the key features of long-term inflation expectations (and related premia) in the euro area. First, investors' long-term inflation expectations are firmly anchored at levels consistent with price stability. Importantly, they have remained so since the intensification of the financial turbulence.[18] Second, the inflation risk premium is, in contrast, far more volatile, accounting for a significant proportion of the volatility in long-term break-even inflation rates. On average, the long-term inflation risk premium has been around 40 basis points, but it declined significantly over the summer of 2010, possibly reflecting lower perceived inflation risks among investors amid increasing concerns of a slowdown in the global economy in the second half of the year. Again, it is important to note that the level of long-term inflation expectations was, in contrast, broadly unchanged during that period. In any case, although significant care is taken in the specification of the term structure model used here, modelling bond markets during the financial crisis period poses significant challenges, which should be taken into account.

Chart 2 Decomposition of long-term forward break-even inflation rates, based on a term structure model

(annual percentage changes; percentage points)



Sources: Reuters and ECB calculations.
Note: Long-term forward break-even inflation rates and components are for the five-year forward five-year-ahead horizon. For term structure model details, see Garcia and Werner (2010).

15 See Garcia, J. A. and van Rixtel, A. (2007), "Inflation-linked bonds from a central bank perspective", *Occasional Paper Series*, No 62, ECB, and references therein for an overview and international comparison.

16 For model details, see Garcia, J. A. and Werner, T. (2010), "Inflation risks and inflation risk premia", *Working Paper Series*, No 1162, ECB.

17 In line with recent literature, the model includes measurement errors for all the variables, thereby allowing for a correction for liquidity and other potential distortions in bond markets during the financial crisis, which is crucial in order to provide a thorough assessment of developments in break-even inflation rates, inflation expectations and the inflation risk premia.

18 See Box 4 entitled "An assessment of recent developments in long-term forward break-even inflation rates", in the December 2009 issue of the Monthly Bulletin.

4 DEVELOPMENTS IN EXPECTATIONS IN RECENT YEARS

Measures of inflation expectations are used by the ECB to gain an insight into the expectations of the private sector, to cross-check its own assessment of the outlook for future inflation and as part of a set of indicators used to evaluate the perceived credibility of its monetary policy. Clearly, all the existing measures have shortcomings and are imperfect gauges of the "true", unobserved inflation expectations of the private sector. For example, measures derived from financial instruments, which are based on market trades and are available in real time for a wide range of maturities, may be affected by unobservable, time-varying risk premia. By contrast, survey-based measures, although not distorted by unobservable risk premia, are not necessarily linked to actual economic behaviour and may be more backward-looking. This is because individual forecasts may only be updated at fixed intervals and the collection and compilation of such forecasts inevitably takes some time. A comprehensive assessment of these limitations and the comparative strengths and weaknesses of both types of measure supports a combined analysis, whereby all available measures are used jointly and the conclusions from all types of indicator are reciprocally cross-checked.

In this regard, it is important to look at how the various measures of inflation expectations have behaved in recent years, taking into account the unusual volatility in actual inflation rates caused by a combination of commodity price shocks and the impact of the financial crisis. In particular, it is instructive to focus on summer 2008, when inflation temporarily rose on account of strong increases in commodity prices in global markets and their pass-through to consumer prices, as well as on autumn 2008, when the financial crisis intensified in the months immediately after the demise of Lehman Brothers in the United States.

THE COMMODITY PRICE SHOCK OF 2007-2008

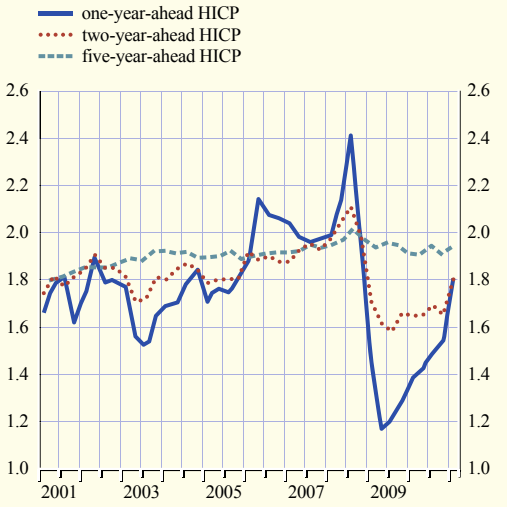
In the wake of the strong commodity price shocks recorded in the course of 2007 and 2008, which culminated in actual HICP inflation rising to 4% on an annual basis in the summer of 2008, inflation expectations provided a key tool for assessing the risks of second-round effects on inflation.

As actual inflation started to rise in the final months of 2007, short-term inflation expectations were progressively revised upwards. For example, the SPF respondents mostly expressed their concern about higher inflation in expectations at the one and, to a lesser extent, two-year horizons (see Chart 3).[19] Similarly, short-term expectations derived from inflation-linked swaps increased in the second quarter of 2008 (see Chart 4). Longer-term expectations initially remained muted, possibly reflecting the

19 Other survey-based measures of expectations, such as those of Consensus Economics and Euro Zone Barometer, showed similar patterns.

Chart 3 Inflation expectations from the SPF

(annual percentage changes)



Source: ECB.

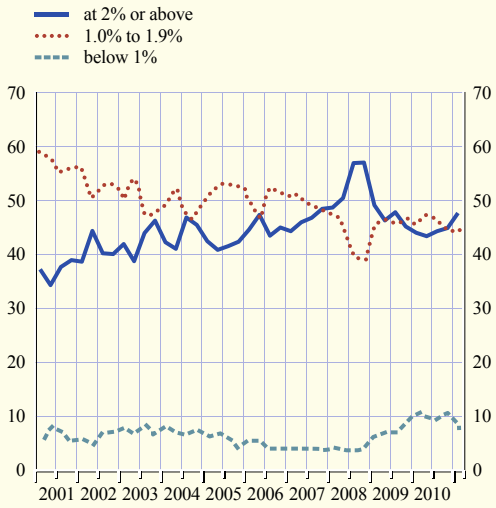
Chart 4 Forward inflation-linked swap rates in the euro area

(annual percentage changes)

Sources: ICAP and Reuters.

Chart 5 Probability of longer-term inflation outcome within given intervals

(as a percentage)



Source: ECB.
Note: Information from the aggregate probability distribution.

perceived transitory nature of the commodity price shock, as well as the fact that the ECB was expected to react to the higher inflation, but started to rise in the summer of 2008 (see Charts 3 and 4).

Market concerns about inflation were also reflected in the aggregate probability distribution available from the SPF. In the two SPF rounds conducted in July and October 2008, when the latest available data for the euro area annual inflation rate showed 4.0% for June and 3.6% for September, the forecasters assigned significantly higher probability to a longer-term inflation outcome of at or above 2% (see Chart 5). The rising level of long-term inflation expectations in the SPF, and the higher probability assigned by respondents to outcomes above the ECB's definition of price stability, were two further elements supporting the overall assessment that led to the monetary policy decision to increase interest rates in July 2008.[20] Thereafter, following the ECB's interest rate increase and the intensification of the financial crisis, the concerns about higher longer-term inflation subsided quickly. Short-term inflation expectations, particularly those derived from financial instruments, fell quickly (see Chart 4).

INFLATION EXPECTATIONS DURING THE CRISIS

The period immediately after the demise of Lehman Brothers in the United States in September 2008 provides another case study for the usefulness of indicators of inflation expectations. As the international economy experienced one of the worst recessions in generations, market concerns about both inflation and deflation emerged. On the one hand, as demand and output fell sharply, and unemployment went up, spare capacity rose and downward pressures on inflation emerged. This, in turn, triggered fears of a sustained

20 According to the editorial of the July 2008 Monthly Bulletin: "The Governing Council's decision [to increase interest rates] was taken to prevent broadly based second-round effects and to counteract the increasing upside risks to price stability over the medium term". "The Governing Council emphasises that […] it is its strong determination to keep medium and long-term inflation expectations firmly anchored in line with price stability."

period of deflation ahead.[21] On the other hand, strong recessionary forces elicited an unprecedented response in both monetary and fiscal policies, which led some observers to argue that inflation was the main threat. According to this view, abundant liquidity, combined with high fiscal deficits, would trigger inflation once a recovery was under way if policy-makers were unable or unwilling to reverse the policy stimulus in time. Inflation expectations provide an important tool for assessing the balance of risks, particularly in an environment subject to upward and downward pressures on price stability.

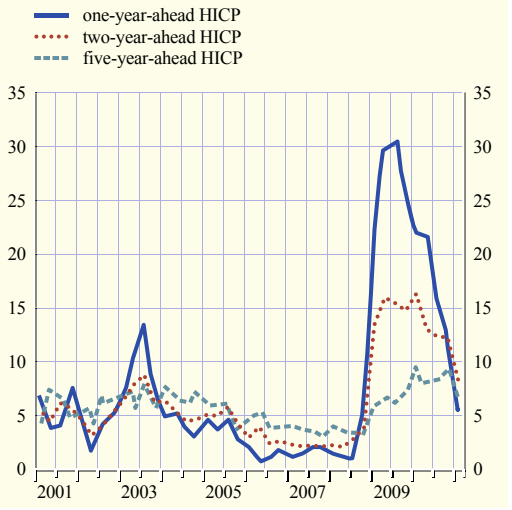
Despite the fact that annual inflation slowed to 0.3% in 2009, the risk of outright deflation in the euro area was always forecast to remain low by the markets. For example, measures of longer-term inflation expectations remained firmly anchored at levels consistent with the ECB's definition of price stability throughout 2009. Furthermore, in the middle of 2009, SPF respondents assigned a very small probability (of less than 4%) to inflation being negative in two years' time. At the same time, a positive but low inflation outcome was perceived as more likely, as the probability of inflation being between 0% and 1% in one year's time was assessed to be around 30% in the second quarter of 2009, declining significantly thereafter (see Chart 6).

The rapidly changing economic environment in autumn 2008 led forecasters to revise their short and medium-term inflation expectations downwards. The overall uncertainty about current and future economic developments increased substantially, which was clearly reflected in the forecasters' probability distributions provided in the SPF. Aggregate uncertainty – the measure that captures both diverging views among forecasters and the uncertainty that each forecaster assigns to their own forecast – remained high and even continued to increase slightly for all forecast horizons (see Chart 7), following increases

21 See, for example, Chapter 1 of the IMF World Economic Outlook, April 2009, and Decressin, J. and Laxton, D. (2009), "Gauging Risks for Deflation", IMF Staff Position Note No 09/01.

Chart 6 Probability of inlation at or above 0% and below 1%

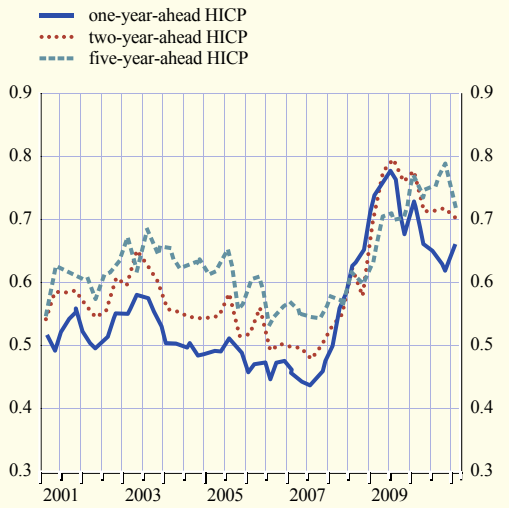
(as a percentage)



Source: ECB.

Chart 7 Aggregate uncertainty

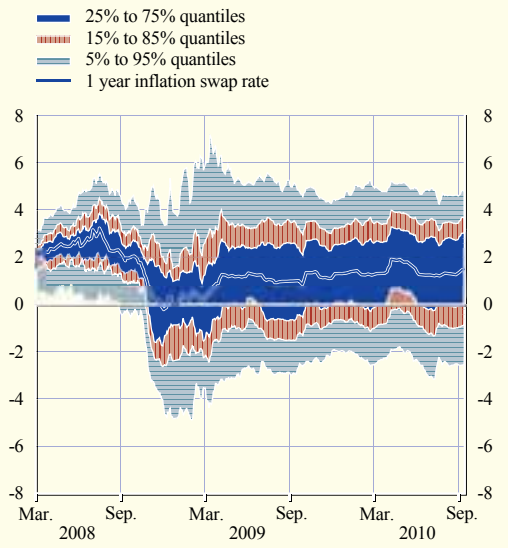
(percentage points)



Source: ECB.
Note: Aggregate uncertainty is measured as the standard deviation of the aggregate probability distribution in the SPF.

Chart 8 Probability bands of various inflation outcomes in one year derived from euro area inflation options

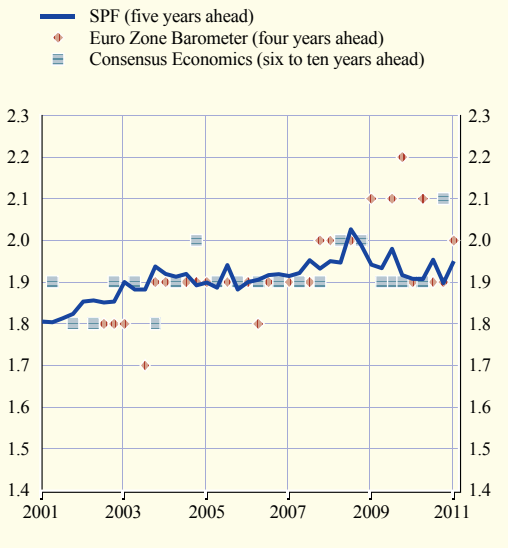
(annual percentage changes)



Sources: Bloomberg and ECB calculations.

Chart 9 Longer-term inflation expectations from various sources

(annual percentage changes)



Sources: Consensus Economics, ECB and Euro Zone Barometer.

during 2008 which were associated with the oil and food prices shocks.[22] However, this feature was not specific to inflation or, indeed, the SPF: similar increases in uncertainty were also observed within the SPF for real GDP growth and unemployment, as well as in other private sector surveys.[23] Although there are some signs of a decline in uncertainty since the beginning of 2010, it still remains higher than before the crisis.

Turning to financial indicators, expectations extracted from financial instruments suggested greater risks of deflation over the short term during the financial crisis than survey-based indicators. Beyond the baseline scenario portrayed by the inflation-linked swap rates discussed in the previous section, additional information can be obtained by looking at probability distributions for inflation outcomes calculated from traded inflation options (caps and floors) over the one-year horizon.[24] Chart 8 shows bands with the probability of various inflation outcomes at a one-year horizon. Inflation options also suggest a very strong shift in inflation expectations in late 2008. The upward trend in actual and expected inflation in the first half of 2008 was also accompanied by a rise in uncertainty and upside risks. The intensification of the crisis in the autumn of 2008 triggered a further increase in inflation uncertainty, as well as a substantial increase in the probability of deflation. Since 2009 these deflation risks have diminished, while inflation uncertainty has remained considerably higher than before the crisis, as

22 For example, the standard deviation of euro area inflation forecasts for the year 2009 within the Consensus Economics panel – another measure of uncertainty among forecasters – increased substantially in autumn 2008 to peak in December at unprecedented levels, twice as high as the five-year average of the standard deviation at this forecasting horizon. For a detailed discussion of measures of uncertainty that can be derived from the SPF, see the box entitled "Measuring perceptions of macroeconomic uncertainty" in the January 2010 issue of the Monthly Bulletin.

23 For a discussion of developments regarding uncertainty, including information from the Consensus Economics forecasts, see the box entitled "Uncertainty and the economic prospects for the euro area" in the August 2009 issue of the Monthly Bulletin.

24 The derivation of the implied inflation densities is based on a spline interpolation of the implied volatilities extracted from the inflation caps and floors, based on the Black-Scholes approach. For an application of this methodology, see Kruse, S. (2010), "On the Pricing of Inflation-Indexed Options", *European Actuarial Journal*, forthcoming.

indicated by the fact that the confidence interval surrounding the median inflation expectations in Chart 8 is still wide.

During these turbulent times, longer-term inflation expectations have remained well anchored (see Chart 9): the mean and median of the point forecasts of the SPF have fluctuated between 1.9% and 2.0% in the last two years. Longer-term forecasts from Consensus Economics and the Euro Zone Barometer have been slightly more volatile. However, owing to the smaller number of respondents for these two surveys than for the SPF, their average results are more sensitive to outliers. Market-based measures declined by less than 1 percentage point at the end of 2008. As pointed out in Section 3, this decline was mostly due to declining risk premia, while market participants' longer-term inflation expectations remained broadly stable throughout the financial crisis. The broad stability of longer-term inflation expectations suggests that monetary policy credibility was not seriously affected during the crisis. The box below looks at developments in inflation expectations for other selected economies outside the euro area.

Box

RECENT INTERNATIONAL DEVELOPMENTS IN INFLATION EXPECTATIONS

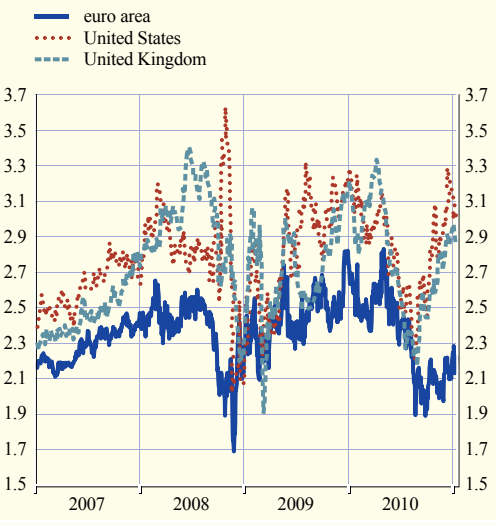
This box reviews developments in financial and survey-based indicators of inflation expectations, similar to those presented in the main text, for other advanced economies outside the euro area, in particular the United States and the United Kingdom. Overall, the comparison points to similar developments in inflation expectations among advanced economies, with long-term expectations remaining well anchored overall, although country-specific temporary shocks have tended to result in some degree of divergence in the dynamics of short to medium-term inflation expectations.

Inflation expectations during the crisis

With the intensification of the international financial and economic crisis in 2008, the sharp drop in output at the global level resulted in downward pressures on global inflation. In this context, medium to longer-term break-even inflation rates and inflation swap rates are useful indicators for interpreting the significant decline in inflation expectations in comparison to the euro area (see Charts A and B). Indeed, the decline in US and UK break-even inflation rates was more pronounced than that observed in the euro area. However, market-based inflation expectations have also become much more volatile and have been influenced by liquidity premia, as well as technical factors. While short-term survey-based indicators also showed similar patterns, the declines were more short-lived. In contrast, survey-based

Chart A Five-year forward five-year-ahead break-even inflation rates

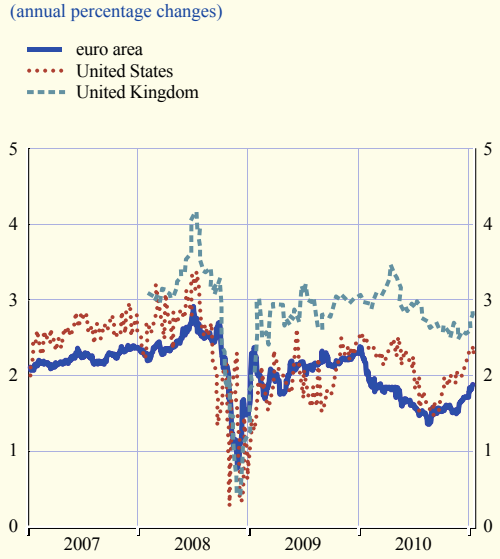
(annual percentage changes)



Sources: Reuters, ECB, Federal Reserve Board staff calculations and Bank of England.

Chart B One-year two-year-ahead forward inflation-linked swap rates

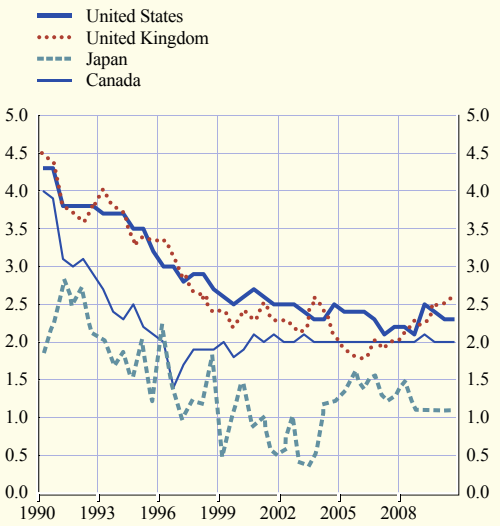
(annual percentage changes)



Sources: ICAP and Reuters.

Chart C Longer-term inflation expectations six to ten years ahead

(annual percentage changes)



Source: Consensus Economics.

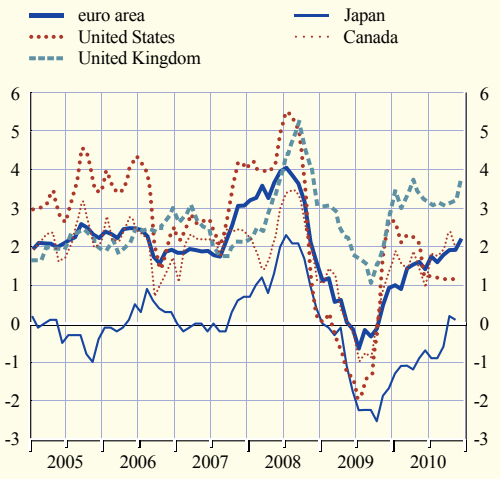
longer-term inflation expectations, such as those provided by Consensus Economics, remained fairly stable (see Chart C). This suggests that, despite significant movements in headline inflation, longer-term inflation expectations remained well anchored throughout the crisis period. Meanwhile, it is not surprising that survey-based long-term inflation expectations have remained relatively low in Japan, given its prolonged experience of very low inflation. In Canada, long-term inflation expectations essentially remained at the level targeted by the monetary authorities throughout the crisis.

Inflation expectations in 2010

After a rebound in economic growth in early 2010, some loss of momentum in the recovery over the summer triggered renewed deflation concerns in the United States. Market-based inflation expectations slowed in the United States and the United Kingdom, as in the euro area, before picking up towards the end of the year. Meanwhile, a rise in actual inflation in the United Kingdom from early 2010 onwards (see Chart D), mainly driven by the increase in VAT and the impact of the depreciation of the pound sterling, was, to a certain extent, reflected in higher market-based short-term inflation expectations. While these patterns for the United States and

Chart D Inflation rates

(annual percentage changes)



Sources: Eurostat, BEA and BIS.
Note: HICP for the euro area and the United Kingdom; CPI for the United States, Japan and Canada.

the United Kingdom were also partly evident in survey-based indicators, such as the Consensus Economics forecast (see Chart C), long-term inflation expectations remained within their historical range, suggesting that inflation expectations remained well anchored. Other survey-based indicators support this view.[1]

Overall, analysing developments in indicators of inflation expectations during the crisis and the summer of 2010 illustrates the advantages of combining information from both surveys and financial markets, where available, to assess those developments, not only in the euro area, but also in other advanced economies. To sum up, trends in inflation expectations among advanced economies have been broadly similar to those observed in the euro area in recent years, with long-term expectations remaining well anchored. However, country-specific temporary shocks lead to diverging dynamics of short to medium-term inflation expectations.

1 For the United States, for example, the University of Michigan measure of consumers' long-term inflation expectations (five to 10 years ahead) fell to 2.7% in September 2010, but rebounded to 2.8% in December. Ten-year-ahead inflation expectations in the SPF and expected average inflation for the next 10 years in the Livingston survey stood at 2.2% and 2.5% in November and December, respectively. All three indicators were close to their historical averages.

5 CONCLUSIONS

Inflation expectations are used by the ECB to gain an insight into the private sector's assessment of the outlook for future inflation and as part of a set of indicators used to evaluate the credibility of monetary policy. They are important for indicating the confidence of the public in the ability of the ECB to deliver on its price stability mandate. Several measures are available in the euro area, some derived from surveys and others extracted from financial markets, covering both the short and medium to longer-term horizons. An analysis of the main factors influencing the various available measures of expectations in the euro area shows that measures at different horizons tend to respond to different information: temporary shocks to volatile components tend to be more prominent in the short term, while longer-term expectations are broadly insensitive to economic news. The fact that longer-term expectations have remained well anchored at levels close to 2% during the past three years, which have been relatively challenging for monetary policy given the massive shocks that have hit the euro area and the global economy, has offered comfort for the conduct of monetary policy and demonstrates the credibility earned by the ECB as a price stability-oriented central bank.

However, there is no room for complacency, as measures of uncertainty and disagreement derived from survey-based expectations, for example, have increased in the immediate aftermath of the financial crisis and have not yet returned to their previous levels; furthermore, inflation risk premia embedded in asset prices have remained non-negligible.

Looking ahead, it is paramount that monetary policy continues to deliver price stability and remains credible in ensuring price stability over time. If investors and economic agents are reassured that inflation will remain stable in the future as a result of credible monetary policy, inflation expectations will remain well anchored and investors will demand lower inflation risk premia, which, in turn, will foster stronger growth in the euro area. This is the best contribution that monetary policy can offer to promoting balanced growth and higher standards of living in the euro area.