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BY TOMASZ ŁYZIAK

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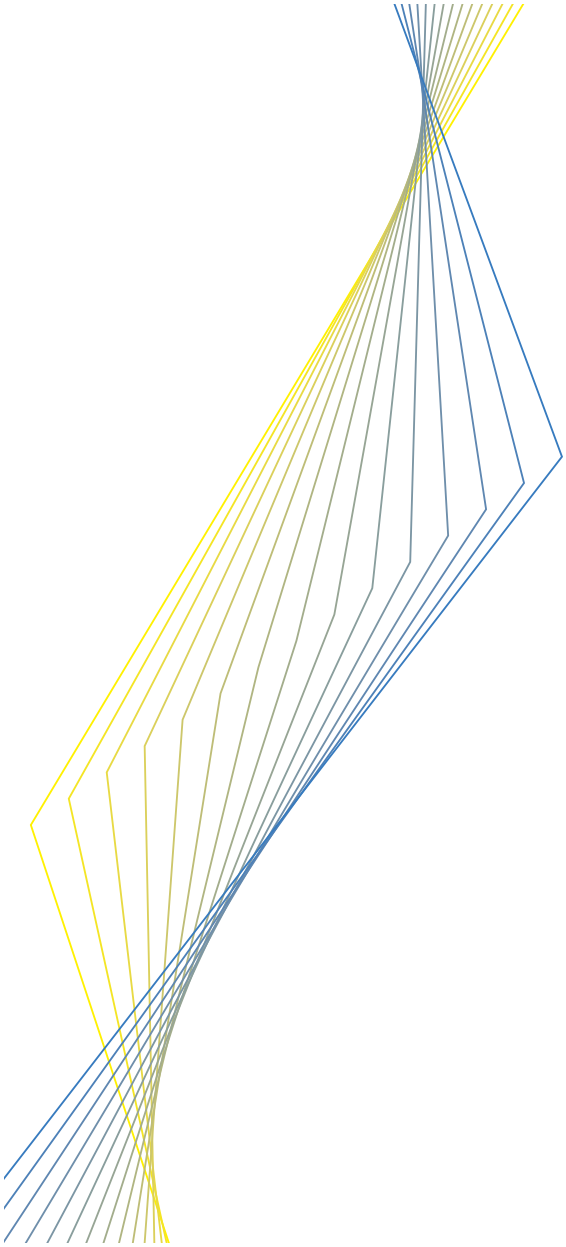

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Contents

Abstract

Inflation expectations constitute a subject of particular contemporary interest to central banks, especially those pursuing a monetary policy based on a strategy of direct inflation targeting. Macroeconomic theory indicates that the transmission of monetary policy impulses and their impact on the real and nominal sectors of the economy bear a close relationship to properties of inflation expectations.

Qualitative data on inflation expectations, as obtained from surveys, can be quantified with the use of probability or regression methods. This paper presents the results of two versions of the probability method, implemented in order to estimate numerical measures of Polish consumer inflation expectations, based on the monthly Ipsos-Demoskop survey. In addition, the unbiasedness and macroeconomic efficiency of Polish consumer inflation expectations are tested, as are the way in which these are formed. The pattern of responses to the survey question and quantified measures of Polish consumer inflation expectations are also compared with the respective findings for the euro area.

Key Words: Inflation expectations, Surveys, Rationality, Poland, Euro Area

JEL Classification: C42, D12, D84, E58

Non technical summary

The importance of inflation expectations for macroeconomists and central bankers results from the fact that expectations exert influence on the behaviour of economic agents, i.e., in terms of consumption, savings and investment decisions. Moreover, to the extent that they provide an unbiased predictor of future inflation, quantitative measures of expected inflation may constitute an important information variable taken into account in forward-looking considerations and monetary policy decisions. Finally, the inflation expectations of different groups of economic agents indicate the degree of confidence enjoyed by the central bank, the credibility of inflation targets, and whether these targets seem to be attainable.

The growing popularity of the strategy of direct inflation targeting stems from the conviction that central banks ought to influence inflation expectations. Monetary policy transparency and central bank credibility – key elements in direct inflation targeting – allow monetary policy to meet its ultimate objective of price stability, and by increasing the forward-lookingness of inflation expectations may reduce the sacrifice ratio. The adoption of direct inflation targeting by the National Bank of Poland in 1998 was also related to the need to overcome existing inflation expectations, perceived as one of the main obstacles in the process of disinflation.

In the course of recent years, economics has become more willing to take a holistic (interdisciplinary) approach to interpreting the behaviour of individuals. The way the attainments of other social sciences are treated in economic considerations has undergone a substantial evolution. The wide use of qualitative surveys in analyses concerning consumer inflation expectations is a clear sign of this tendency. Attempts are being made to exploit survey data not only in a descriptive way, but also to quantify them and to include them in macroeconometric models.

As presented in this paper, quantification procedures founded on the canonical Carlson and Parkin (1975) probability approach seem to be useful in terms of translating qualitative survey data on consumer inflation expectations into numbers consistent with statistical measures. Quantification results supplemented with the analysis of pattern of responses to the survey question

facilitate examining basic features of consumer inflation expectations, including their rationality and formation.

The study shows that the process of disinflation in Poland, which has reduced price growth to low levels, has resulted in Polish consumer expectations gradually converging with those in the euro area. This process was noticeably intense most recently, i.e., in 2001-2002, as confirmed by changes in the pattern of responses to Ipsos-Demoskop survey question. Nevertheless, consumer inflation expectations in Poland do not fulfil the rational expectations hypothesis: their macroeconomic efficiency is limited and they do not constitute an unbiased predictor of future price movements. In explaining these findings one should take into consideration specific factors affecting Polish consumer inflation expectations during the past decade, such as: the memory of hyperinflation deeply rooted in public consciousness, the process of learning the rules of the market economy and the limited credibility of economic policies.

Introduction

Macroeconomists and central bankers pay close attention to inflation expectations, both in their theoretical debates and in empirical studies. The importance of inflation expectations results from the fact that they influence the behaviour of economic agents, i.e., in terms of consumption, savings and investment decisions. Moreover, to the extent that they provide an unbiased predictor of future inflation, quantitative measures of expected inflation may constitute an important information variable taken into account in forward-looking considerations and monetary policy decisions [Forsells and Kenny (2002 a)]. Finally, the inflation expectations of different groups of economic agents indicate the degree of confidence enjoyed by the central bank, the credibility of inflation targets, and whether these targets seem to be attainable.

Depending on their nature, inflation expectations may play an important role in price formation. By affecting real interest rates, changes in inflation expectations may lead to changes in aggregate demand, which may then influence prices. As regards cost-push effects, an increase in the expected rate of inflation may make employees demand higher wage settlements. Companies, anticipating higher costs to be faced in the future, may see incentives to increase prices and may be more willing to pay higher wages. Even if prices are not adjusted immediately, companies may temporarily put off the sale of their products. All these interactions, combined with each other, may result in an increase in demand and a simultaneous decrease in supply. In this way, a rise in inflation expectations may generate an increase in prices.

The growing popularity of the strategy of direct inflation targeting stems from the conviction that central banks ought to influence inflation expectations. Monetary policy transparency and central bank credibility – key elements in direct inflation targeting – allow monetary policy to meet its ultimate objective of price stability[1], and by increasing the forward-lookingness of inflation expectations may reduce the sacrifice ratio [Gomez (2002)]. The adoption of direct inflation targeting by the Monetary Policy Council of the National Bank of Poland in 1998 was also related to

[1] F. S. Mishkin, A. S. Posen (1997), p. 6.

the need to overcome existing inflation expectations, perceived as *"one of the main obstacles in the process of steadily reducing inflation"*.[2]

This paper attempts to examine the nature of consumer inflation expectations in Poland and to confront their basic properties with features of consumer expectations in the euro area. For this reason quantified measures of inflation expectations are used. They are derived on the basis of qualitative Ipsos-Demoskop survey data with the use of probability method, founded on the canonical Carlson and Parkin (1975) approach.

The study shows that the process of disinflation in Poland, which has reduced price growth to low levels, has resulted in Polish consumer expectations gradually converging with those in the euro area. This process was noticeably intense most recently, i.e., in 2001-2002. Nevertheless, consumer inflation expectations in Poland do not fulfil the rational expectations hypothesis: their macroeconomic efficiency is limited and they do not constitute an unbiased predictor of future price movements. In explaining these findings one should take into consideration specific factors exerting influence on Polish consumer inflation expectations during the past decade, such as: the memory of hyperinflation deeply rooted in public consciousness, the process of learning the rules of the market economy and the limited credibility of economic policies.

The paper is organised as follows. Section 1 lays out the adjusted version of Carlson and Parkin (1975) method as applied to quantify Polish consumer inflation expectations on the basis of Ipsos-Demoskop survey data. Section 2 describes the nature of consumer inflation expectations in Poland. In particular, unbiasedness and macroeconomic efficiency of inflation expectations are discussed. Section 3 compares properties of consumer inflation expectations in Poland and in the euro area member states. The last section concludes the study.

[2] National Bank of Poland (1998), p. 10.

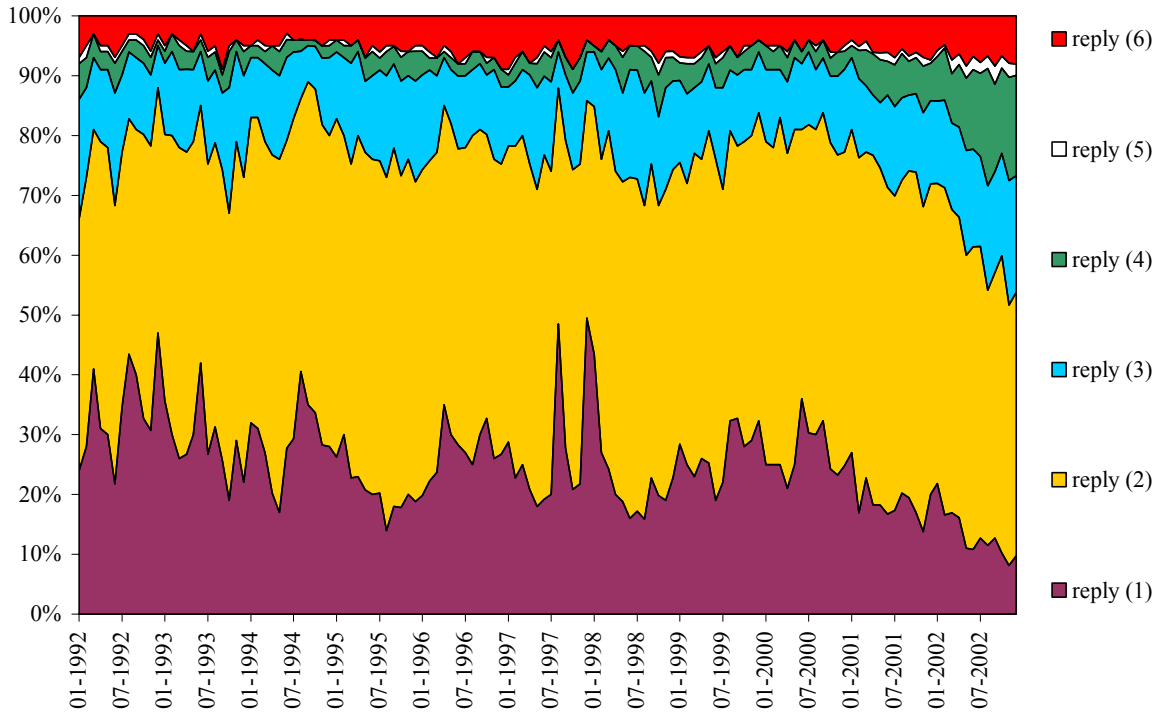
1. Measuring consumer inflation expectations

1.1. Ipsos-Demoskop survey

Qualitative data used to derive quantitative measures of Polish consumer inflation expectations come from the Ipsos-Demoskop survey. It is carried out monthly, on a sample consisting of approximately 1,000 individuals. The survey question concerning inflation expectations is designed in a qualitative way, i.e., the respondents do not give precise quantitative answers regarding future inflation, but rather declare the expected direction and magnitude of change in prices, comparing their predictions against the price movements currently observed. They respond to the following question: "*Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present, (2) rise at the same rate, (3) rise more slowly, (4) stay at their present level, (5) go down, (6) difficult to say"*. The proportion of respondents choosing each of these response categories in the years 1992-2002 is presented in Figure 1 below.

An analysis of the pattern of responses to the survey question from 1992 to 2000 reveals the following two tendencies: a decrease in the proportion of respondents declaring that prices will rise faster (down from some 34% in 1992 to around 27% in 2000) and an increase in the proportion believing that prices will rise at the same rate (up from some 44% in 1992 to around 53% in 2000). The remaining percentages were relatively steady, with the scale of changes observed making it difficult to distinguish any clear tendencies. In 2001 and 2002, the shifts in the pattern of responses to the Ipsos-Demoskop survey gathered greater speed. The fraction of respondents expecting prices to rise faster dropped rapidly. At the same time, the percentage of individuals expecting prices to rise at the same rate fell compared to 2000. It should be noted that in previous years the most pessimistic respondents tended to move to this group as their view brightened. On the contrary, in 2001 and 2002, a decline in the proportion of respondents reporting that prices would rise faster was accompanied by growth in the three most optimistic groups (replies (3), (4) and (5)), which had stayed fairly stable in the period from 1992 to 2000.

Figure 1. Response patterns, Ipsos-Demoskop survey question on inflation expectations, 1992-2002



Source: Ipsos-Demoskop.

Survey question: "Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present, (2) rise at the same rate, (3) rise more slowly, (4) stay at their present level, (5) go down, (6) difficult to say".

1.2. Probability approach to quantification of inflation expectations

The probability method was first employed by Theil (1952) in order to derive quantitative measures of inflation expectations which could represent an alternative to simple "balance statistics", defined as the difference between the percentage of respondents reporting an increase in prices and the percentage of respondents reporting a decrease. Theil's method (1952), and also its further implementation by Knöbl (1974), Carlson and Parkin (1975), and more recently by Taylor (1988), refers to surveys in which respondents are questioned as to whether prices are expected to "go up", "stay the same" or "go down".

There are two central assumptions in probability methods. Firstly, each individual is supposed to have a probability function over the expected price change. This may vary by individual and over time, but it determines the responses to the survey question. Secondly, it is assumed that, if the expected price change falls within a certain interval centred around zero $(-s,+s)$, the respondents will report that prices are going to stay the same. This interval is termed the "sensibility interval" or "indifference interval".

The survey carried out by Ipsos-Demoskop contains more response categories, meaning that the quantification procedure had to be adjusted, as in Berk (1997), Berk (2000) or Forsells and Kenny (2002 a). In this section, two probability methods are presented, as proposed in Łyziak (2000). The first, i.e., the adjusted Carlson and Parkin (1975) method, assumes that, if the number of respondents is sufficiently large, the expected rate of price change is normally distributed[3], while the second treats this distribution as uniform.

1.2.1. Normal distribution – adjusted Carlson and Parkin (1975) method

In the following parts of this paper, the following notation applies:

a – percentage of respondents expecting prices to rise faster;

b – percentage of respondents expecting prices to rise at the same rate;

c – percentage of respondents expecting prices to rise more slowly;

d – percentage of respondents expecting prices to stay at their present level;

e – percentage of respondents expecting prices to go down[4];

π^{e}_{+12} – expected rate of price change over the next 12 months in the population, assumed to be normally distributed with unknown parameters m, σ^2;

[3] Batchelor (1982) points out that if individual distributions are independent across respondents, have a common form and finite first and second moments, the survey results can be interpreted as a sampling from some aggregate distribution, which under the Central Limit Theorem is normally distributed.

[4] Contrary to other implementations of probability methods, such as Berk (1997), Berk (2000) or Forsells and Kenny (2002 a), the percentage of respondents giving the „difficult to say" reply is not proportionally allocated to the other response categories, but is divided into five equal parts and allocated to the remaining response categories. This is because of the high frequency of cases (in 1992-2000) where the fraction of respondents reporting that prices would fall was equal to zero.

π_0 – perceived rate of price change over the previous 12 months;

f – density function of expected rate of inflation;

F – cumulative distribution function of expected rate of inflation;

Nz – cumulative standardised normal distribution function.

The quantification of qualitative responses makes use of the fact that, in replying to the survey question regarding inflation expectations, respondents compare their predictions with the rate of price change as perceived when the survey is carried out. Indeed, two replies – that prices will "rise at the same rate" or "stay at their present level" – are in fact quantitative in nature.

A proxy for the perceived rate of price change used in this paper is the current rate of inflation, i.e. the most recent inflation rate available to respondents when answering the survey question regarding future prices.[5] Alternatively the perceived rate of inflation might be derived on the basis of survey question pertaining to price developments in the past 12 months [Berk (2000), Forsells and Kenny (2002 a)], but the lack of such a question within the Ipsos-Demoskop consumer survey constrains the implementation of this approach.

Probability methods presume that the respondents reporting that "prices will rise at the same rate" include agents whose expectations fall within a sensibility interval centred on the current rate of inflation: $(\pi_0 - s\,; \pi_0 + s)$. For instance, if the current inflation rate is 2%, one might expect that the respondents who declare that prices will rise at the same rate are not exclusively composed of agents who predict that, over the next 12 months, the rate of inflation will be exactly 2%, but also individuals who think that future inflation will differ insignificantly from 2%, e.g., it might come to 1.8% or 2.1%.

It may be expected that the length of the sensibility interval is contingent on the current rate of inflation. Batchelor (1986) argues that the theory of signal detection, suggesting that perceptual

[5] Since the Ipsos-Demoskop survey is carried out at the beginning of each month, i.e., before the Central Statistical Office (GUS) releases the previous month's inflation rate, the perceived rate of inflation is proxied by the CPI year on year, lagged 2 months.

thresholds depend systematically on the level and noisiness of inflation, finds support in survey data from eight European countries.

Another sensibility interval applies to respondents reporting that prices will stay at their present level, i.e., that the rate of price change over the next 12 months will amount to 0. It is assumed that this reply will be chosen by individuals expecting the inflation rate twelve months ahead to fall within an interval centred on zero: $(-t;+t)$.

Contrary to the primary version of the Carlson and Parkin (1975) method, where only one sensibility interval was considered and it was necessary to fix its length on an *ad hoc* basis, the adjusted quantification procedure makes the variables s and t, determining the length of indifference intervals, fully endogenous. Due to the broader scope of information contained in the Ipsos--Demoskop survey, the only assumption that must be made with regard to the adjusted Carlson and Parkin (1975) approach refers to the type of distribution of the expected rate of inflation.

Figure 2. Adjusted Carlson and Parkin (1975) method

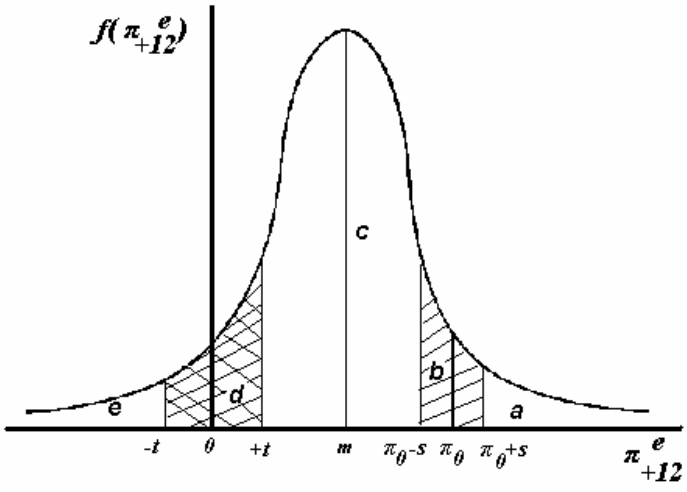


Figure 2 gives a graphical presentation of the adjusted Carlson and Parkin (1975) approach, as tailored to the Ipsos-Demoskop survey. The quantification method may be expressed algebraically in the following set of equations:

[1] $$a = P\left(\pi^{e}_{+12} > \pi_0 + s\right) = 1 - F\left(\pi_0 + s\right)$$

[2] $$b = P\left(\pi_0 - s < \pi^{e}_{+12} < \pi_0 + s\right) = F\left(\pi_0 + s\right) - F\left(\pi_0 - s\right)$$

[3] $$c = P\left(t < \pi^{e}_{+12} < \pi_0 - s\right) = F\left(\pi_0 - s\right) - F\left(t\right)$$

[4] $$d = P\left(-t < \pi^{e}_{+12} < t\right) = F\left(t\right) - F\left(-t\right)$$

[5] $$e = P\left(\pi^{e}_{+12} < -t\right) = F\left(-t\right)$$

Equations [1]-[5] may be rearranged using the formula [6] of the normal density standardisation:

[6] $$F(k) = Nz\left(\frac{k-m}{\sigma}\right)$$

where m is the unknown mean of the expected inflation rate and σ denotes its standard deviation. With this transformation, the system may be rewritten as follows:

[7] $$a = 1 - Nz\left(\frac{\pi_0 + s - m}{\sigma}\right)$$

[8] $$b = Nz\left(\frac{\pi_0 + s - m}{\sigma}\right) - Nz\left(\frac{\pi_0 - s - m}{\sigma}\right)$$

[9] $$c = Nz\left(\frac{\pi_0 - s - m}{\sigma}\right) - Nz\left(\frac{t - m}{\sigma}\right)$$

[10] $$d = Nz\left(\frac{t - m}{\sigma}\right) - Nz\left(\frac{-t - m}{\sigma}\right)$$

[11] $e = Nz\left(\frac{-t-m}{\sigma}\right)$

There are four dependent variables in the above equations, namely, m (mean of the expected rate of price change), σ (standard deviation), and also s and t (parameters determining the length of sensibility intervals). The explanatory variables comprise: a, b, c, d, e (fractions of respondents choosing the respective replies to the survey question) and π_0 (current rate of inflation). After solving the equations [7]-[11], the following results are obtained:

[12] $m = \frac{\pi_0 \cdot (C+D)}{C+D-(A+B)}$

[13] $\sigma = \frac{-2 \cdot \pi_0}{C+D-(A+B)}$

[14] $s = \frac{\pi_0 \cdot (B-A)}{D+C-(A+B)}$

[15] $t = \frac{\pi_0 \cdot (D-C)}{C+D-(A+B)}$

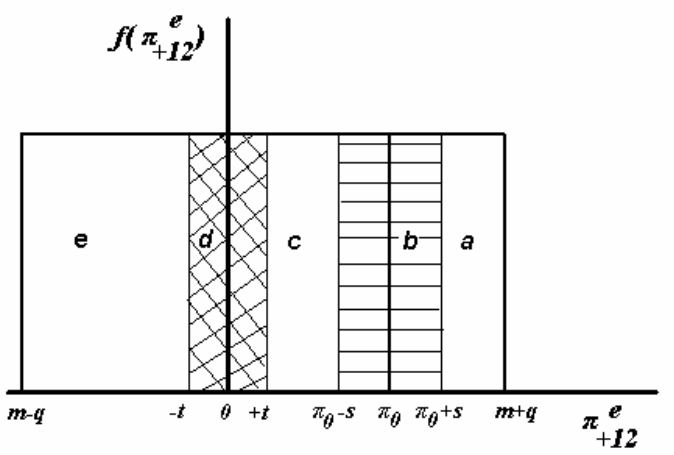
where: $A = Nz^{-1}(1-a)$; $B = Nz^{-1}(1-a-b)$; $C = Nz^{-1}(1-a-b-c)$; $D = Nz^{-1}(e)$.

The equation [12] defines the mean of the expected rate of inflation.

1.2.2. Uniform distribution – adjusted method

Similarly, the primary version of the uniform distribution method, designed for surveys containing three decisive responses to the question regarding inflation expectations[6], may be adjusted to the Ipsos-Demoskop survey question. As shown in Figure 3, it is assumed that the expected rate of inflation in the population is uniformly distributed and falls within an interval $(m-q, m+q)$.

Figure 3. Adjusted uniform distribution method



On the basis of the assumptions depicted above, the following relationships may be recorded:

[16] $$a = \frac{1}{2q} \cdot (m + q - \pi_0 - s)$$

[17] $$b = \frac{s}{q}$$

[6] The primary version of the uniform distribution method is described, inter alia, in: M. H. Pesaran (1987), pp. 214- - 217.

[18] $$c = \frac{1}{2q} \cdot (\pi_0 - s - t)$$

[19] $$d = \frac{t}{q}$$

[20] $$e = \frac{1}{2q} \cdot (-t - m + q)$$

In equations [16]-[20], the set of dependent variables comprises m (mean of the expected rate of price change), q (half of the range between the minimum and maximum expected inflation) and also s and t (sensibility intervals). There are six explanatory variables, namely, a, b, c, d, e (fractions of respondents choosing the respective replies to the survey question) and π_0 (current rate of inflation). The solution of equations [16]-[20] may be expressed as:

[21] $$s = \frac{b \cdot \pi_0}{2c + b + d}$$

[22] $$q = \frac{\pi_0}{2c + b + d}$$

[23] $$t = \frac{d \cdot \pi_0}{2c + b + d}$$

[24] $$m = \frac{\pi_0 \cdot (1 - d - 2e)}{2c + b + d}$$

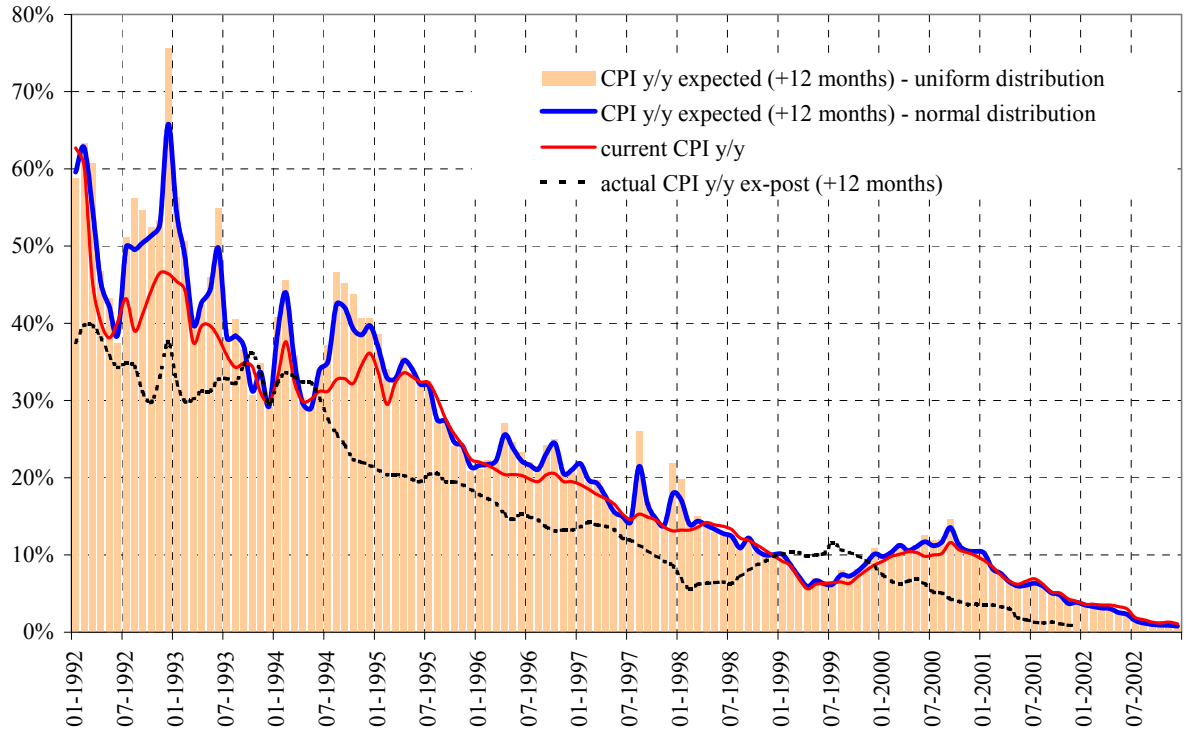
The relationship [24] defines the expected rate of inflation.

2. Properties of Polish consumer inflation expectations

2.1. Quantification results

Both versions of the probability method described in the previous paragraph – assuming a normal or uniform distribution of the expected rate of inflation– were implemented in order to estimate Polish consumer inflation expectations on the basis of the Ipsos-Demoskop survey data. Figure 4 presents the expected rates of inflation in the years 1992-2002, compared to the current rate of inflation (known at the moment the surveys were carried out) and the actual rate of inflation ex-post (with reference to which the expectations were formed).

Figure 4. Quantification results, 1992-2002

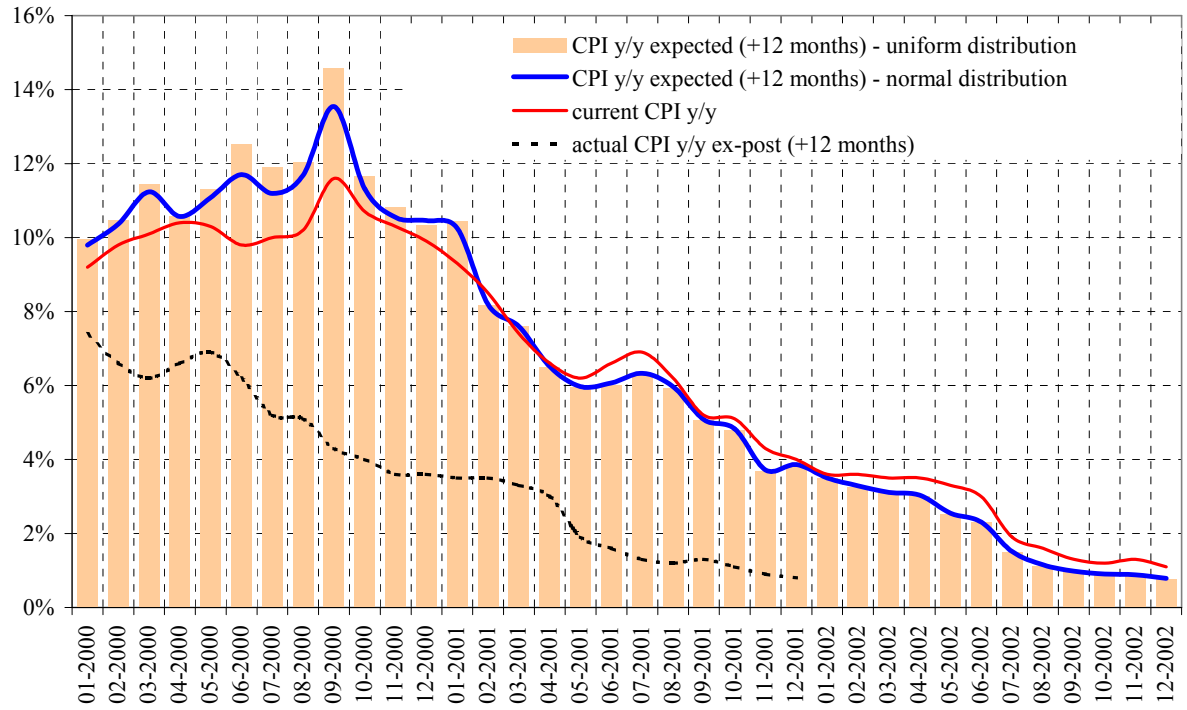


Source: GUS, own calculations.

CPI y/y expected (+12 months) *denotes the expected rate of change of consumer prices over the next 12 months, estimated on the basis of the adjusted (normal or uniform) probability method;* ***actual CPI y/y ex-post (+12 months)*** *denotes the actual CPI year on year, with reference to which the expectations were formed;* ***current CPI y/y*** *is the annual consumer price index known at the moment surveys were carried out.*

The results derived from both quantification methods are similar. They suggest that Polish consumer inflation expectations are usually close to the current rate of price change. This mainly refers to the last five years, when the expected rate of inflation has almost overlapped with current inflation. In previous years, there had been periods when inflation expectations were even higher than current inflation, which was caused by a coincidence of economic, political and social events.[7] By contrast, from April 2001 onwards, consumer inflation expectations have consistently been lower than the current inflation rate (Figure 5).

Figure 5. Quantification results, 2000-2002



Source: GUS, own calculations.

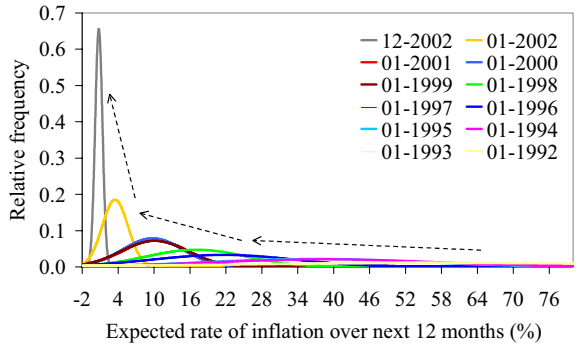
CPI y/y expected (+12 months) *denotes the expected rate of change of consumer prices over the next 12 month, estimated on the basis of the adjusted (normal or uniform) probability method;* ***actual CPI y/y ex-post (+12 months)*** *denotes the actual CPI year on year, with reference to which the expectations were formed;* ***current CPI y/y*** *is the annual consumer price index known at the moment the surveys were carried out.*

[7] As far as economic factors are concerned, attention should mainly be focussed on periods when the disinflation process in Poland was temporarily reversed, i.e., when annual inflation was increasing. This caused inflation expectations to rise even faster than could be attributable to the increase in the current rate of inflation. This effect was accelerated by the memory of hyperinflation, deeply rooted in public consciousness, and also by political turbulence, such as the fall of governments and parliamentary elections. Details in: T. Łyziak (2000).

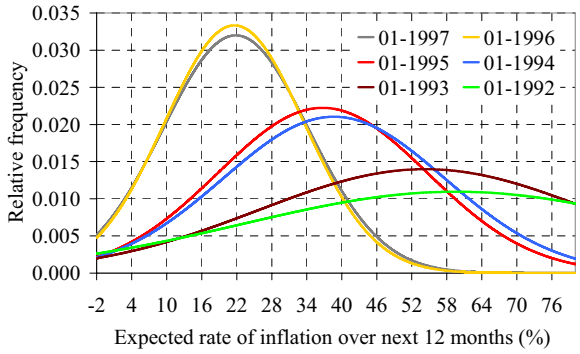
The period under analysis saw considerable changes in the main characteristics of the distribution of inflation expectations (Figure 6). The mean of the distribution decreased, as did its dispersion measures, such as the range or standard deviation (this does not refer to the standard deviation expressed in relative terms with respect to the mean value, which remained stable and has recently increased). Sensibility intervals became shorter.

Figure 6. Main characteristics of distribution of expected rates of inflation, 1992-2002

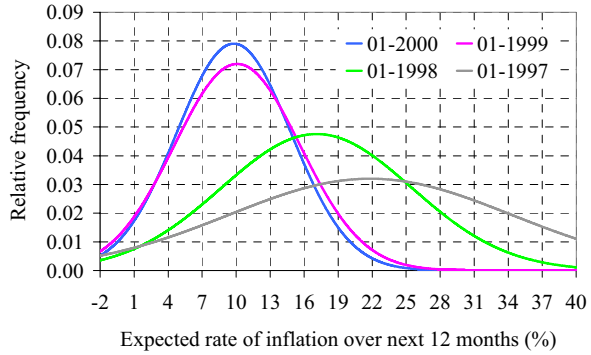
6A) Distribution, 1992-2002



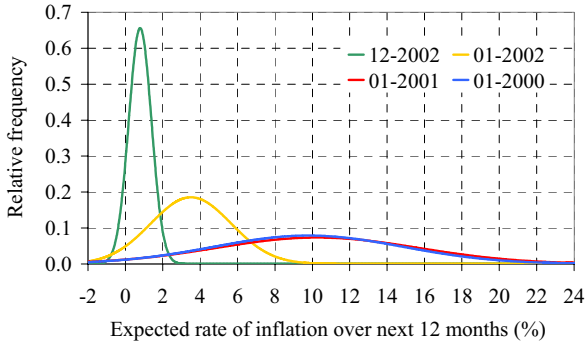
6B) Distribution, subperiod 1992-1997



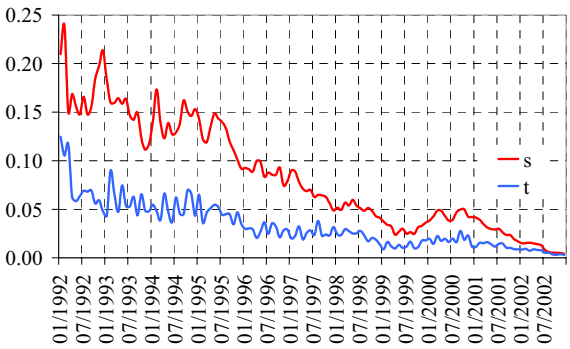
6C) Distribution, subperiod 1997-2000



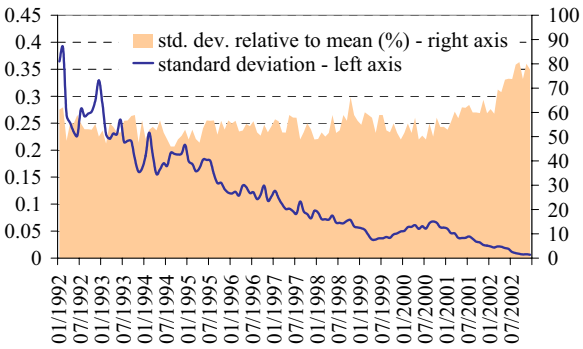
6D) Distribution, subperiod 2000-2002



6E) Sensibility intervals, 1992-2002



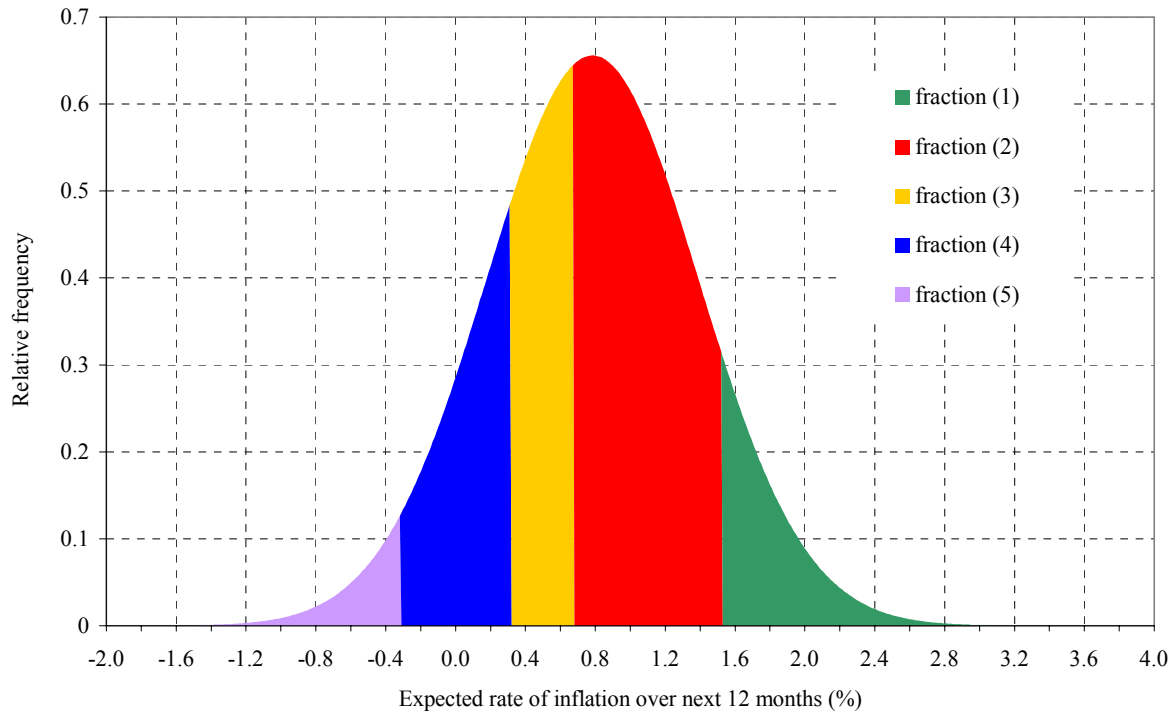
6F) Dispersion measures, 1992-2002



Source: own calculations.

For a detailed overview of quantification outcomes, let us refer to the distribution of consumer inflation expectations in December 2002, as assumed to be normal (Figure 7). The current rate of inflation at that time stood at 1.1%, while the mean of the expected rate of price change over the next 12 months was estimated at 0.8%. The coefficients s and t, derived from the probability method and determining the length of indifference intervals, were equal to 0.004 and 0.003, respectively. This means that the respondents reporting that prices over the next 12 months would rise at the same rate believed that in the corresponding month of the following year annual inflation would fall within the interval $(0.7\%\,;1.5\%)$, while those respondents reporting that prices would stay at their present level believed that price growth over the next 12 months would fall within the interval $(-0.3\%\,;0.3\%)$.

Figure 7. Distribution of expected rates of inflation, December 2002, normal distribution method

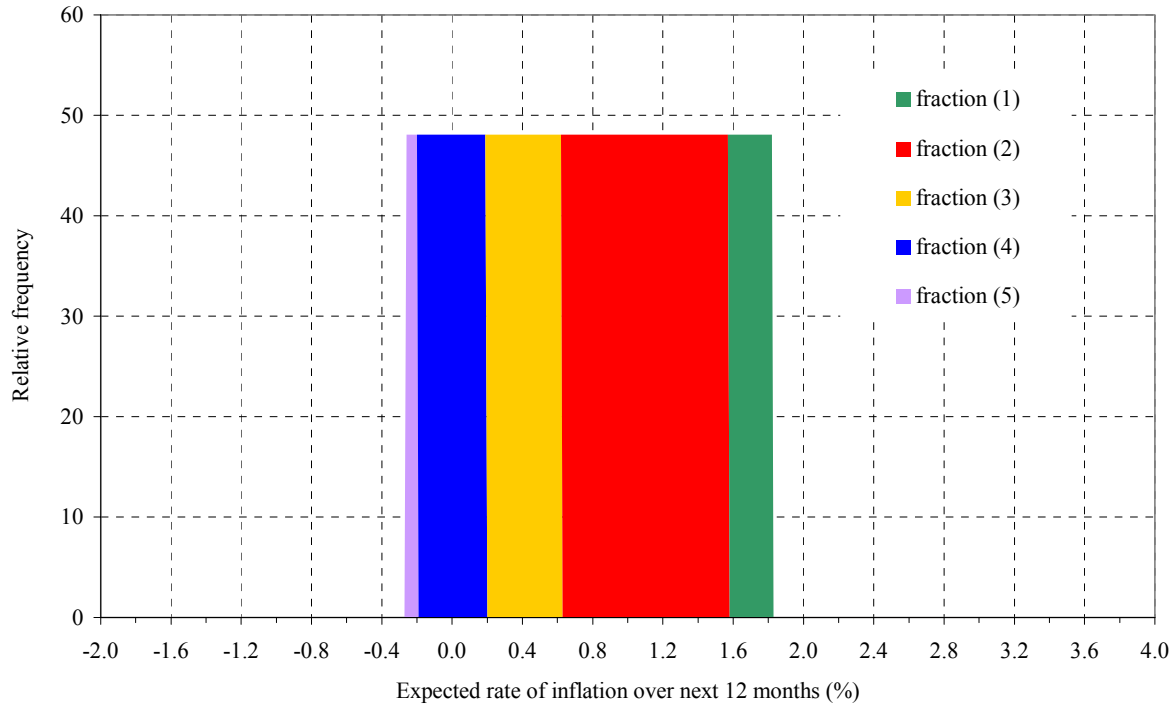


Source: own calculations.

Survey question: "Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present, (2) rise at the same rate, (3) rise more slowly, (4) stay at their present level, (5) go down, (6) difficult to say".

As far as the uniform distribution method is concerned, the mean of the expected rate of price change over the next 12 months coincided with the result derived from the normal distribution method (i.e. 0.8%). Coefficient q was estimated at 0.01, therefore respondents' inflation expectations fell in the interval $(-0.3\%\,;1.8\%)$. The coefficients s and t were equal to 0.005 and 0.002, respectively. This means that the respondents reporting that prices over the next 12 months would rise at the same rate believed that in the corresponding month of the following year annual inflation would fall within the interval $(0.6\%\,;1.6\%)$, while those respondents reporting that prices would stay the same believed that price growth over the next 12 months would fall within the interval $(-0.2\%\,;0.2\%)$.

Figure 8. Distribution of expected rates of inflation, December 2002, uniform distribution method



Source: own calculations.

Survey question: "Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present, (2) rise at the same rate, (3) rise more slowly, (4) stay at their present level, (5) go down, (6) difficult to say".

2.2. Determinants of quantification outcomes

In accordance with equations [12] and [24], the mean of the expected rate of price change, derived on the basis of probability methods, depends on the distribution of responses to the survey question and on the current rate of inflation known when the survey was carried out. The first factor describes the degree of the respondents' optimism as to future price movements. The second factor is a scale variable, which – along with the design of the survey question – serves respondents as a reference value in revealing their expectations. In terms of their impact on the quantification results, the above-mentioned factors may reinforce each other, but they may also operate in opposite directions. Thus, even if changes in the pattern of responses to the survey question, as disclosed by balance statistics, indicate an improvement in public opinions regarding future price movements, this does not necessarily mean that inflation expectations have been reduced. If these changes are accompanied by a sufficiently sizeable increase in the current rate of inflation, to which respondents refer in answering the survey question, the quantification outcome may lead to the conclusion that consumer inflation expectations have increased. Comparing changes in the R9 balance statistics calculated by Ipsos-Demoskop[8] with changes in measures of consumer inflation expectations derived on the basis of the adjusted Carlson and Parkin (1975) approach[9], we may note that, if they were both treated as indicators of the level of inflation expectations, they would in many cases lead to completely different conclusions as for the direction of change of consumer expectations (Figure 9). This is due to the fact that balance statistics can indicate the level of expected price changes only under a strong assumption that current inflation is constant. Failing this, they only summarise changes in the pattern of responses to the survey question, yet these are not the only determinant of the expected rate of inflation.

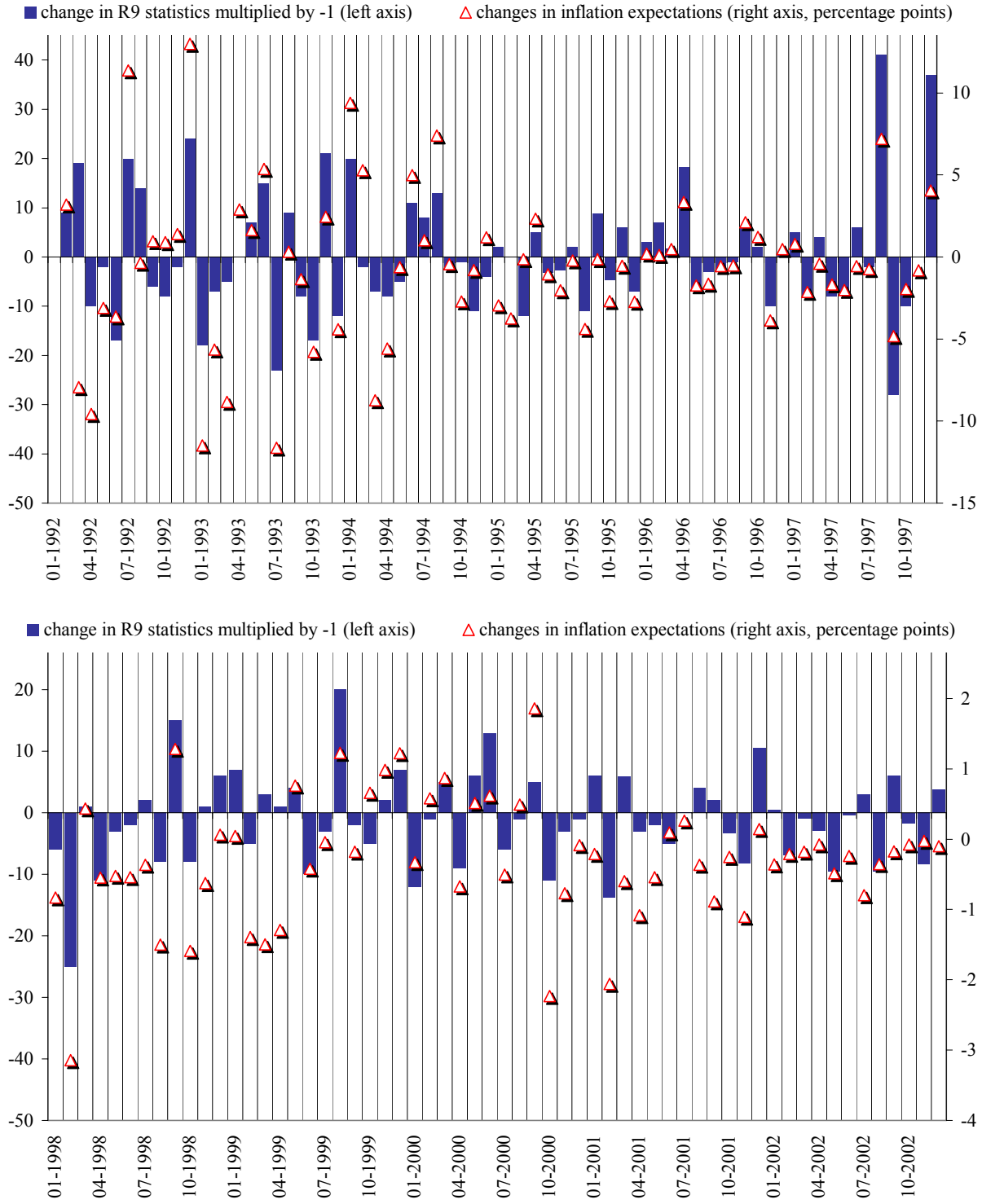
[8] R9 statistics calculated by Ipsos-Demoskop as follows:

$$R9 = 100 \cdot (b + f) + 200 \cdot (c + d + e)$$

where f is the percentage of respondents, who report that it is difficult to say how prices will behave in the course of the next 12 months. The increase in R9 suggests that consumers are more optimistic about future price movements. Obviously, there are alternative balance statistics. Forsells and Kenny (2002 a) note that a widely reported one is calculated as $\left(a + \frac{1}{2}b\right) - \left(\frac{1}{2}d + e\right)$.

[9] In subsequent parts of the paper, analysing features of consumer inflation expectations in Poland, normal distribution measures quantified on the basis of adjusted Carlson and Parkin (1975) approach are taken into account.

Figure 9. Monthly changes in R9 balance statistics multiplied by (–1)[*)] and changes in expected rate of inflation; 1992-1997 (upper chart) and 1998-2002 (lower chart)

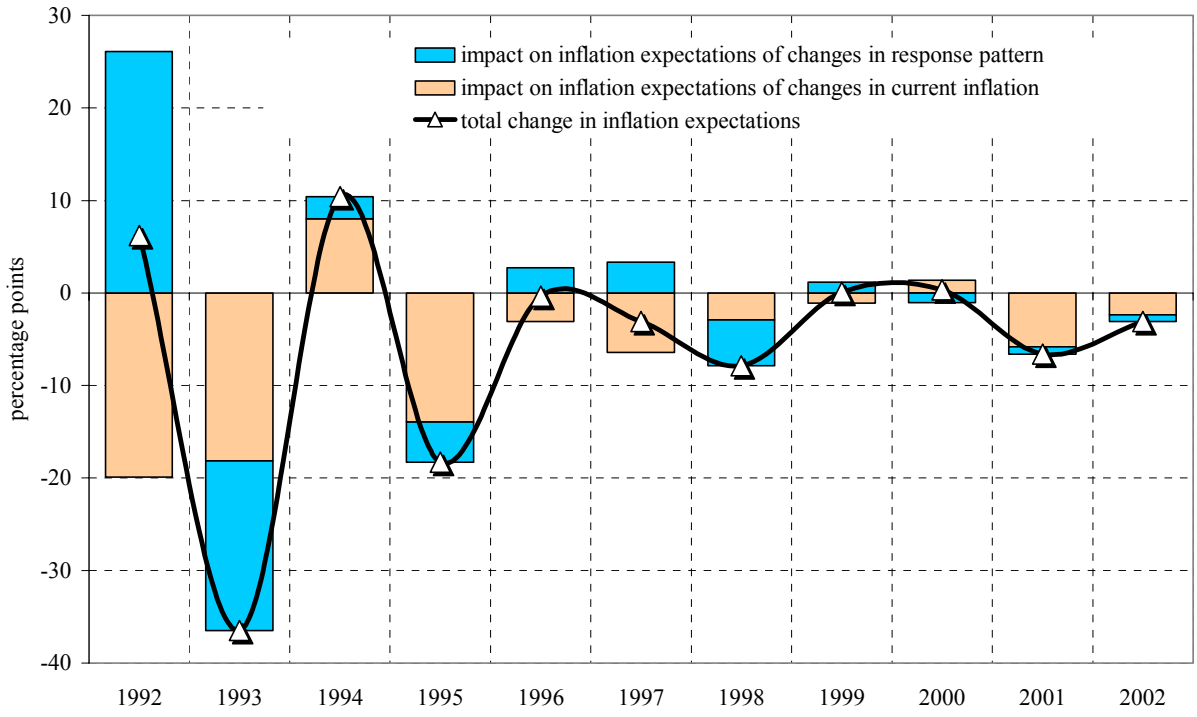


Source: Ipsos-Demoskop, own calculations.

[*)] An increase in the value of the balance statistics presented in Figure 9 (i.e. R9 balance statistics multiplied by – 1) represents a deterioration of the way, in which consumer inflation expectations are formed.

The years 1992-2002, which may be described as a decade of "movement from the fresh memory of hyperinflation to the first signs of price stability", saw significant changes in the pattern of responses to the survey question concerning Polish consumer inflation expectations. In the course of these years, the percentage of respondents reporting that over the next 12 months prices would rise faster fell by over 14 percentage points, while the percentage believing that prices would not change increased by over 10 percentage points.[10] However, the dominant factor lowering survey measures of inflation expectations was the disinflation process itself. In Figure 10, the cumulative annual changes in consumer inflation expectations are decomposed into two parts, reflecting the impact on the quantification outcome of changes in the distribution of responses to the survey question and of changes in the current rate of inflation.[11]

Figure 10. Decomposition of changes in consumer inflation expectations



Source: own calculations.

[10] Comparison of survey data for December 2002 and January 1992.
[11] The decomposition results should be treated as proxies. Referring to equations [12] and [24], one should note that the partial derivative of m with respect to the changes in the current rate of inflation depends on the pattern of responses to the survey question, while the partial derivatives of m with respect to changes in the response pattern depend upon the current rate of inflation.

In 1993, 1998 and 2000, changes in the pattern of responses to the survey question were more important in reducing Polish consumer inflation expectations than changes in the current rate of inflation. There were five years within the period under analysis when these two factors determining quantitative measures of inflation expectations operated in opposite directions (1992, 1996, 1997, 1999 and 2000).

2.3. Formation of Polish consumer inflation expectations

Before testing the character of Polish consumer inflation expectations, it should be underlined that the design of the survey question itself and the features of the quantification procedure affect conclusions concerning how inflation expectations are formed, as derived from the survey measures. With respect to the Ipsos-Demoskop survey, let us observe that, even if individuals set their expectations independently of what is currently happening, they will have to refer to their perception of past price movements in answering the question. The quantitative measures of inflation expectations are shaped both by the pattern of responses to the survey question and by the current rate of inflation. The assumptions of the probability methods therefore impose a close relationship, to some extent at least, between the quantification results and the current rate of inflation.

Figure 4 suggests that Polish consumer inflation expectations are heavily dependent on the current rate of inflation. However, let us note that the impact of changes in the current rate of inflation on consumer inflation expectations is amplified by movements in the pattern of responses to the survey question caused by changes in current inflation (among other things). Consumer inflation expectations seem to be more sensitive to increases than to decreases in the current rate of price change. Therefore, in order to examine quantitatively the relationship between changes in current inflation $\left(\Delta\pi^{0}\right)$ and changes in inflation expectations $\left(\Delta\pi^{e}\right)$, the additional variables: $\Delta\pi^{0-}$ and $\Delta\pi^{0+}$ are introduced, defined as follows:

[25] $$\Delta\pi_t^{0-} = \begin{cases} \Delta\pi_t^0 & if\ \Delta\pi_t^0 \prec 0 \\ 0 & if\ \Delta\pi_t^0 \geq 0 \end{cases}$$

[26] $$\Delta\pi_t^{0+} = \begin{cases} 0 & if\ \Delta\pi_t^0 \prec 0 \\ \Delta\pi_t^0 & if\ \Delta\pi_t^0 \geq 0 \end{cases}$$

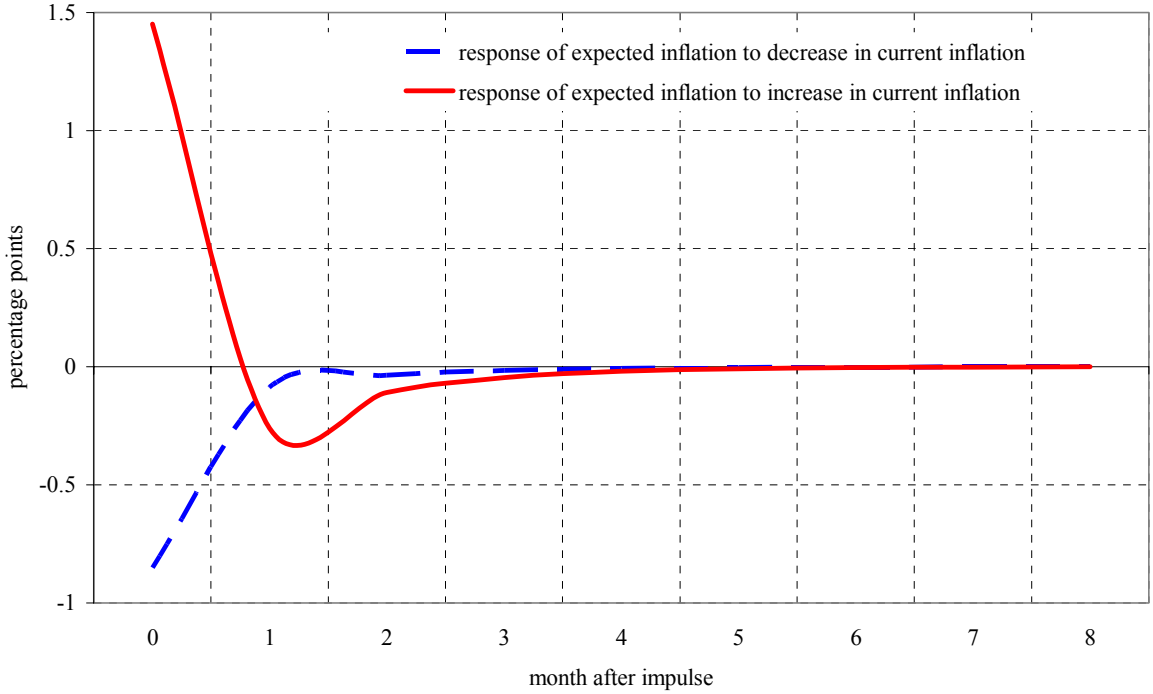
The relationship between positive and negative changes in the current rate of inflation and changes in Polish consumer inflation expectations is given by the following equation (standard errors in parentheses):

[27] $$\Delta\pi^e_{t+12|t} = \underset{(0.09)}{0.58}\cdot \pi^0_{t-1} - \underset{(0.09)}{0.54}\cdot \pi^e_{t+11|t-1} + \underset{(0.26)}{0.85}\cdot \Delta\pi_t^{0-} + \underset{(0.40)}{1.45}\cdot \Delta\pi_t^{0+} + \underset{(0.01)}{0.05}\cdot d_1 + \underset{(0.01)}{0.08}\cdot d_2 + \underset{(0.00)}{0.05}\cdot d_3 + \varepsilon_t$$

Sample: 1992.02-2002.12
Observations: 131
R^2 (adjusted R^2) – 0.60 (0,58)
DW stat. – 1.85

Variables d_1, d_2, d_3 are dummies indicating selected political and social events, namely, the fall of the Government in June 1992, the fall of the Government in May 1993, and the widespread flooding of July 1997. The estimation results indicate that a 1-percentage-point fall in the current rate of inflation causes an 85-basis-point fall in consumer inflation expectations, while a 1-percentage-point increase in the current rate of inflation raises inflation expectations by over 1.4 percentage points. The reaction of Polish consumer expectations to price changes is therefore asymmetrical with respect to the direction of these changes (Figure 11).

Figure 11. Reaction of expected inflation to temporary 1-point increase (decrease) in current rate of inflation



Source: own calculations.

Equation [27] may be expressed in the form of an error correction mechanism (ECM). In ECM models, it is assumed that some sort of long-run relationship exists among the variables analysed. Short-run fluctuations of the dependent variable are generated both by the short-run dynamics of explanatory variables and by the prior period deviation of the dependent variable from its long--run equilibrium value. Thus, equation [27] may be rewritten as[12]:

$$[28]\quad \Delta\pi^{e}_{t+12|t} = \underset{(0.09)}{-0.54}\cdot\left(\pi^{e}_{t+11|t-1} - \beta\cdot\pi^{0}_{t-1}\right) + \underset{(0.26)}{0.85}\cdot\Delta\pi^{0-}_{t} + \underset{(0.40)}{1.45}\cdot\Delta\pi^{0+}_{t} + \underset{(0.01)}{0.05}\cdot d_1 + \underset{(0.01)}{0.08}\cdot d_2 + \underset{(0.00)}{0.05}\cdot d_3 + \varepsilon_t$$

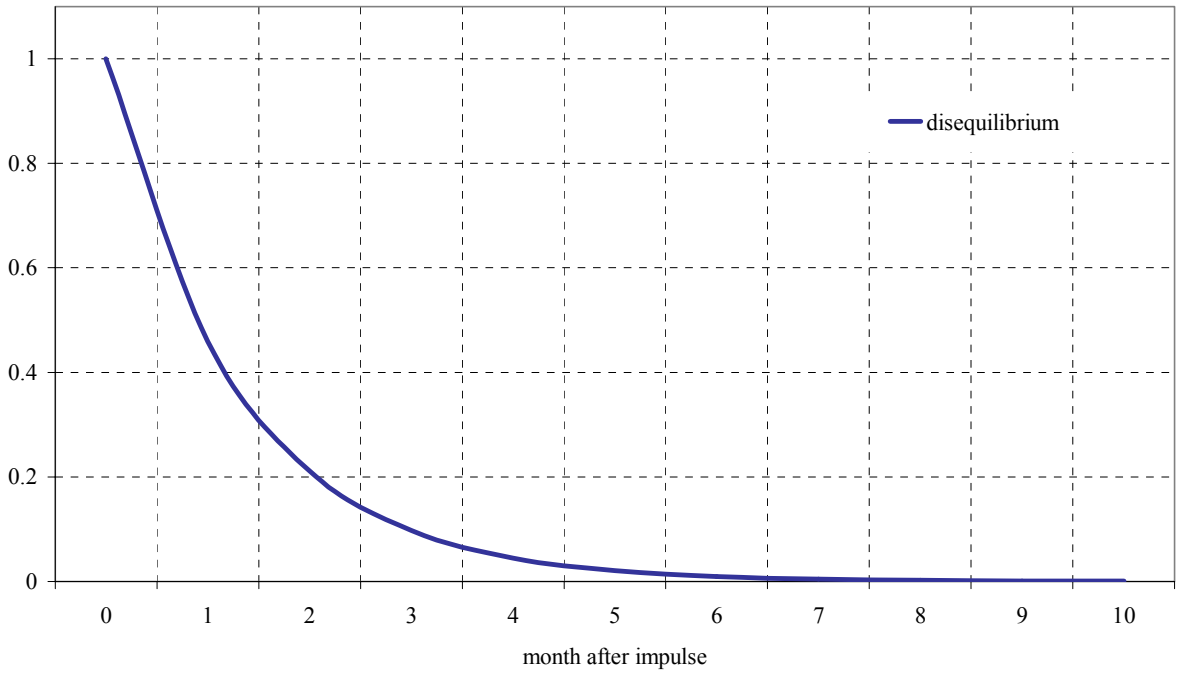
The parameter β, which describes the long-run relationship between the current rate of inflation and consumer inflation expectations, is equivalent to $0.58/0.54 \approx 1.07$. Applying the Wald test,

[12] Without making distinctions between positive and negative changes in the current rate of inflation, equation [27] is as follows (standard errors in parentheses):

$$\Delta\pi^{e}_{t+12|t} = \underset{(0.10)}{0.59}\cdot\pi^{0}_{t-1} - \underset{(0.09)}{0.54}\cdot\pi^{e}_{t+11|t-1} + \underset{(0.20)}{1.01}\cdot\Delta\pi^{0}_{t} + \underset{(0.01)}{0.05}\cdot d_1 + \underset{(0.01)}{0.07}\cdot d_2 + \underset{(0.00)}{0.06}\cdot d_3 + u_t$$

the hypothesis that β is equal to 1 is not rejected (the value of statistics χ^2: 0.2). This means that in the long run Polish consumer inflation expectations are equal to the current rate of inflation.[13] Should inflation expectations rise above their long-run value in a certain period, they will gradually return to the long-run path in subsequent periods. As a result, 54% of the disequilibrium is eliminated in the next period and equilibrium is restored approximately in the seventh period after the shock, as shown in Figure 12 below.

Figure 12. Error correction mechanism of Polish consumer inflation expectations



Source: own calculations.

It is assumed that, at the starting point (period 0), consumer inflation expectations rise 1 percentage point above the current rate of inflation (i.e., the long-run equilibrium level). The above figure illustrates how the resulting disequilibrium is reduced in subsequent periods (months) after the shock (on the basis of equation [28]).

[13] Replacing the current rate of inflation with the actual inflation ex-post in the long-run component of the equation [28] does not yield satisfactory results. The actual inflation ex-post appears statistically insignificant.

2.4. Testing the unbiasedness of Polish consumer inflation expectations

An important feature of inflation expectations, one that is a focus of ongoing debate among economists, is the degree to which they are consistent with actual inflation, ex-post. A frequent assumption made in macroeconomic models is that inflation expectations are rational, which means that economic agents fully exploit all available information and do not commit systematic forecast errors.[14] In other words, their expectations are unbiased and efficient predictors of actual inflation, which is equal to expected inflation on average, and to expected inflation plus a random forecast error period by period:

[29] $\pi^{e}_{t/t-n} \equiv \alpha + \beta \cdot \pi_t + \varepsilon_t \qquad (\alpha, \beta) = (0,1)$

where π_t denotes the actual inflation in period t, $\pi^{e}_{t/t-n}$ is the expectation of inflation at time t formed at time $t-n$, while ε_t is a white-noise error. In line with the rational expectations hypothesis, the coefficients α and β should be equal to zero and one, respectively. [15]

If inflation expectations are fully rational, they should exhibit two fundamental characteristics, i.e., unbiasedness and efficiency [Lloyd (1999)]. As far as Polish consumer inflation expectations are concerned, the former is tested in this section, while the latter will be dealt with in the next part of the paper. Confronting Polish consumer inflation expectations with actual inflation ex--post, forecast errors may be computed in the following way:

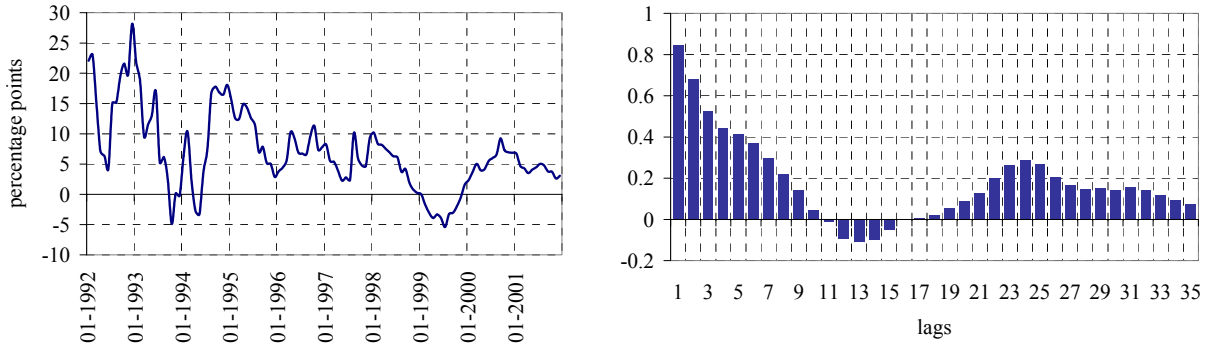
[30] $e_t = \pi^{e}_{t} - \pi_{t+12}$

In line with the rational expectations hypothesis, forecast errors should have a zero mean. In addition, non-overlapping errors in predicting inflation should be uncorrelated – otherwise agents could improve their expectations by taking better account of past errors [Forsells and Kenny

[14] A. Stevenson, V. Muscatelli, M. Gregory (1988), pp. 73-76.
[15] See: H. Bakhshi and A. Yates (1998), p. 9.

(2002 a)].[16] For monthly data and expectations formed for 12 months ahead, the errors are overlapping and this may lead to some positive autocorrelation, although it should dampen out for lags greater than 12. As Figure 13 demonstrates, neither of the desirable features mentioned above are supported by Polish data: the mean of the error distribution is positive (equal approximately to 7 percentage points in 1992-2002) and non-overlapping errors seem to be positively correlated in the longer horizon.

Figure 13. Expectation errors and their autocorrelation



Source: own calculations.

Forecast performance statistics (Table A), such as the mean error (ME), the mean absolute error (MAE), the mean absolute percentage error (MAPE) or the root mean squared error (RMSE), reveal the following tendencies. Firstly, Polish consumer inflation expectations seem to be biased and permanently overstate future price movements. Secondly, they constitute a worse predictor of inflation one year ahead than two benchmarks taken into consideration, namely, the inflation expectations of commercial bank analysts and naive expectations. Thirdly, the forecast errors of Polish consumers tend to diminish over time.[17]

[16] Grant and Lloyd (1999) point out that in early studies the existence of a strong serial correlation in expectational errors was commonly interpreted to be inconsistent with the rational expectations hypothesis. However, such a judgement is today considered invalid because of overlapping forecast intervals (agents are frequently unaware of their recent errors at the time they have to report new predictions). Uncertainty about the persistence of shocks can also give rise to correlated forecast errors.

[17] Due to the fact that the Reuters survey data on commercial bank analyst expectations are available starting from 1996, two time periods were examined separately: 1992-2001 and 1996-2001. Additionally the second sample was split in subperiods: 1996-1998 and 1998-2001. The cut-off corresponds to the adoption of direct inflation targeting in Poland.

Table A. Forecast performance statistics: alternative measures of expected inflation

	Polish consumer expectations (normal distribution)	Polish consumer expectations (uniform distribution)	Commercial bank analyst expectations [1)]	Naive expectations [2)]
Period: 1992.01-2001.12				
ME	**6.99**	**7.72**	**-**	**5.05**
MAE	**7.68**	**8.39**	**-**	**5.80**
MAPE	**0.75**	**0.78**	**-**	**0.68**
RMSE	**0.92**	**1.17**	**-**	**0.50**
Period: 1996.01-2001.12				
ME	**4.30**	**4.60**	**1.22**	**3.50**
MAE	**5.13**	**5.40**	**2.39**	**4.48**
MAPE	**0.97**	**1.00**	**0.57**	**0.92**
RMSE	**0.33**	**0.39**	**0.07**	**0.23**
Subperiod: 1996.01-1998.12				
ME	6.10	6.52	1.94	4.93
MAE	6.10	6.52	2.07	4.93
MAPE	0.61	0.65	0.22	0.51
RMSE	0.45	0.55	0.06	0.28
Subperiod: 1999.01-2001.12				
ME	2.50	2.68	0.50	2.06
MAE	4.17	4.28	2.72	4.03
MAPE	1.34	1.36	0.91	1.34
RMSE	0.21	0.23	0.09	0.19

[1)] Based on quantitative Reuters survey.
[2)] Expected inflation equal to current rate of inflation.

To carry out a formal check of the rationality of Polish consumer expectations, the approach that has been applied is that suggested by Bakhshi and Yates (1998). Since both actual inflation and consumer inflation expectations are non-stationary[18], the cointegration between these variables is first tested. The Johansen cointegration test indicates that there is one cointegrating equation at both the 5% and 1% significance levels. This yields the following long-run relationship between consumer inflation expectations and actual inflation (standard errors in parentheses):

[18] Actual inflation (year on year) and expected inflation are both I(1). ADF statistics on the levels of both variables are equal to –1.24 and –1.22, respectively, while on the first differences they are equal to –5.15 and –6.87.

[31] $\pi^{e}_{t/t-12} = \underset{(0.006)}{-0.003} + \underset{(0.03)}{1.12} \cdot \pi_t + \varepsilon_t$

Sample: 1994.02-2002.12
Observations: 107
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Under the rational expectations hypothesis, the cointegrating vector should have a null constant term and opposite coefficients for expected and actual inflation. The joint restriction of a unit coefficient and zero constant is rejected: the LR statistic is equal to 8.3.

Alternatively, the cointegrating equation is estimated with Ordinary Least Squares and the Wald coefficient test is used to examine the rationality of Polish consumer inflation expectations. The results presented in Table B confirm that objectified measures of consumer expectations in Poland were biased, taking into consideration both headline inflation and various measures of core inflation.

Table B. Test for unbiasedness ($\pi^{e}_{t/t-12} = \alpha + \beta \cdot \pi_t + \varepsilon_t$) with respect to headline and core inflation

	Sample period	α	β	R^2	χ^2
Headline CPI	**1992:01-2001:12**	**0.027 (.008)**	**1.26 (0.06)**	**0.86**	**188.0 [.000]**
Headline CPI	1992:01-1996:12	0.072 (.023)	1.12 (.11)	0.63	200.6 [.000]
Headline CPI	1997:01-2001:12	0.061 (.007)	0.67 (.12)	0.33	137.0 [.000]
Core CPI – all items excluding officially administered prices	1997:01-2001:12	0.064 (.007)	0.70 (.14)	0.30	183.3 [.000]
Core CPI – all items excluding most volatile prices	1997:01-2001:12	0.063 (.008)	0.66 (.13)	0.31	149.9 [.000]
Core CPI – all items excluding fuels and most volatile prices	1997:01-2001:12	0.053 (.007)	0.81 (.12)	0.40	170.3 [.000]
15% trimmed mean	1997:01-2001:12	0.047 (.006)	0.91 (.10)	0.49	152.0 [.000]
"Net" inflation (CPI – all items ex-food and fuels)	1997:01-2001:12	0.032 (.006)	0.92 (.07)	0.63	69.0 [.000]

Equations are estimated by OLS using covariance matrix corrections suggested by Newey and West (1987). Figures in parentheses are standard errors. Figures in brackets are P values. χ^2 *statistics pertain to null hypothesis:* $H_0 : (\alpha , \beta) = (0 , 1)$.

To summarise, the econometric evidence suggests that Polish consumer inflation expectations are not rational. However, as indicated by Lloyd (1999), some warnings about drawing inferences from survey data should be acknowledged. Firstly, the surveys do not necessarily measure informed opinion, nor do they indicate the most probable scenario as expected by respondents.[19] Secondly, respondents may devote little time and effort to the development of their individual predictions. Thirdly, the unforeseen consequences of regime changes can result in systematic forecast errors in certain periods, even when agents are fully rational.[20]

2.5. Testing the macroeconomic efficiency of Polish consumer inflation expectations

This section examines the second condition for expectations to be rational, namely, macroeconomic efficiency. In testing the macroeconomic efficiency of Polish consumer inflation expectations, the method employed is that suggested by Forsells and Kenny (2002 a) and also by Mehra (2002). Two degrees of macroeconomic efficiency are distinguished. The weak-form efficiency of inflation expectations requires that expectational errors (defined as the difference between the expected and actual rate of inflation) be orthogonal to an information set that includes only past values of inflation.[21] The strong-form efficiency requires that expectational errors be orthogonal with respect to a much wider information set, encompassing a range of macroeconomic variables that are thought to influence price behaviour. In other words, agents are supposed to incorporate effectively information about all the variables that a state-of-the-art model of inflation would include [Lloyd (1999)].

[19] For example something akin to a "threat contagion effect" and "optimism contagion effect" may be discerned. The former involves the fact that, when respondents perceive a relatively high probability of finding themselves in financial distress, they may be inclined to express more pessimistic views in responding to survey questions related to other areas, which among other things may be reflected in an increase in their inflation expectations. In this case, the quantification results would not necessarily yield the most probable inflation scenario predicted by consumers, but rather the most pessimistic one. The second effect referred to above applies to periods when the respondents' optimism makes their responses to survey questions biased in the opposite direction. In this case, quantified measures of inflation expectations would reflect the most optimistic scenario perceived by consumers. There is some evidence of the behavioural relationship described above in Poland.

[20] Referring to U.S. experiences, Lloyd (1999) mentions two examples of such regime change, namely, the imposition of wage-price controls in 1971 and the implementation of the Federal Reserve's "monetarist experiment" in 1979.

[21] Lloyd (1999) underlines that the weak-form efficiency is based on the notion that information about the past history of inflation itself is costless, while other information is costly.

To check the efficiency of consumer inflation expectations in the euro area countries, Forsells and Kenny (2000 a) estimate a sequence of equations of the following structure:

[32] $e_t = \alpha + \beta \cdot \Omega_t + u_t$

where e denotes expectational errors and Ω represents the set of information variables that are relevant for predicting inflation and are available at the time when expectations are formed. Due to possible problems with multicollinearity, which could appear while estimating equation [32] in a multivariate context, univariate regressions are run, in which the dependent variable is the year--on-year change in the information variable at the time that the expectations were formed. A statistically significant β suggests that agents failed to take account of the selected information variable in an optimal way in assessing future price developments.

The method used to verify the macroeconomic efficiency of Polish consumer inflation expectations differs from the approach of Forsells and Kenny (2002 a) in two ways. Firstly, due to a strong autocorrelation of forecast errors, an additional estimate is performed of an extended version of the test equation [32], with the lagged forecast error on its right-hand side. This substantially improves the statistical properties of the estimation results. Secondly, data publication lags are taken into account, so information variables effectively known to respondents when the survey is carried out are used in the test equation. Four groups of information variables are considered: interest rates, exchange rates, demand variables, and price and cost variables. The test results are presented in Table C below, both for the full sample period (1992-2002) and for two subperiods (1992-1998; 1999-2002). The cut-off selected corresponds to the adoption of direct inflation targeting by the National Bank of Poland.

Table C. Testing the macroeconomic efficiency of Polish consumer inflation expectations

Equation:	$e_t = \alpha + \beta \cdot \Omega_t + u_t$						$e_t = \alpha_0 + \alpha_1 \cdot e_{t-1} + \gamma \cdot \Omega_t + v_t$					
Period:	**1992:01 - - 2002:12**		1992:01 - - 1998:12		1999:01 - - 2002:12		**1992:01 - - 2002:12**		1992:01 - - 1998:12		1999:01 - - 2002:12	
	β	***Prob.***	β	*Prob.*	β	*Prob.*	γ	***Prob.***	γ	*Prob.*	γ	*Prob.*
INTEREST RATES												
Δ(WIB1M)	**0.04**	***.87***	-0.37	*.02***	0.60	*.00****	**0.09**	***.04****	0.03	*.74*	0.20	*.00****
Δ(WIB1MR)	**-0.02**	***.91***	-0.23	*.04***	0.59	*.00****	**0.11**	***.02****	0.08	*.27*	0.18	*.00***
Δ(WIB3M)	**0.13**	***.45***	0.03	*.88*	0.56	*.00****	**0.09**	***.06****	0.06	*.49*	0.19	*.00****
Δ(WIB3MR)	**0.03**	***.86***	-0.11	*.37*	0.47	*.03***	**0.12**	***.03****	0.09	*.23*	0.19	*.00****
Δ(ICR) [1)]	**0.86**	***.00****	-	-	0.79	*.00****	**0.25**	***.00****	-	-	0.27	*.00****
Δ(ICRR) [1)]	**0.85**	***.00****	-	-	0.80	*.01****	**0.08**	***.38***	-	-	0.21	*.04***
EXCHANGE RATES												
Δ(PLN/USD)	**0.04**	***.60***	-0.06	*.58*	-0.12	*.16*	**0.01**	***.72***	-0.01	*.81*	0.04	*.07**
Δ(PLN/EUR)	**0.05**	***.52***	0.15	*.44*	-0.37	*.00****	**0.00**	***.81***	0.09	*.47*	-0.03	*.50*
DEMAND VARIABLES												
Δ(IOUT)	**0.37**	*.00****	0.38	*.00****	0.21	*.09**	**0.08**	***.09****	0.09	*.28*	0.08	*.00****
Δ(GDP) [2)]	**0.46**	*.27*	-0.25	*.71*	-	-	**0.20**	***.47***	-0.18	*.67*	-	-
Δ(U)	**-0.51**	*.16*	0.22	*.71*	1.93	*.02***	**-0.04**	***.78***	0.04	*.88*	0.80	*.00****
PRICE AND COST VARIABLES												
Δ(CPI)	**0.43**	***.02****	0.61	*.00****	0.71	*.00****	**0.13**	***.09****	0.24	*.06**	0.19	*.00****
Δ(PPI)	**0.29**	***.08****	0.35	*.01***	0.40	*.08**	**0.04**	***.44***	0.06	*.39*	0.14	*.00****
Δ(OP) [3)]	**0.01**	***.57***	-	-	-	-	**0.02**	***.01****	-	-	-	-
Δ(FPI)	**-0.18**	***.00****	-0.19	*.00****	0.11	*.26*	**-0.03**	***.25***	-0.05	*.15*	-0.04	*.10**

[1)] Sample starts 1998.
[2)] Estimated using data of quarterly frequency.
[3)] Estimated using data of quarterly frequency, sample starts 1995.

** denotes significance at .1 level. ** denotes significance at .05 level. *** denotes significance at .01 level.*

WIB1M – 1-month interbank offered rate; WIB1MR – WIB1M in real terms; WIB3M – 3-month interbank offered rate; WIB3MR – WIB3M in real terms; ICR – interest rate on personal PLN time deposits; ICRR – ICR in real terms; IOUT – industrial output; OP – world oil price (USD per barrel); FPI – food price index (y/y); PPI – producer price index (y/y).

The estimation results indicate that the use of available information by Polish consumers seems to be far from optimal, and even weak-efficiency requirements are not fulfilled. In the years 1992-2002 the variables taken into account by consumers in formulating inflation predictions mainly comprised exchange rates and demand variables such as GDP growth or unemployment rate. The remaining categories analysed do not appear to be given adequate consideration (al-

though in some cases different specifications of the test equation lead to contradictory conclusions), since they are statistically significant in explaining expectational errors.

Interestingly, there is no evidence that the macroeconomic efficiency of Polish consumer inflation expectations tends to increase over time. On the contrary, some of the information variables (e.g. interbank interest rates, unemployment rate) taken into consideration in the first of the subperiods selected were not used in the second. This suggests that, even if the adoption of direct inflation targeting in Poland and the commitment of the monetary authorities to achieving price stability has influenced the pattern of responses to the survey question and anchored the level of consumer inflation expectations, it has yet to increase their forward-lookingness.

3. Consumer inflation expectations in euro area and in Poland

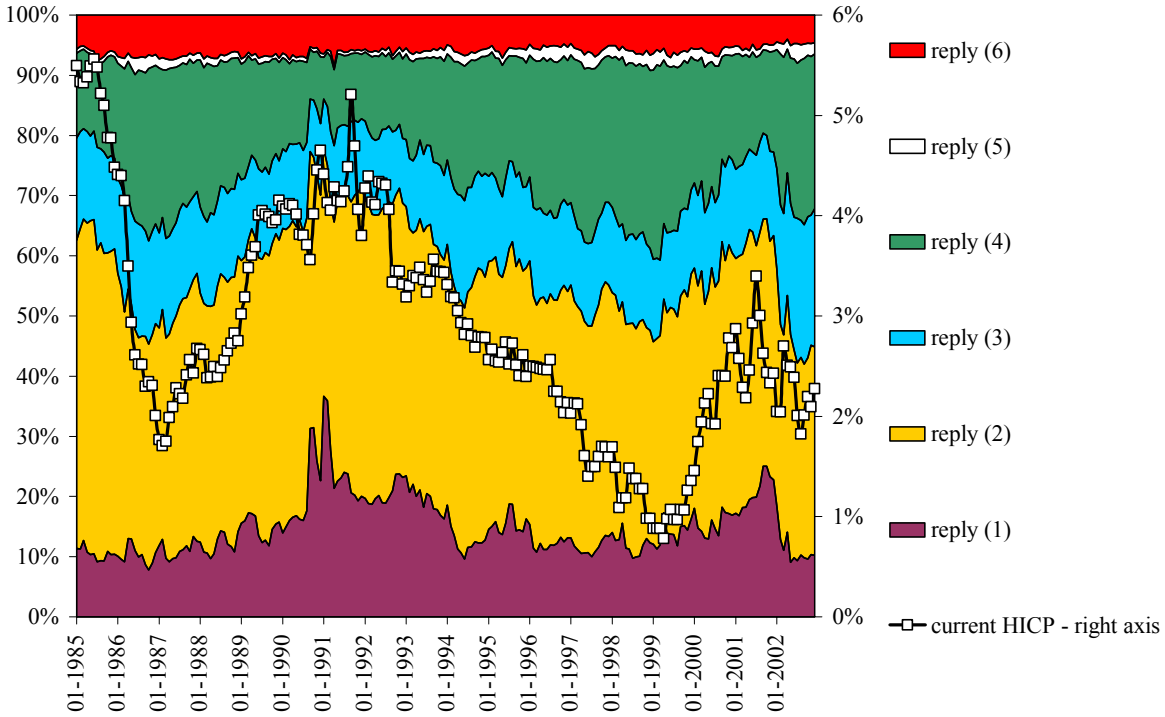
3.1. Euro area survey question response patterns and quantification results

Is the way in which consumers form their expectations in Poland significantly different from that in the developed market economies? The aim of the following sections of this paper is to shed some light on the specific features of consumer inflation expectations in a transition economy that has in the past experienced high and volatile inflation.

Data from the European Commission Consumer Survey question are used to quantify consumer inflation expectations in the euro area. Since the European Commission Survey question is analogous to the Ipsos-Demoskop one, it is possible to implement the same adjusted Carlson and Parkin (1975) approach to derive objectified measures of euro area consumer inflation expectations. These may then be analysed in order to draw some conclusions for cross-country comparisons.

The pattern of responses to the European Commission Survey question concerning consumer inflation expectations is presented in Figure 14. Movements in the distribution of responses, which reveals the degree of the respondents' optimism in forming expectations, seem to be highly correlated with changes in the current rate of inflation.

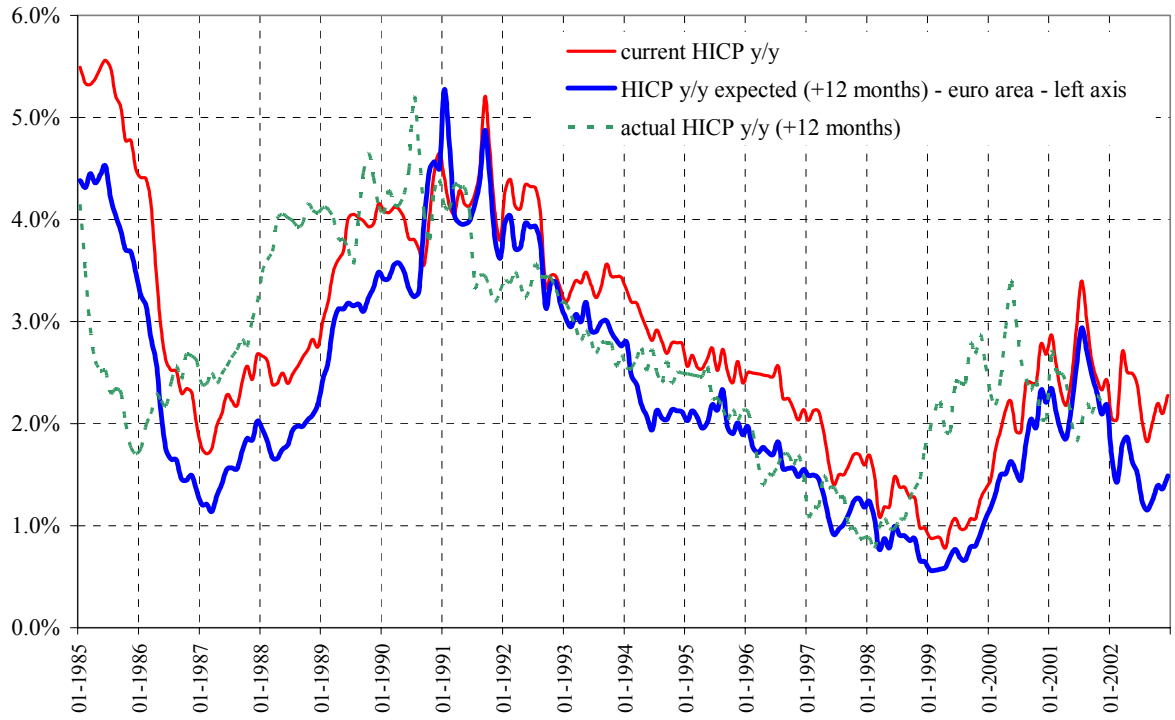
Figure 14. Pattern of responses to European Commission Survey question concerning inflation expectations in euro area member states, 1985-2002



Source: survey carried out by the European Commission – DG ECFIN, Eurostat.
Survey question: "By comparison with what is happening now, do you think that in the next 12 months: (1) there will be a more rapid increase in prices, (2) prices will increase at the same rate, (3) prices will increase at the slower rate, (4) prices will stay about the same, (5) prices will fall slightly, (6) difficult to say".

As with the measures quantified by Forsells and Kenny (2002 a), objectified measures of consumer inflation expectations in the euro area suggest a strong relationship between actual and expected inflation (Figure 15). In particular, it seems worth mentioning that consumers anticipated the downtrend in inflation in the course of the 1990s, contrary to the second half of the 1980s and the years 1998-2000, when they underpredicted the actual inflation figures.

Figure 15. Objectified measures of euro area consumer inflation expectations

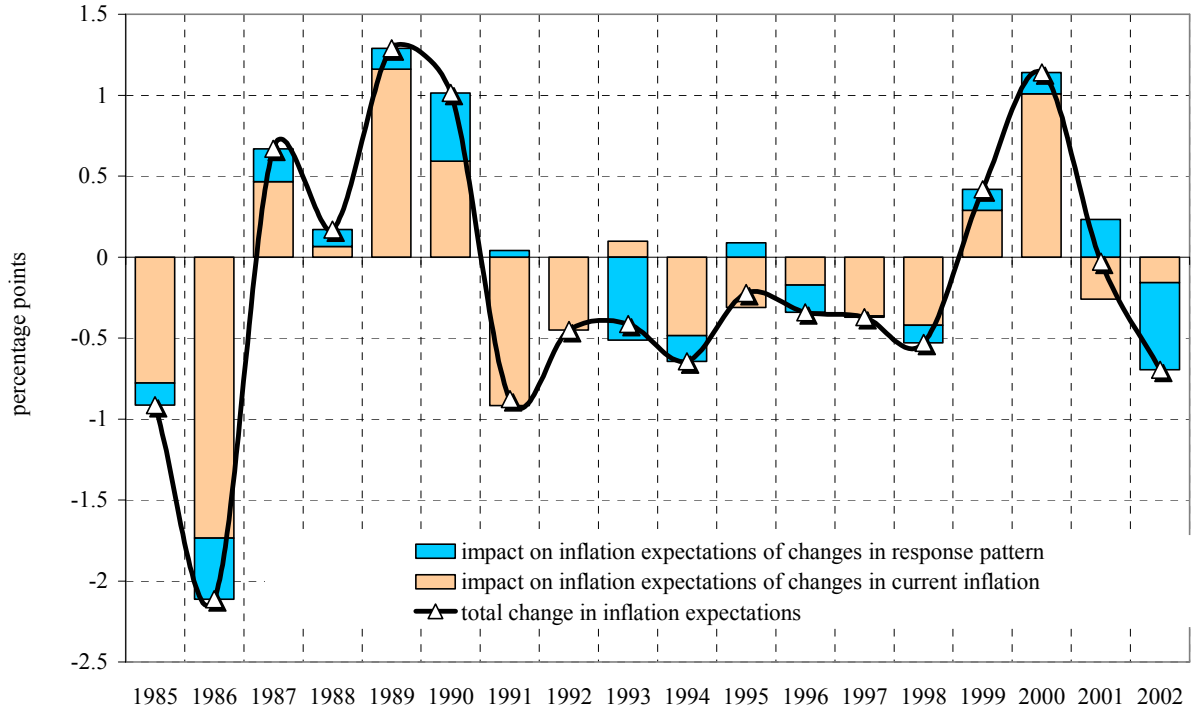


Source: Eurostat, own calculations.

HICP y/y expected (+12 months) *denotes the expected rate of change of consumer prices over the next 12 months, estimated on the basis of the adjusted Carlson and Parkin (1975) method;* ***actual HICP y/y ex-post (+12 months)*** *denotes the actual HICP year on year, with reference to which expectations were formed;* ***current HICP y/y*** *is the annual harmonised index of consumer prices known at the moment when surveys were carried out.*

Decomposing annual changes in consumer inflation expectations to provide a separate reflection of the effect produced by shifts in the pattern of responses to the survey question and by changes in the current rate of inflation confirms the prominent role of the latter (Figure 16). Both determinants of the quantification outcome have usually operated in the same direction, with the exception of 1991, 1993, 1995 and 2001.

Figure 16. Decomposition of changes in euro area consumer inflation expectations



Source: own calculations.

3.2. Formation and properties of euro area consumer inflation expectations

To describe how euro area consumers set their inflation expectations, the following ECM relationship is taken into account:

$$[33] \quad \Delta\pi^{e}_{t+12|t} = \alpha_1 \cdot \pi_{t+11} + \alpha_2 \cdot \pi^{e}_{t+11|t-1} + \beta_1 \cdot \Delta\pi_t^{0-} + \beta_2 \cdot \Delta\pi_t^{0+} + \varepsilon_t$$

where π^e denotes expected inflation, π actual inflation and $\Delta\pi^{0-}$ and $\Delta\pi^{0+}$ are positive and negative changes in the current rate of inflation, respectively:

$$[34] \quad \Delta\pi_t^{0-} = \begin{cases} \Delta\pi_t^0 & if\ \Delta\pi_t^0 \prec 0 \\ 0 & if\ \Delta\pi_t^0 \geq 0 \end{cases}$$

[35] $$\Delta\pi_t^{0+} = \begin{cases} 0 & if\ \Delta\pi_t^0 \prec 0 \\ \Delta\pi_t^0 & if\ \Delta\pi_t^0 \geq 0 \end{cases}$$

The estimation results of equation [33] may be written as follows (standard errors in parentheses):

[36] $$\Delta\pi^e_{t+12|t} = \underset{(0.01)}{0.03}\cdot \pi_{t+11} - \underset{(0.01)}{0.03}\cdot \pi^e_{t+11|t-1} + \underset{(0.07)}{0.66}\cdot \Delta\pi_t^{0-} + \underset{(0.06)}{0.73}\cdot \Delta\pi_t^{0+} + \varepsilon_t$$

Sample: 1985.02-2001.12
Observations: 203
R^2 (adjusted R^2) – 0.59 (0.58)
DW stat. – 2.00

The hypothesis that respondents adjust their expectations to the prior period deviation from actual inflation ex-post and react symmetrically to increases and decreases in the current rate of inflation, i.e.:

[37] $$H_0: \quad \alpha_1 = -\alpha_2 \ , \ \beta_1 = \beta_2$$

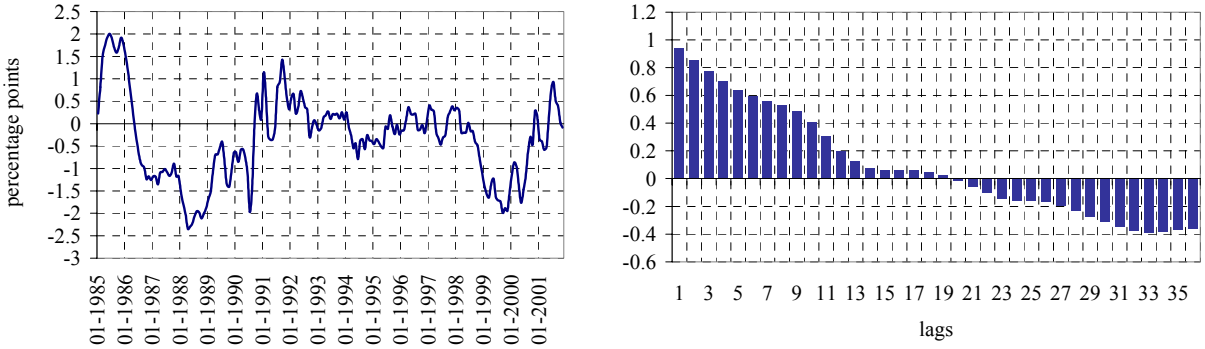
is not rejected (χ^2 statistics equal to 0.92). Therefore, a constrained version of equation [36] is estimated, leading to the following specification:

[38] $$\Delta\pi^e_{t+12|t} = -\underset{(0.01)}{0.03}\cdot \left(\pi^e_{t+11|t-1} - \pi_{t+11}\right) + \underset{(0.05)}{0.70}\cdot \Delta\pi_t^0 + u_t$$

Sample: 1985.02-2001.12
Observations: 203
R^2 (adjusted R^2) – 0.59 (0.58)
DW stat. – 2.00

Objectified measures of consumer inflation expectations in the euro area do not fulfil the requirements of the rational expectations hypothesis and usually underestimated actual price movements ex-post. The mean of expectational errors is negative (equal to –0.3 percentage points) and even if the autocorrelation of these errors decays gradually, there does appear to be some negative autocorrelation for lags greater than twelve.

Figure 17. Expectation errors and their autocorrelation



Source: own calculations.

A formal verification of the rational expectations hypothesis was carried out in the way consistent with Forsells and Kenny (2002 a) study, i.e. using the test equation:

[39] $\pi_t = \alpha + \beta \cdot \pi^e_{t/t-n} + \varepsilon_t$

If the joint null hypothesis $(\alpha, \beta) = (0,1)$ is not rejected, it can be argued that expectations are unbiased in statistical sense. Estimation results prove that in 1986-2002 consumer inflation expectations in the euro area were biased, in terms of both headline inflation (Table D) and various measures of core inflation (Table E). This result also applies to the recent subperiod (1993-2002), which stands in contradiction to the findings obtained on the basis of subjective measures of consumer inflation expectations by Forsells and Kenny (2002 a).[22]

[22] Quantifying consumer inflation expectations, Forsells and Kenny (2002 a) calculate the subjective perception of past price movements on the basis of a qualitative EC Survey question concerning perceived inflation. They use this indicator instead of assuming that consumers perceive inflation correctly.

Table D. Test for unbiasedness ($\pi_t = \frac{\alpha}{100} + \beta \cdot \pi^e_{t/t-12} + \varepsilon_t$) with respect to headline inflation

	Measure of euro area consumer inflation expectations based on current inflation rate				Forsells and Kenny (2002 a) measure of euro area consumer inflation expectations based on subjectively perceived inflation rate*)			
	α	β	R^2	χ^2	α	β	R^2	χ^2
Full period: 1986:01-2002:12	1.44 (.25)	0.53 (.10)	0.37	33.6 [.000]	0.55 (.40)	0.90 (.14)	0.41	5.86 [.053]
Subperiod: 1986:01-1992:12	2.77 (.38)	0.20 (.13)	0.07	52.5 [.000]	2.48 (.48)	0.37 (.15)	0.12	32.4 [.000]
Subperiod: 1993:01-2002:12	1.12 (.28)	0.56 (.10)	0.50	17.6 [.000]	-0.07 (.39)	1.00 (.14)	0.63	0.91 [.635]

*) *Sample finishes December 2000.*

Equations are estimated by OLS using covariance matrix corrections suggested by Newey and West (1987). Figures in parentheses are standard errors. Figures in brackets are P values. χ^2 *statistics pertain to null hypothesis:* $H_0 : (\alpha , \beta) = (0 , 1)$.

Table E. Test for unbiasedness ($\pi_t = \frac{\alpha}{100} + \beta \cdot \pi^e_{t/t-12} + \varepsilon_t$) with respect to core inflation

	HICP – all items excluding energy and unprocessed food				HICP – all items excluding energy and food				HICP – all items excluding energy			
	α	β	R^2	χ^2	α	β	R^2	χ^2	α	β	R^2	χ^2
Full period: 1988:10-2002:12	0.53 (.13)	0.92 (.04)	0.84	25.9 [.000]	0.45 (.12)	0.95 (.04)	0.84	26.9 [.000]	0.70 (.17)	0.84 (.06)	0.76	21.3 [.000]
Subperiod: 1988:10-1992:12	2.34 (.17)	0.45 (.05)	0.75	202.0 [.000]	2.19 (.15)	0.51 (.04)	0.78	250.2 [.000]	2.70 (.24)	0.35 (.07)	0.56	149.8 [.000]
Subperiod: 1993:01-2002:12	0.34 (.08)	0.94 (.04)	0.89	28.4 [.000]	0.30 (.09)	0.96 (.05)	0.88	25.5 [.000]	0.58 (.12)	0.81 (.04)	0.81	23.4 [.000]

Equations are estimated by OLS using covariance matrix corrections suggested by Newey and West (1987). Figures in parentheses are standard errors. Figures in brackets are P values. χ^2 *statistics pertain to null hypothesis:* $H_0 : (\alpha , \beta) = (0 , 1)$.

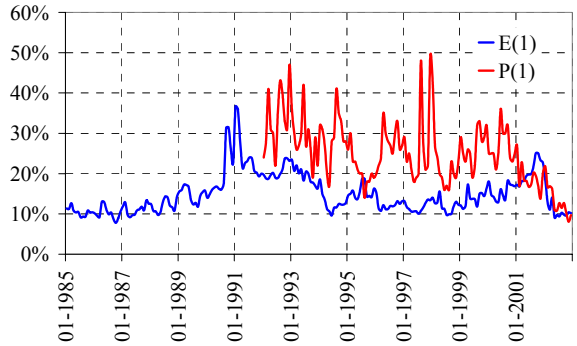
3.3. Comparison of Polish and euro area consumer inflation expectations

The availability of similar survey data and the implementation of analogous quantification procedures allow some comparative conclusions to be drawn regarding how consumer inflation expectations are formed in the euro area and in Poland. The transition from a centrally planned economy to a market economy constitutes a complex process of structural and institutional adjustment, but the primary changes which make this process possible are behavioural. Given this, the way in which Polish consumers set their inflation expectations should be expected to react to the psychological changes that are a crucial part of the transition process. Hence it seems particularly interesting to analyse whether the basic features of consumer inflation expectations in both economies display a tendency to converge.

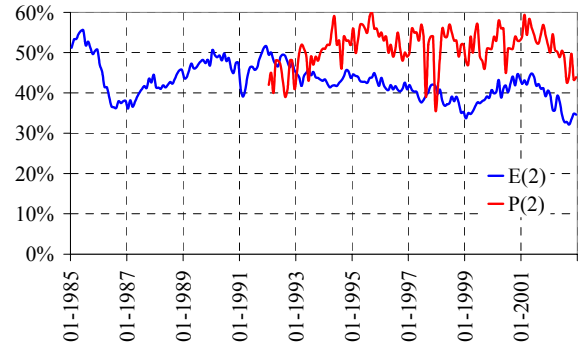
The gradual convergence of the formation of consumer inflation expectations in Poland and in the euro area is confirmed by changes in the pattern of responses to the survey question, as portrayed in Figure 18. Significant differences are apparent in examining the respective fractions of respondents in 1992-2000. These refer both to the average percentage of respondents choosing each of the response categories and to their volatility. In particular, fractions (1) and (2), consisting of relatively more pessimistic respondents, were larger and more volatile in Poland than in the euro area, while fraction (4), comprising respondents who believed that prices would remain stable, was substantially smaller and less volatile in Poland than in the euro area. The high inflation environment meant that Polish consumers rarely reported that prices would fall in the course of the following twelve months.

Figure 18. Pattern of responses to survey question, euro area and Poland

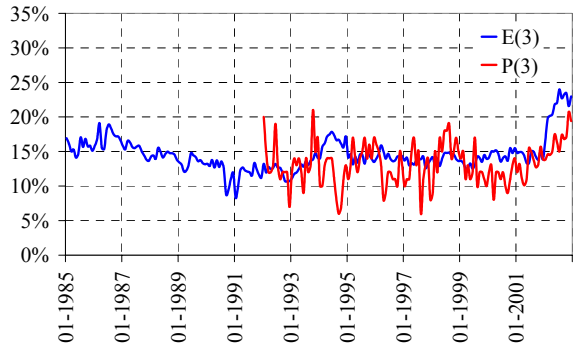
18A) Fraction (1)



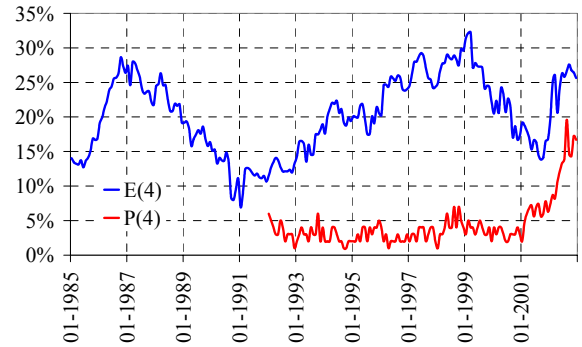
18B) Fraction (2)



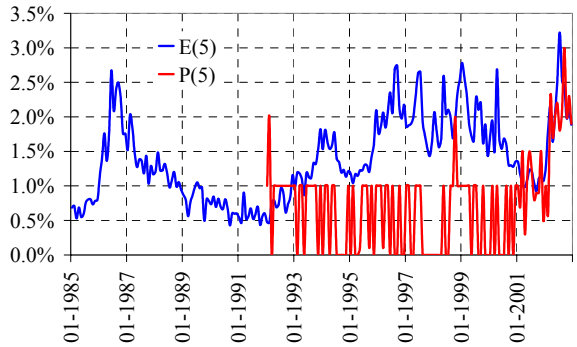
18C) Fraction (3)



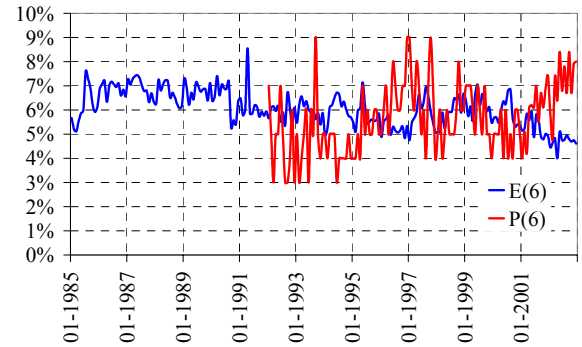
18D) Fraction (4)



18E) Fraction (5)



18F) Fraction (6)



Source: EC-DG ECFIN, Ipsos-Demoskop.

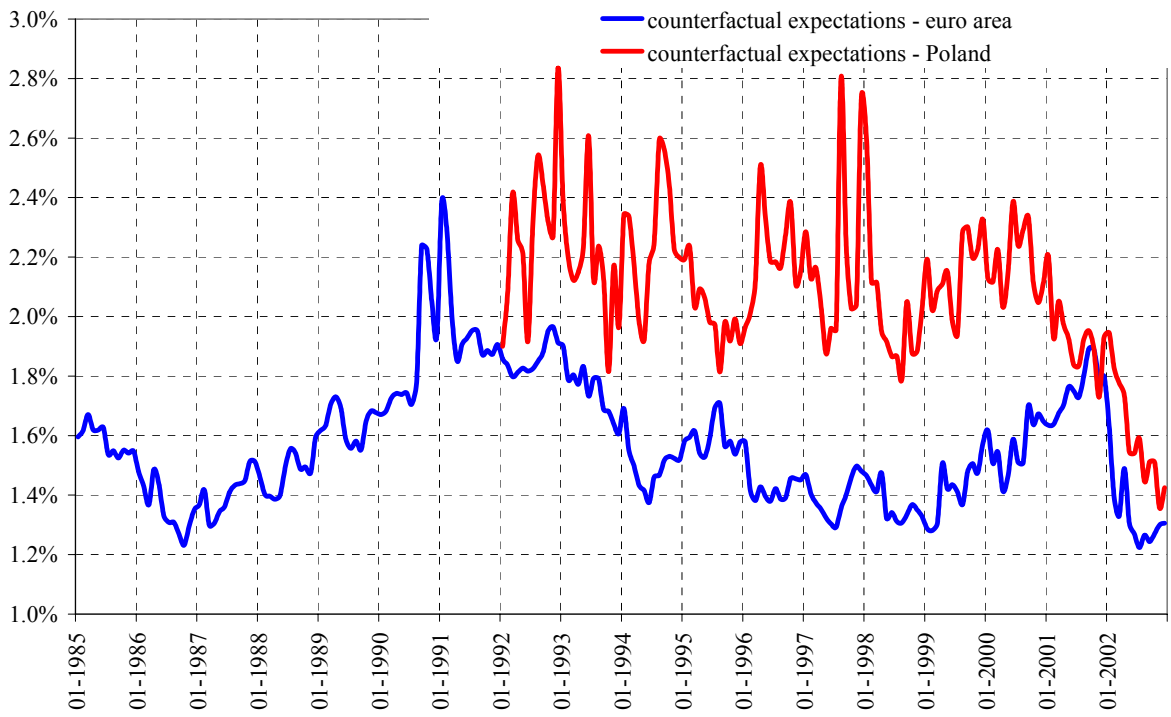
Survey question: "Given what is currently happening, do you believe that over the next 12 months prices will: (1) rise faster than at present, (2) rise at the same rate, (3) rise more slowly, (4) stay at their present level, (5) go down, (6) difficult to say".

In 2001-2002, the distribution of Polish consumer opinions concerning future price movements changed considerably, tending to become similar to the distribution of consumer expectations in the euro area. To assess the scale of the remaining differences, the following experiment was

conducted. The adjusted Carlson and Parkin (1975) approach was implemented to quantify counterfactual consumer inflation expectations under the assumption that the current rate of inflation was the same in both economies, equal to 2% for the whole sample period. Under this assumption, the probability measures of inflation expectations exclusively reflect the pattern of responses to the survey question and allow these to be compared. In other words, the quantification outcomes are adjusted for the differences in inflation rates between the euro area and Poland.

The results of the experiment, presented in Figure 19, show that in 1992-2001 the pattern of responses to the survey question in Poland was significantly worse than in the euro area in terms of the impact this had on the quantification outcomes. In 2001, Polish consumers rapidly revised the way they formed their price expectations, and by the end of the sample period the influence on the quantification outcome of the distribution of survey responses was in line with that noted in the euro area.

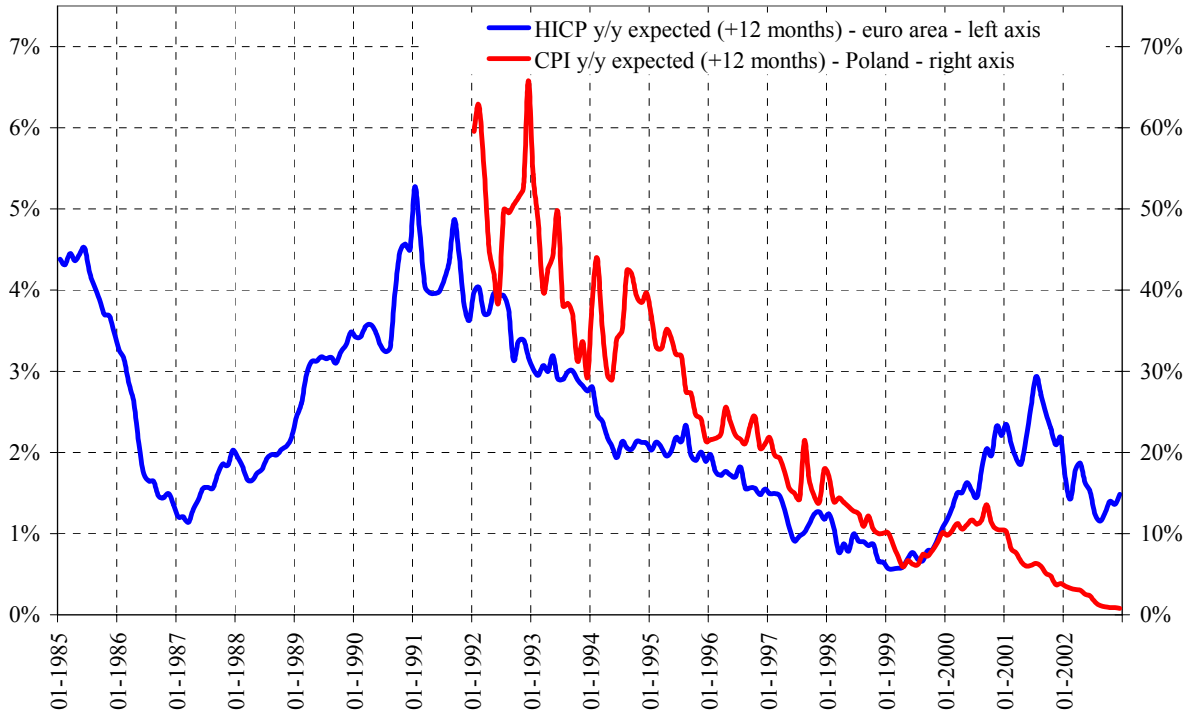
Figure 19. Counterfactual inflation expectations in euro area and in Poland, assuming 2% current inflation



Source: own calculations.

The differences between the euro area and Poland concerning price growth and the distribution of responses to the survey question led to a sizeable gap between objectified measures of consumer inflation expectations in the two economies (Figure 20, Table F). In 1992, Polish consumer inflation expectations were over 14 times higher than euro area ones. In subsequent years, these expectations came down as disinflation proceeded. In September 2002, consumer expectations in Poland were for the first time lower than those in the euro area. At the end of the sample period, i.e., in December 2002, objectified measures of inflation expectations in the euro area and Poland stood at 1.5% and 0.8%, respectively.

Figure 20. Inflation expectations in euro area and in Poland



Source: own calculations.

Table F. Ratio of consumer inflation expectations, Poland vs. euro area, annual averages

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Ratio	14.13	13.71	16.91	14.66	13.33	14.32	14.34	10.65	6.52	2.69	1.35

A detailed comparison of the basic properties of consumer inflation expectations in the euro area and in Poland is presented in Table G. This refers to the pattern of responses to the survey question, the relative importance of the factors determining quantification outcomes, the forecasting accuracy of consumer inflation expectations, and the way in which these are formed in the two economies.

Table G. Features of consumer inflation expectations in euro area and in Poland

		Polish consumer inflation expectations	**Euro area consumer inflation expectations**
Sample period		1992:01-2002:12	1985:01-2002:12
Average percentage of respondents (P) in each response category (%) and standard deviations (SD) (percentage points)	*Response (1)*	P: 25.0, SD: 8.0 *[1992-2002]* P: 9.7 *[2002.12]*	P: 14.9, SD: 4.9 *[1985-2002]* P: 10.2 *[2002:12]*
	Response (2)	P: 51.2, SD: 4.7 *[1992-2002]* P: 43.9 *[2002.12]*	P: 42.8, SD: 4.6 *[1985-2002]* P: 34.6 *[2002:12]*
	Response (3)	P: 13.2, SD: 3.0 *[1992-2002]* P: 19.4 *[2002.12]*	P: 14.5, SD: 2.4 *[1985-2002]* P: 23.0 *[2002:12]*
	Response (4)	P: 4.4, SD: 3.3 *[1992-2002]* P: 16.7 *[2002.12]*	P: 20.3, SD: 5.7 *[1985-2002]* P: 25.6 *[2002:12]*
	Response (5)	P: 0.7, SD: 0.7 *[1992-2002]* P: 1.9 *[2002.12]*	P: 1.4, SD: 0.6 *[1985-2002]* P: 1.9 *[2002:12]*
	Response (6)	P: 5.6, SD: 1.4 *[1992-2002]* P: 8.0 *[2002.12]*	P: 6.1, SD: 0.8 *[1985-2002]* P: 4.6 *[2002:12]*
Factors determining quantification outcomes	*Total change in inflation expectations during sample period (percentage points)*	-58.8	-2.89
	Change (%) caused by changes in survey question response pattern	-9.3% *[1992:01-2002:12]* 31.7% *[1993:01-2002:12]*	18%
	Change (%) caused by changes in current rate of inflation	109.3% *[1992:01-2002:12]* 68.3% *[1993:01-2002:12]*	82%
	Absolute change (%) caused by changes in survey question response pattern	36.3%	30.6%
	Absolute change (%) caused by changes in current rate of inflation	63.7%	69.4%
Forecast performance statistics vs. naive expectations (in parentheses)	*ME*	6.99 (5.05)	-0.33 (0.20)
	MAE	7.68 (5.80)	0.76 (0.75)
	MAPE	0.75 (0.68)	0.29 (0.32)
	RMSE	0.92 (0.50)	0.01 (0.01)

		Polish consumer inflation expectations	Euro area consumer inflation expectations
Formation of inflation expectations	*Rationality:*		
	- Mean of forecast errors	6.99	-0.33
	- Biasedness	Biased upwards	Biased downwards
	- Efficiency	Constrained use of macroeconomic information, no signs of increasing macroefficiency.	Macroeconomic variables taken into account while forming expectations, increasing macroefficiency [Forsells and Kenny (2002 a)].
	Long-run relationship with:	Current inflation	Actual inflation ex-post
	Symmetry of responses to changes in current rate of inflation	Reaction of inflation expectations (measured in absolute terms) to positive changes in current rate of inflation stronger than to negative changes in current rate of inflation.	Same reaction of inflation expectations (measured in absolute terms) to positive and negative changes in current rate of inflation.
	Maximum response of inflation expectations to temporary increase in current rate of inflation of 1 percentage point (in percentage points)	1.45	0.70
	Maximum response of inflation expectations to temporary decrease in current rate of inflation of 1 percentage point (in percentage points)	0.85	0.70

Conclusions

In the 1980s, the relationship between economics and other social sciences was perceived as unsatisfactory, since economics was treated as a self-contained discipline. With reference to inflation expectations, Wärneryd (1986) offered an interesting assessment of the divide between economists and other social scientists: *"*[A] *necessary, but, of course, not sufficient condition for the usefulness of psychology in economics, is that the findings are stable over long periods of time. (...) There are certain areas of psychology that cannot be accused of being fickle. There are, for example, psychophysical laws that have survived the test of time, there is the consistent development of certain areas in cognitive psychology, and there is finally considerable stability in the methods used to study human behavior. (...) In psychology there are two ways of dealing with expectations: a behavioristic and a cognitive way. In strict behavioristic psychology, expectations which are usually referred to as expectancies cannot be observed directly but only inferred from observable behavior. (...) While expectancy is inferred from behavior, expectation, which is used in cognitive psychology refers to something that is subjectively experienced. The only way of assessing a person's expectations thus lies in asking the person about them in a more or less subtle way. (...) Many economists apparently feel that psychological theories and methods cannot contribute anything of value to economic analyses. The area of expectations is a case in point. Expectation was introduced in economic analysis as a non-measurable, psychological concept. The prevailing view among economists has always been and still is that the type of measurements carried out by psychologists do not qualify for use in economic models".*[23]

In the course of recent years, the way the attainments of other social sciences are treated in economic considerations has undergone a substantial evolution. Economics has become more willing to take a holistic (interdisciplinary) approach to interpreting the behaviour of individuals. The revolution in rational expectations and ongoing debate on the way in which expectations are formed have put behavioural and cognitive measures of the inflation expectations of different groups at the centre of interest of contemporary central banks.

[23] K. E. Wärneryd (1986), pp. 261-262.

Qualitative surveys constitute an important source of information concerning consumer inflation expectations. Attempts are being made to use survey data not only in a descriptive (qualitative) way, but also to quantify them and to include them in macroeconometric models [Forsells and Kenny (2002 b), Łyziak (2002)]. It appears that a dynamic development of this new tendency is likely in the near future.

As presented in this study, quantification procedures founded on the canonical Carlson and Parkin (1975) approach seem to be useful in terms of translating cognitive survey data on consumer inflation expectations into numbers consistent with statistical measures. Quantification results supplemented with the analysis of pattern of responses to the survey question facilitate examining basic features of consumer inflation expectations, including their rationality and formation.

The memory of hyperinflation, the limited credibility of economic policies and the process of learning the rules of the market economy have all exerted an influence on how Polish consumers set their expectations during the past decade. In particular, the fraction of relatively more pessimistic respondents has on average been relatively larger and more volatile than in the euro area while the fraction comprising respondents, who believed that prices would remain stable, was substantially smaller and less volatile than in the euro area. However, the ongoing process of disinflation, which has reduced price growth to extremely low levels (as seen at year end 2002, when twelve-month inflation sank to 0.8%), has resulted in Polish consumer expectations gradually converging with those in the euro are. This process was noticeably intense most recently, i.e., in 2001-2002.

The way in which Polish consumers form their expectations, confronted with the performance of the disinflation process in Poland, leads to a long-run bias in inflation expectations. These usually overshoot inflation ex-post, and thus do not fulfil the rational expectations hypothesis and do not constitute an unbiased predictor of future price movements.

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