MATERIAŁY I STUDIA

Paper No. 37

Consumer inflation expectations

Survey questions and quantification methods – the case of Poland

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Warsaw, March 2006

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The authors wish to thank Professor Ryszard Kokoszczyński and Dr Emilia Tomczyk for their inspiring comments and suggestions as well as participants in seminars at the Bank of England, the European Central Bank and the National Bank of Poland, during which some parts of this study were presented. Opinions reflected in the paper are of the authors and do not necessarily represent views of the institution they work for.

Design:

Oliwka s.c.

Layout and print:

NBP Printshop

Published by:

National Bank of Poland
Department of Information and Public Relations
00-919 Warszawa, 11/21 Świętokrzyska Street
phone: (22) 653 23 35, fax (22) 653 13 21

http://www.nbp.pl

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Abstract

Qualitative data on inflation perceptions and expectations, as obtained from surveys, can be quantified into numerical indicators of the perceived and expected rates of price change. This paper presents the results of different versions of probability and regression methods, implemented in order to estimate Polish consumer inflation perceptions and predictions, based on monthly consumer surveys. The paper also discusses the limited usefulness of quantitative questions, which occur to be excessively difficult for a significant part of respondents, whose numerical declarations are inconsistent with opinions expressed in a qualitative manner.

Key Words: Inflation expectations, Surveys, Quantification, Poland

JEL Classification: C42, D12, D84

Introduction

A straightforward way to measure inflation perception and expectations of consumers is to ask them about their estimates quantitatively. However, the uncertainty concerning such numerical estimates is considerably higher than in the case of indicating direction of price changes (Jonung, 1986) and evidence on benefits from using quantitative questions is mixed. Therefore, most surveys are designed in a qualitative way, even if their results have to be later quantified.

First attempts to quantify qualitative survey data were based on "balance statistics", i.e. the difference between percentages of optimistic and pessimistic respondents. Efforts to overcome its shortcomings and to provide it with a theoretical justification, have led to the development of two groups of methods. The regression method makes use of the relationship between current inflation (measured by official statistics) and its perception by survey respondents. It is assumed that the same relationship holds between inflation expectations (expressed quantitatively) and qualitative opinions of respondents concerning future inflation. Such a construction of the quantification procedure restricts its application to surveys including questions on both expected and past inflation, with appropriately long history. The probability method, on the contrary, can be used even in absence of the inflation perception question. In this approach, each individual is supposed to have a probability function over the expected price change, which may vary between individuals and over time. Assuming a specific form of the distribution of inflation expectations in the population, its parameters can be estimated based on the distribution of responses to the survey question.

In the present paper we use the above mentioned quantification methods to derive a range of indicators of perceived and expected inflation in the period 1992-2005 and we discuss the usefulness of quantitative surveys. Quantification results indicate that even if different measures of Polish consumer inflation perceptions and expectations vary in single observations, they all display similar tendencies. Analysing reliability of quantitative data, we show that quantitative questions are excessively difficult for a significant part of respondents, who declare random numbers, inconsistent with opinions expressed in a qualitative manner. However, after applying an adjustment mechanism similar to that of the regression method, the results are comparable with those derived from qualitative questions.

The paper is organized as follows. In Section 1 we introduce various qualitative consumer surveys, employed in the subsequent part of the paper in quantification procedures. Section 2 and 3 outline adjusted versions of two popular approaches to survey data quantification, the Pesaran (1984) regression method and the Carlson and Parkin (1975) probability method. In Section 4 the quantification results are presented, while in Section 5 the usefulness of quantitative survey data is discussed. The last section concludes.

1
Qualitative survey data

In our paper we refer to different types of consumer surveys and apply various methods to quantify inflation expectations of Polish consumers. In particular we use qualitative data from three surveys conducted on monthly basis by private firms: GfK Polonia, Ipsos and Pentor on samples consisting of approximately 1,000 individuals. The Ipsos survey has been conducted since 1992, while the GfK Polonia and Pentor surveys cover more recent observations, as they were only started in 2001.

The question concerning inflation expectations in surveys carried out by Ipsos and GfK Polonia is designed in a qualitative way, i.e., the respondents do not give precise quantitative responses regarding future inflation, but declare the expected direction and magnitude of change in prices, comparing their predictions to the price movements currently observed. The question has the following form: "*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 1992-2005 is presented in Figure 1 and Figure 2.

There is an additional question concerning the perception of current price movements in the GfK Polonia survey, which can be useful in assessing the perceived rate of inflation. Responding to this question, consumers compare the present level of prices with the price level 12 months ago: *"In your opinion, is the price level now compared to that 12 months ago: (1) much higher; (2) moderately higher; (3) a little higher; (4) about the same; (5) lower; (6) difficult to say"*[1]. The proportion of respondents choosing each of these categories in the period from May 2001 to May 2005 is presented in Figure 3.

In contrast to the questions included in the Ipsos and GfK Polonia surveys, referring to a 12-month horizon, the qualitative question in the Pentor consumer survey concerns the perceived and expected price changes in a 3-month horizon. The perception question is phrased as follows: *"In your opinion, over the last three months, prices: (1) increased; (2) remained the same; (3) went down; (4) difficult to say"*. The respondents stating that prices have changed are subsequently asked to assess the magnitude of these changes in comparison to the previous period: *"Prices were increasing (decreasing): (a) faster than before; (b) at the same rate as before; (c) more slowly than before; (d) difficult to say"*. The question concerning future inflation is analogous. The proportion of respondents choosing each of these categories in the period from August 2001 to May 2005 is presented in Figure 4 and Figure 5. In our view, the Pentor survey questions might be excessively complicated for respondents, which might negatively affect the quality of their responses. To answer these questions respondents should remember past dynamics of price changes. Moreover, 3-month inflation has no counterpart in official statistics published by the Polish Central Statistical Office (GUS) and it is characterized by seasonality, which makes the comparison between two periods even more difficult.

The analysis of the patterns of responses to the question on inflation expectations included in the Ipsos survey (Figure 1) reveals that in 1992-1999 approximately 80% of respondents used to expect that prices would increase faster or at the same rate. The percentage of the most pessimistic respondents was highly volatile, reacting to different political and social events. In 1998

[1] It should be noted that in the GfK Polonia survey question concerning inflation expectations respondents declare the expected direction and magnitude of likely changes in prices, comparing their predictions against the price movements currently observed. The question concerning perception of current price movements is designed differently, namely in terms of the price level.

the National Bank of Poland adopted the strategy of inflation targeting. Significant changes in the distribution of responses to the survey question were noted with a delay – that is in the years 2001-2003, when the sum of fractions of respondents stating that prices would increase faster or at the same rate was reduced to 50-60%. However, fears of a rapid price increase caused by the EU accession (May 2004) dominated the responses to the survey question from mid-2003 until mid-2004. At the moment the EU-bubble in inflation expectations seems to have been absorbed – the distribution of responses to the survey question is similar to that observed before mid-2003. The EU accession shock is also reflected in the data from the GfK Polonia and Pentor surveys.

The quantification procedures make use of adjusted response fractions, i.e. the proportion of answers "difficult to say" is equally distributed among the remaining fractions. The notation used in the paper is the following:

a^p – percentage of respondents declaring that prices are much higher;

b^p – percentage of respondents declaring that prices are moderately higher;

c^p – percentage of respondents declaring that prices are a little higher;

d^p – percentage of respondents declaring that prices are about the same;

e^p – percentage of respondents declaring that prices are lower;

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;

R^p – percentage of respondents declaring that prices have risen;

F^p – percentage of respondents declaring that prices have gone down;

R – percentage of respondents expecting that prices will rise;

F – percentage of respondents expecting that prices will go down;

π_j – inflation rate over the last j months;

π_j^p – perceived rate of inflation over the last j months;

π^e_{+j} – expected rate of price change over the next j months in the population.

2
Regression methods

The regression method of expectations' quantification was introduced by Pesaran (1984, 1987) who reinterpreted and developed Anderson's (1952) concept. In general, this method is based on estimation of the relationship between current inflation (measured by official statistics) and its perception by survey respondents. It is assumed that the same relationship holds between inflation expectations (expressed quantitatively) and qualitative opinions of respondents concerning future inflation. As Pesaran (1987) stresses, this relationship should not be treated as causative, but rather as a simple tool to approximate unknown values. Such a construction of the regression method restricts its application to surveys including questions on both expected and current inflation with appropriately long history.

The second crucial assumption made in the regression approach is that perception of the current rate of inflation is unbiased. It is believed that although an assessment of price changes by a single respondent might deviate from the current inflation (as measured by official statistics), the aggregated experience of larger group of agents is more likely to map price changes in the economy correctly. The unbiasedness conjecture remains unverified and, if not correct, may be a source of error. The assumption of inflation perception's unbiasedness does not necessarily imply the unbiasedness of inflation expectations, and so this feature can be formally tested after obtaining the quantitative measure of inflation expectations.

The regression approach was originally designed to quantify firms' inflation expectations. However, as long as survey question refers to respondents' individual experience and not their assessment of economy wide variables, it can be used for other series (e.g. production, employment) and other groups of agents (e.g. consumers) (Nardo 2003). There are several models which can be employed to approximate the relationship between inflation and survey data, varying with respect to their assumptions and interpretation of parameters[2]. In our paper we use a dynamic non-linear regression model, an extension of the Pesaran model, proposed by Smith and McAleer (1995). Their results suggest that models like Anderson's (1952) or Pesaran's (1984) might be too restrictive.

Due to differences in basket of goods purchased, consumers experience various rates of inflation. As showed by Simmons and Weiserbs (1992), inflation for the whole economy might be presented as an average of inflation rates specific to each consumer[3]:

$$\pi_t = \sum_{i=1}^{N} \frac{y_{it}}{Y_t} \pi_{it} + \varepsilon_t, \; E(\varepsilon_t) = 0 \qquad (1)$$

where π_{it} – inflation rate experienced by ith consumer, $\frac{y_{it}}{Y_t}$ – share of ith consumer spending in total spending, N – number of consumers in a sample, ε_t – error term. If we split consumers into two categories according to their declaration about current prices (rise or fall) and assume that consumers belonging to the same category have the same perception of inflation, we get:

$$\pi_t = \pi_t^+ R_t^p \frac{\overline{y}_t^+}{\overline{Y}_t} + \pi_t^- F_t^p \frac{\overline{y}_t^-}{\overline{Y}_t} + \varepsilon_t \qquad (2)$$

2 As pointed out by Smith and McAleer (1995), in the probability method the quantified measures are a function of a specific probability distribution, whereas in the regression method a function of a specific regression model.

3 Pesaran (1984, 1987) treated the rate of inflation in the economy as a weighted average change of prices of goods sold by firms.

where: π_t^+ (π_t^-) – perception of price changes by consumers who declared rise (fall) in prices, $\frac{\overline{Y}_t^+}{\overline{Y}_t}$ ($\frac{\overline{Y}_t^-}{\overline{Y}_t}$) – average share of spending of consumers who declared rise (fall) in prices in total spending. The choice of assumptions referring to the perception of price changes by both categories of consumers determines a form of the model[4]. In our paper we follow Smith and McAleer (1995) who allow positive and negative perceived price changes to be time-varying. More specifically, we assume that they are weighted averages of current and past inflation rates[5]. Additionally, we assume that the average share of spending of consumers in both categories in total spending is constant over time[6]. The model has the following form:

$$\pi_t = \frac{\alpha R_t^p + \beta F_t^p + R_t^p \sum_{i=1}^{m} \alpha_i \pi_{t-i} + F_t^p \sum_{j=1}^{n} \beta_j \pi_{t-j}}{1 - \alpha_0 R_t^p - \beta_0 F_t^p} + \varepsilon_t,\ 1 - \alpha_0 R_t^p - \beta_0 F_t^p \neq 0 \qquad (3)$$

Model parameters might be estimated by time-series regression based on the perception question of the survey ($\hat{\alpha}, \hat{\beta}, \hat{\alpha}_0, \hat{\beta}_0, \hat{\alpha}_i, \hat{\beta}_i$). They have no interpretation and no restrictions are placed on them. Agents' expectations are calculated with use of the equation (3) by substituting responses to the perception question with responses to the expectation question:

$$\pi_t^e = \frac{\hat{\alpha} R_t + \hat{\beta} F_t + R_t \sum_{i=1}^{m} \hat{\alpha}_i \pi_{t-i} + F_t \sum_{j=1}^{n} \hat{\beta}_j \pi_{t-j}}{1 - \hat{\alpha}_0 R_t - \hat{\beta}_0 F_t} + \varepsilon_t \qquad (4)$$

As our data is monthly and we want to avoid multicollinearity and overlapping of periods, which inflation indices included on the right and left side of the equation (3) refer to, in our model specification we used only one lag of inflation (t-12) in case of the GfK Polonia survey and (t-3) in case of the Pentor survey. As the regression method requires the perception and the expectation questions to be symmetric, we have to aggregate some categories of responses in the GfK Polonia survey in such a way as to obtain information only about direction of price movements ($R^p = a^p + b^p + c^p$). Also in the Pentor survey we can't use information concerning magnitude of price movements due to a strong correlation between fractions of respondents. Another problem with Pentor survey is that the 3-month inflation rate is characterized by seasonality. Despite this, a seasonal pattern is not present in the survey fractions, which suggests that respondents do not notice it, or make some kind of seasonal adjustments while answering the questions. Therefore, in the quantification equation for this expectations horizon we use seasonally adjusted inflation rate. Estimation results are presented in Table 1.

The inflation perception equation for the GfK Polonia survey fits data very well. The results seem to confirm our presumption that perceived decrease in prices is time varying, but it depends only on current inflation and not the past one (F_t in numerator and $F_t\pi_{t-12}$ are statistically insignificant). On the contrary, perceived positive changes in price level vary with present and past inflation rate. Estimation results for the Pentor survey are a little bit disappointing. Only two variables are statistically significant. Moreover, error term is characterized by autocorrelation and heteroskedasticity. These problems might result from unusual expectations horizon as discussed previously.

4 Anderson (1952) assumes that perceived price rise and price fall are constant over time. Pesaran (1984, 1987) assumes that positive changes in the price level perceived by respondents are proportional to the current inflation.

5 $\pi_t^- = \beta + \sum_{j=0}^{n} \beta_j \pi_{t-j},\ \pi_t^+ = \alpha + \sum_{j=0}^{m} \alpha_j \pi_{t-j}$

6 It allows us to omit it in further analysis, as it will be incorporated in estimates of the parameters.

3
Probability methods

3.1. 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". His original method, as well as its further implementations by Knöbl (1974), Carlson and Parkin (1975), and more recently by Taylor (1988), refers to surveys in which respondents are questioned whether prices are expected to *"go up"*, *"stay the same"* or *"go down"*.

There are two central assumptions in the probability methods. Firstly, each individual is supposed to have a probability function over the expected price change, which may vary between individuals and over time. Secondly, it is assumed that, if the expected price change falls within a certain interval centred on zero, the respondents will report that prices are going to stay the same. This interval is termed "sensitivity interval" or "indifference interval".

Surveys introduced in Section 1 contain more response categories, meaning that the quantification procedure has to be adjusted. The probability approach used in this paper refers to the canonical Carlson and Parkin (1975) method and assumes that, if the number of respondents is sufficiently large, the expected rate of price change is normally distributed in the population[7]. Quantifying inflation expectations 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 at the time 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.

It is assumed that respondents reporting that *"prices will rise at the same rate"* include agents whose expectations fall within a sensitivity interval ($\pi_0 - s$; $\pi_0 + s$), centred on the perceived rate of inflation. Another sensitivity 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 zero. This reply is expected to be chosen by individuals predicting the inflation rate twelve months ahead to fall within an interval centred on zero: $(-t;+t)$[8]. Contrary to the primary version of the Carlson and Parkin (1975) method, where only one sensitivity interval was considered, 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 surveys considered, 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.

A frequently used proxy for the perceived rate of price change is the current rate of inflation (Berk, 1997; Łyziak, 2003), i.e. the most recent inflation rate available to respondents when answering the survey question regarding future prices[9]. In this case, quantified measures of

[7] 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.

[8] It may be expected that the length of the sensitivity interval is contingent on the current rate of inflation. Batchelor (1986) argues that the theory of signal detection, suggesting that perceptual thresholds depend systematically on the level and noisiness of inflation, finds support in survey data from eight European countries.

[9] Since the surveys are carried out at the beginning of each month, i.e., before the Central Statistical Office (GUS) publishes the previous month's inflation rate, the perceived rate of inflation is proxied by 2-month lagged CPI. In contrast, in the regression method the current inflation means the last month official rate of inflation.

inflation expectations may be described as objectified, since they assume that the respondents perceive the current price dynamics correctly. Alternatively, the perceived rate of inflation may be derived on the basis of survey question pertaining to the recently observed price developments (Berk, 2000; Forsells and Kenny, 2002). Indicators of inflation expectations quantified with a survey measure of recent price changes' perception may be called subjectified.

Figure 6 gives a graphical presentation of the adjusted Carlson and Parkin (1975) approach. The quantification method may be expressed algebraically in the following set of equations, in which F_c denotes the cumulative distribution function of the expected rate of inflation:

$$a = P\left(\pi^e_{+12} > \pi_0 + s\right) = 1 - F_c\left(\pi_0 + s\right) \tag{5}$$

$$b = P\left(\pi_0 - s < \pi^e_{+12} < \pi_0 + s\right) = F_c\left(\pi_0 + s\right) - F_c\left(\pi_0 - s\right) \tag{6}$$

$$c = P\left(t < \pi^e_{+12} < \pi_0 - s\right) = F_c\left(\pi_0 - s\right) - F_c\left(t\right) \tag{7}$$

$$d = P\left(-t < \pi^e_{+12} < t\right) = F_c\left(t\right) - F_c\left(-t\right) \tag{8}$$

$$e = P\left(\pi^e_{+12} < -t\right) = F_c\left(-t\right). \tag{9}$$

Equations (5)-(9) may be rearranged using the formula (10) of the normal density standardisation:

$$F_c\left(k\right) = Nz\left(\frac{k-m}{\sigma}\right), \tag{10}$$

where Nz is the cumulative standardized normal distribution function, m is the unknown mean of the expected inflation rate and σ denotes its standard deviation. Except the distribution parameters there are also determinants of the length of sensitivity intervals (s and t), which are endogenous in the quantification procedure. The explanatory variables comprise: a, b, c, d, e (fractions of respondents choosing the respective replies to the survey question) and π_0 (perceived rate of inflation). After solving the equations (5)-(10), the following results are obtained:

$$m = \frac{\pi_0 \cdot \left(C + D\right)}{C + D - \left(A + B\right)} \tag{11}$$

$$\sigma = \frac{-2 \cdot \pi_0}{C + D - \left(A + B\right)} \tag{12}$$

$$s = \frac{\pi_0 \cdot \left(B - A\right)}{D + C - \left(A + B\right)} \tag{13}$$

$$t = \frac{\pi_0 \cdot \left(D - C\right)}{D + C - \left(A + B\right)} \tag{14}$$

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

According to the equation (11), the mean of the expected rate of price change depends on the distribution of responses to the survey question and on the perception of current price dynamics. The first factor describes the degree of respondents' optimism concerning future price movements as compared to current price changes. 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.

3.2. Probability approach to quantification of perceived inflation

The probability method to quantify perceived inflation proposed in this paper is consistent with the approach followed by Forsells and Kenny (2002) while deriving numerical measures of the perceived inflation in the euro area. They refer to the original version of the method developed by Carlson and Parkin (1975), expressing the percentage of respondents claiming that prices are about the same as 12 months ago (d^p) as the probability that the perceived inflation in the population falls within sensitivity interval: ($-\delta$, $+\delta$). Similarly, the probability that the perceived price dynamics exceeds the upper limit of the sensitivity interval equals the fraction of respondents declaring that prices are higher than 12 months ago ($a^p+b^p+c^p$). Finally, the percentage of respondents claiming that prices are lower than 12 months ago (e^p) corresponds with the probability of the perceived inflation being below the lower limit of the sensitivity interval. The perceived rate of inflation π^p is assumed to be normally distributed with unknown parameters m^p, $(\sigma^p)^2$.

Figure 7 gives a graphical representation of the Carlson and Parkin (1975) method, as used to quantify the perceived rate of inflation. The quantification method may be expressed algebraically in the following set of equations:

$$a^p + b^p + c^p = P\left(\pi^p > \delta\right) = 1 - F_c^p\left(\delta\right) \tag{15}$$

$$d^p = P\left(-\delta < \pi^p < \delta\right) = F_c^p\left(\delta\right) - F_c^p\left(-\delta\right) \tag{16}$$

$$e^p = P\left(\pi^p < -\delta\right) = F_c^p\left(-\delta\right), \tag{17}$$

where F_c^p denotes the cumulative distribution function of the perceived rate of inflation.

Equations (15)-(17) may be rearranged using the formula (18) of the normal density standardisation:

$$F_c^p\left(k\right) = Nz\left(\frac{k - m^p}{\sigma^p}\right). \tag{18}$$

There are two dependent variables in the above equations, namely, m^p (mean of the perceived rate of price change) and σ^p (standard deviation). The explanatory variables comprise: a^p, b^p, c^p, d^p, e^p (fractions of respondents choosing the respective replies to the survey question) and δ (parameter determining the length of the sensitivity interval). After solving the equations (15)-(18), the following results are obtained:

$$m^p = -\delta \cdot \frac{A^p + B^p}{A^p - B^p} \tag{19}$$

$$\sigma^p = 2\delta \cdot \frac{1}{A^p - B^p} \tag{20}$$

where: $A^p = Nz^{-1}\left[1 - \left(a^p + b^p + c^p\right)\right]$, $B^p = Nz^{-1}\left(e^p\right)$

According to the equation (19), the perceived rate of inflation is a function of the distribution of responses to the survey question and the parameter δ, which is called the scaling factor. While quantifying the perceived inflation in the euro area, Forsells and Kenny (2002) refer to a concept of "backward unbiasedness" to fix the length of the sensitivity interval. In a given period T the scaling factor is derived assuming that if its values were to be constant in all periods prior to T, the average value of the perceived inflation would equal the average actual rate of inflation (π), i.e.:

$$\frac{1}{T}\sum_{t=1}^{T}\pi_t^p = \frac{1}{T}\sum_{t=1}^{T}\pi_t . \tag{21}$$

Using the equation (19), the condition of backward unbiasedness (21) may be expressed as:

$$\frac{1}{T}\sum_{t=1}^{T}\left(-\delta_t \cdot \frac{A_t^p + B_t^p}{A_t^p - B_t^p}\right) = \frac{1}{T}\sum_{t=1}^{T}\pi_t \tag{22}$$

and solved with respect to δ_T, which in this stage of the quantification procedure is treated as constant over time:

$$\delta_1 = \delta_2 = \ldots = \delta_T \tag{23}$$

The resulting formula for the scaling factor is as follows:

$$\delta_T = \frac{-\sum_{t=1}^{T}\pi_t}{\sum_{t=1}^{T}\left(\frac{A_t^P + B_t^P}{A_t^P - B_t^P}\right)}. \tag{24}$$

While making quantification of the perceived rate of inflation, it is assumed that the scaling factor may vary over time and that for each period prior to *T* the parameter δ is calculated on the basis of analogous expression:

$$\delta_{T-j} = \frac{-\sum_{t=1}^{T-j}\pi_t}{\sum_{t=1}^{T-j}\left(\frac{A_t^P + B_t^P}{A_t^P - B_t^P}\right)} \tag{25}$$

However, two shortcomings of the above described procedure should be pointed out. Firstly, fractions of respondents claiming that prices are much higher, quite a bit higher and a little higher are analysed as a homogenous group of individuals declaring that prices are higher. In this way the quantification procedure ignores an important piece of information included in the movements taking place within those percentages of respondents. Secondly, the aggregation of those responses leads to another weakness of the quantification method, namely to its restricted flexibility. Having only one sensitivity interval and such a method of its estimation in which new observations have a small impact on the scaling factor, changes in the distribution of responses to the survey question – even those looking insignificant – may have disproportional impact on the estimate of the perceived rate of inflation and, consequently, on the subjectified measure of inflation expectations[10].

[10] It should be reminded that there are four endogenous variables in the adjusted Carlson and Parkin (1975) approach used to obtain numerical measures of inflation expectations, which adjust the distribution of the expected rate of inflation to patterns of responses to the survey question. They include: mean and standard deviation of the distribution as well as thresholds of two sensitivity intervals: centred on the current rate of inflation and on the rate of inflation equal zero. While quantifying the perceived rate of inflation with the procedure based on the original version of Carlson and Parkin (1975) method and the assumption of backward unbiasedness, the scaling factor is set endogenously, but outside the quantification procedure. It leads to relatively high volatility of the perceived rate of inflation. As experiences gathered while deriving estimates of the perceived rate of inflation in Poland and in the euro area suggest, this feature may be particularly relevant under specific distribution of responses to the survey question. If the fractions of respondents declaring that prices are lower than 12 months ago or about the same, become relatively small, even slight changes in the distribution of responses to the survey question may lead to intuitively unrealistic jumps in the quantification result.

4
Quantification of qualitative data on consumer inflation expectations in Poland – results

Using the regression and probability methods described above as well as qualitative survey data from GfK Polonia, Ipsos and Pentor consumer surveys we derived a range of indicators of perceived and expected inflation. Three-month horizon indicators based on the Pentor survey comprise two measures of inflation perception and three measures of inflation expectations. As far as the twelve-month horizon is concerned, there are two measures of perceived price changes based on the GfK Polonia survey and four indicators of inflation expectations based on the GfK Polonia and Ipsos surveys.

The longest time series of Polish consumer inflation expectations is the objectified measure based on Ipsos survey data. It is useful in analysing changes in the character of inflation predictions formed by this group of economic agents in the transition from high-inflation environment to price stability. Figure 8 presents the expected rate of inflation in the years 1992-2005, compared to the current rate of inflation (known at the moment the surveys were carried out) and the actual inflation ex-post (with reference to which the expectations were formed). Quantification results suggest that Polish consumer inflation expectations are usually close to the current rate of price change, which to some extent reflects the form of survey question and assumptions of the quantification procedure. However, in 1992-1997 there were periods when inflation expectations were even higher and much more volatile than current inflation, which was caused by a coincidence of economic, political and social events[11]. By contrast, from April 2001 – except for the period November 2003-August 2004, when respondents' opinions were heavily influenced by the EU accession shock – consumer inflation expectations have been lower than the current inflation rate.

Figure 9 and Figure 10 present the official measure of inflation and its perception in both time horizons, as calculated on the basis of qualitative survey data. On average, the probability measure of perceived inflation was higher than the official and the regression ones – it deviated from them, especially in the case of annual inflation in the period 2002-2004. Also, none of the inflation perception measures has reached as low values as the official indicator (i.e. 0.3% for a 12-month horizon and -0.8% for a 3-month horizon[12]). It seems that respondents of the Pentor survey perceived inflation as much smoother than the official measure (which can result from problems with the formulation of the survey questions mentioned in Section 1) and reacted only to a rapid rise in prices after the EU accession.

Differences between the official and perceived rate of price change lead to disparity between objectified and subjectified measures of consumer inflation expectations derived by the probability method (Figure 11 and Figure 12). Despite this, all measures are closely related to each other (correlation ratios range from 0.85 to 0.97 for a 12-month horizon and from 0.66 to 0.88 for a 3-month horizon; all are statistically significant at 0.01 level). The subjectified expectations derived with the probability method and the regression measure are characterized by the highest degree of correlation. Table 2 presents basic characteristics of the quantified measures of inflation perception and expectations.

[11] As far as economic factors are concerned, attention should be focused 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 attributed 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.

[12] The 3-month perceived inflation was always positive.

5
Quantitative survey data: useful or useless?

5.1. Performance of quantitative questions on inflation perception and expectations

A straightforward way to measure consumers' inflation perception and expectations is to ask them about their numerical estimates. There are experiments with asking consumers about their price perception and expectations in a quantitative manner[13]. At the workshop on business and consumer surveys in Brussels in November 2002, it was decided to introduce new questions into the European Commission Consumer Survey, which is carried out by GfK Polonia in Poland. As a result, qualitative survey questions concerning price perceptions and expectations were supplemented with the quantitative ones. Consumers declaring qualitatively that the price level has changed (will change) are asked about their numerical estimates.

As shown by Jonung (1986), when asked for numerical estimates of the perceived and expected rate of inflation, uncertainty increases considerably[14]. This puts constraints on the usefulness of quantitative survey questions concerning past inflation and inflation expectations and constitutes an argument in favour of using qualitative questions in policy analyses. As far as the more recent studies are concerned, there is mixed evidence on benefits from using quantitative questions. Lindén (2004) concludes that the quantitative and qualitative data in the euro area countries are similar and even if the qualitative data have a long time series, measuring the interest variable directly offers substantial advantages. In his view quantification methods applied to qualitative data do no more than scale the qualitative data to inflation rate, which means that any information on too high or too low perceptions and expectations is lost. Furthermore, some quantification procedures smooth the data in such a way that any structural shifts in the resulting perceived and expected inflation rates are concealed. Poncet (2003) shows that in the case of the French Consumer Survey responses to quantitative questions seem to be consistent with the answers to qualitative questions about prices, but they do not add any new significant information. Contradictory results are provided by Buiten and Rooijakkers (2003), who demonstrate that in the Dutch Consumer Survey aggregate (point) estimates are not representative, contain a statistical bias, are in part arbitrary and imprecise. Quantitative questions seem to be difficult for a substantial part of consumer population, which leads to inconsistencies in the point estimates for people expecting higher price increases than currently: about one third of the respondents actually give a lower point estimate.

[13] E.g. Swedish Household Survey, the University of Michigan survey on consumer attitudes.

[14] Jonung (1986) refers to a Swedish questionnaire designed to explore the perceptional and expectational uncertainty of individuals, which was conducted in April 1984 (in 1983-1985, the rate of inflation was about 6-8% on an annual basis). The survey was carried out in three steps. First, the respondents were asked qualitatively about their beliefs concerning the direction of change in the price level during the past 12 months. Second, respondents who answered that prices had increased/decreased proceeded to a question that asked for a numerical estimate of the change in prices. Third, those who answered with a numerical value were asked to state how certain they felt about their estimate (very certain, rather certain, as certain as uncertain, rather uncertain, very uncertain). Analogous questions were asked about the expected rate of inflation during the coming 12 months.
The results are as follows. Firstly, respondents display little uncertainty about the direction of change in the price level (the ratio of "do not know" answers was 3-5%). Secondly, as regards the point estimates of perceived and expected inflation, uncertainty increases substantially (the percentage of "do not know" responses approaches 45%). Thirdly, those respondents who actually give a point estimate of the rate of inflation display uncertainty concerning their answers. The majority of them are "rather certain" about their numerical responses. Fourthly, there is a tendency for respondents to be slightly more uncertain about expected than perceived inflation.

Polish experiences with the use of quantitative questions on price perception and expectations are even more disappointing. It is true that there is some consistency between qualitative and quantitative responses on aggregate level, which means that respondents declaring higher inflation perception and expectations in the qualitative part of the survey also provide higher numerical responses on average (Figure 13, Figure 14). However, the inconsistency between qualitative and quantitative declarations on individual level is more visible than in the Dutch case. As presented in Figure 15, the percentage of respondents declaring that prices will rise at a faster (slower) rate and giving inconsistent numbers approaches 37% (47%) on average.

In addition, respondents asked to state their opinions in the quantitative manner tend to declare specific numbers, such as 5%, 10%, 15%, etc., that are substantially higher than the official measure of current inflation (so-called digit preference). Taking into account all individual GfK Polonia survey observations collected in the whole sample period, in the case of 78% (76%) of respondents giving positive numbers from the range 0%-40%, their perceived (expected) inflation was dividable by 5 (Table 3).

The problems mentioned above suggest a low reliability of quantitative data. Quantitative questions seem to be excessively difficult for a significant part of respondents, who declare inconsistent, random numbers. As a result, subjective inflation perception and expectations differ sizably from official inflation figures (Figure 16).

Moreover, changes introduced to the GfK Polonia consumer survey in May 2003 by supplementing qualitative questions concerning price perception and expectations with the quantitative ones are likely to have a negative impact on the accuracy of qualitative responses, which is reflected in a persistent gap between objectified measures of Polish consumers' inflation expectations calculated on the basis of the GfK Polonia and Ipsos surveys occurring since then (Figure 11).

5.2. Adjusting quantitative indicators of inflation expectations

As shown in the previous part of the paper, quantitative survey data on Polish consumer inflation perception and expectations is characterized by significant measurement errors. However, an analogous design of quantitative questions concerning perception and expectations may support the hypothesis that errors from both questions are closely linked to each other. Therefore, assuming that the gap between respondents' subjective perception of price movements over last 12 months (π_s^p) and current inflation measured by official statistics (π_0) is fully attributable to the measurement errors, we can derive implied measurement errors related to quantitative (subjective) estimates of inflation expectations (π_s^e). The logic behind this transformation corresponds directly to the regression methods, which translate subjective projections into numbers consistent with official measures of inflation.

In the first step, the relationship between the subjective perception of past price changes and the relevant statistical indicators of past inflation is examined. The aim here is to identify a function *f*, such as:

$$\pi_{0,t} = f\left(\pi_{s,t}^{p}\right) \tag{26}$$

In the second step, assuming that the same function transforms expected price movements as subjectively reported in the survey into objectified measures of consumer inflation expectations, the latter indicators may be quantified:

$$\pi_{+12,t}^{e} = f\left(\pi_{s,t}^{e}\right) \tag{27}$$

Due to the fact that changes of inflation perceptions declared numerically by the respondents in the GfK Polonia survey were higher than shifts in official inflation figures, in estimating the

relationship between subjective perception of price movements and the current rate of inflation we take into account a moving average of the former indicator. The transformation formula is the following:

$$\hat{\pi}_{0,t} = \underset{(-5.56)}{-0.013} + \underset{(17.23)}{0.071} \cdot \sum_{i=0}^{4} \pi^{p}_{s,t-i} \qquad (28)$$

Sample: 08.2003 – 05.2005
OLS estimators (t-statistics in parentheses)
Newey-West HAC Standard Errors & Covariance
$R^2 = 0.96$
Breusch-Godfrey Serial Correlation Test Statistics (12 lags) = 4.53 (p-value = 0.03)
Jarque-Bera Normality Test Statistics = 1.36 (p-value = 0.50)
White Heteroskedasticity Test Statistics = 0.80 (p-value = 0.46)

Adjusted measures of inflation expectations based on quantitative declarations are calculated in the analogous manner, i.e.:

$$\pi^{e}_{+12,t} = -0.013 + 0.071 \cdot \sum_{i=0}^{4} \pi^{e}_{s,t-i} \qquad (29)$$

The quantification results show that in terms of tendencies the adjusted measure of consumer inflation expectations based on the GfK Polonia quantitative survey data was close to the subjectified probability measure derived on the basis of the qualitative question in the same survey (Figure 17). Differences between both indicators occurred before the EU-accession, but they have already been absorbed. Thus the mechanism of adjusting the quantitative measures of inflation expectations on the basis of inflation perception errors proposed above, makes the results of both survey questions consistent with each other, which is not fulfilled on the level of individual responses. It should be noted, however, that due to a very short sample covered in this analysis, one should be cautious in making conclusive comments.

6
Concluding remarks

Survey data constitute the main source of information concerning private individuals' inflation perception and expectations. In this paper we presented quantification methods useful in analysing survey data. These methods either transform qualitative survey responses into numerical measures of perceived and expected inflation or make it possible to limit the errors characterizing individual responses to quantitative survey questions. Implementing the regression and probability methods we derived indicators of Polish consumers' inflation perception and expectations.

There are three principal lessons to be learnt from our paper, which we would like to underline concluding the study. They all seem to us particularly relevant in the context of the use of the proposed measures of Polish consumers' inflation perception and expectations in macroeconomic policy considerations.

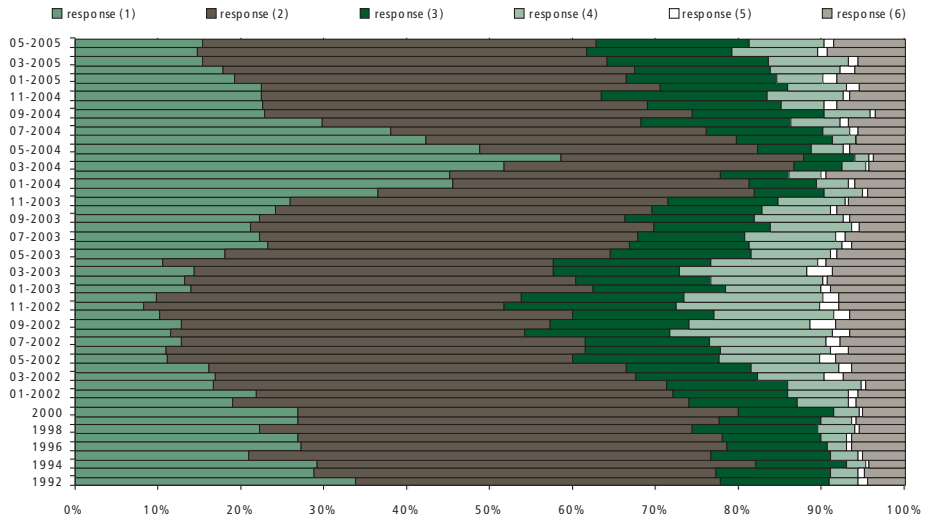
Firstly, it seems to us that probability and regression quantification methods adjusted to different types of survey questions offer a useful way of measuring inflation perceptions and expectations. Quantified measures of perceived and expected inflation exploit more information than simple balance statistics and therefore provide a more advanced way to analyse consumers' opinions.

Secondly, we have shown that in the case of Polish consumers the reliability of quantitative declarations concerning perceived and expected inflation is fairly low, which may mean that quantitative questions introduced between qualitative ones (as in the GfK Polonia consumer survey) may have a negative impact on the accuracy of qualitative responses. However, the adjustment of quantitative indicators of expected inflation makes quantitative survey results consistent with the subjectified measure calculated on the basis of qualitative data.

Thirdly, due to measurement errors connected with the use of survey data and with the assumptions of quantification methods, single indicators of inflation perception and expectations should not be excessively emphasized in policy considerations. Instead of analysing them on monthly basis, they should be interpreted in terms of general tendencies. Analysed in such a perspective, different measures of Polish consumer inflation perception and expectations presented in this paper behave in a similar way.

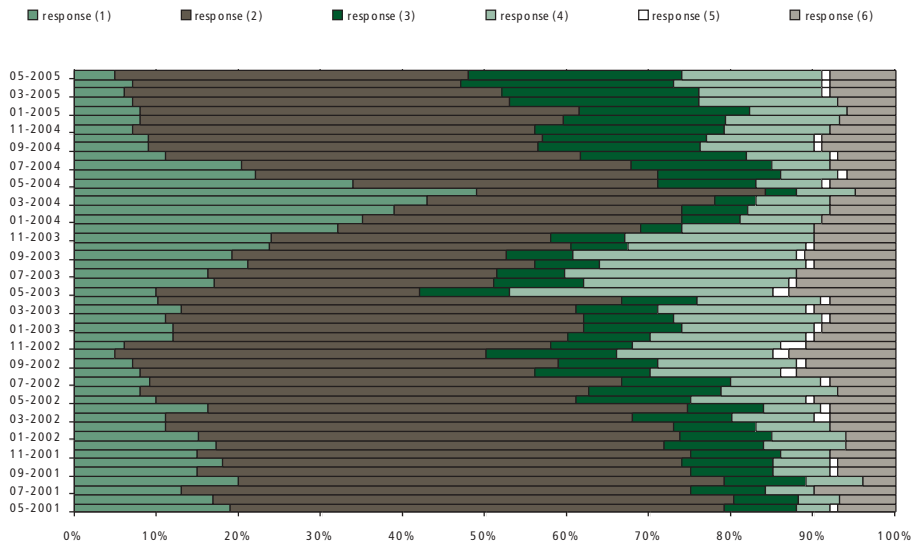
7
Tables and Figures

Figure 1. Response patterns, Ipsos survey question on inflation expectations, 1992-2001 (annual averages), 2002-2005 (monthly data)



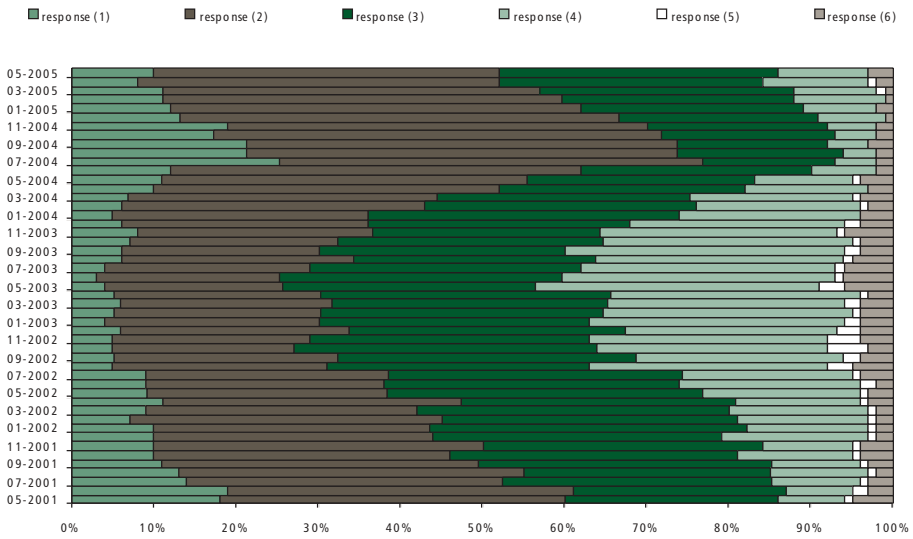
Source: Ipsos, own calculations.

Figure 2. Response patterns, GfK Polonia survey question on inflation expectations, 2001-2005



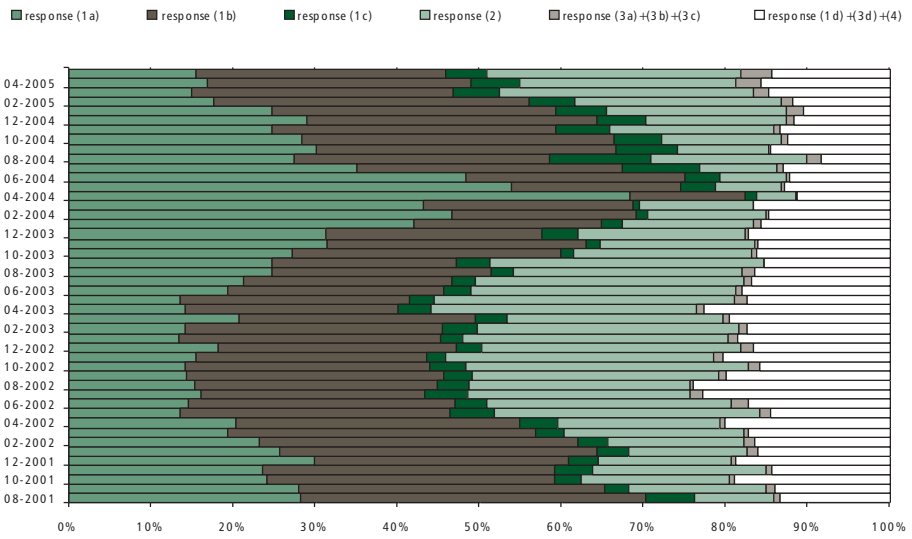
Source: GfK Polonia.

Figure 3. Response patterns, GfK Polonia survey question on perceived inflation, 2001-2005



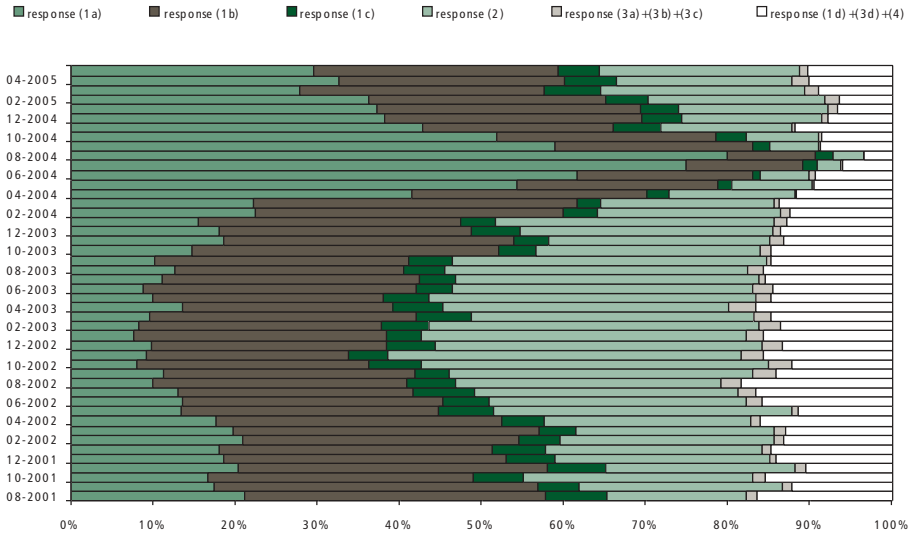
Source: GfK Polonia.

Figure 4. Response patterns, Pentor survey question on inflation expectations, 2001-2005



Source: Pentor, own calculations.

Figure 5. Response patterns, Pentor survey question on perceived inflation, 2001-2005



Source: Pentor, own calculations.

Table 1. Estimation results

Parameter	GfK (π_{12})	Pentor (π_3)
α	0.006 (0.001)	0.004 (0.002)
β	-0.059 (0.040)	-0.016 (0.021)
α_j	0.040 (0.010)	-0.035 (0.060)
β_j	0.170 (0.685)	-0.793 (1.147)
α_0	0.936 (0.025)	0.885 (0.093)
β_0	2.226 (0.701)	2.256 (1.031)
R^2	0.94	0.65
BG	20.58 (p-value = 0.06)	28.99 (p-value = 0.00)
JB	1.11 (p-value = 0.58)	0.88 (p-value = 0.64)
WH	5.33 (p-value = 0.50)	12.54 (p-value = 0.05)

j=12 for GfK Polonia survey and j=3 for Pentor survey
Sample: 05.2001 – 05.2005
NLS estimators (t-statistics in parentheses)
BG - Breusch-Godfrey Serial Correlation Test Statistics (12 and 3 lags)
JB - Jarque-Bera Normality Test Statistics
WH - White Heteroskedasticity Test Statistics

Figure 6. Adjusted Carlson and Parkin (1975) method

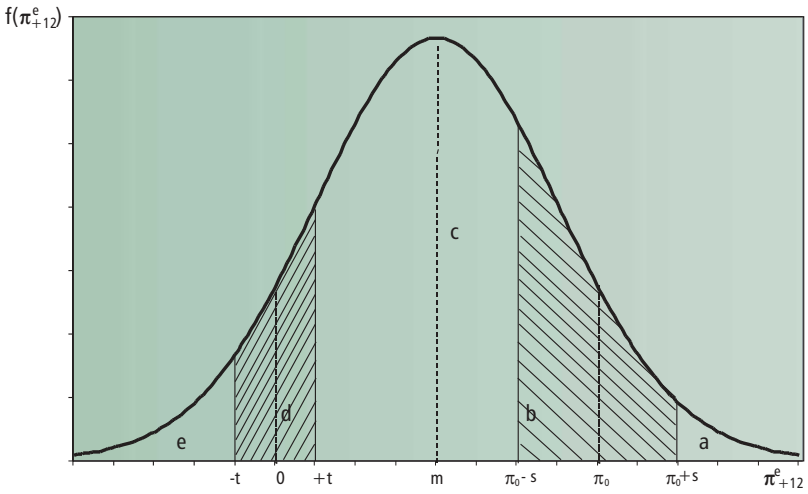


Figure 7. Carlson and Parkin (1975) method as used to quantify perceived rate of inflation

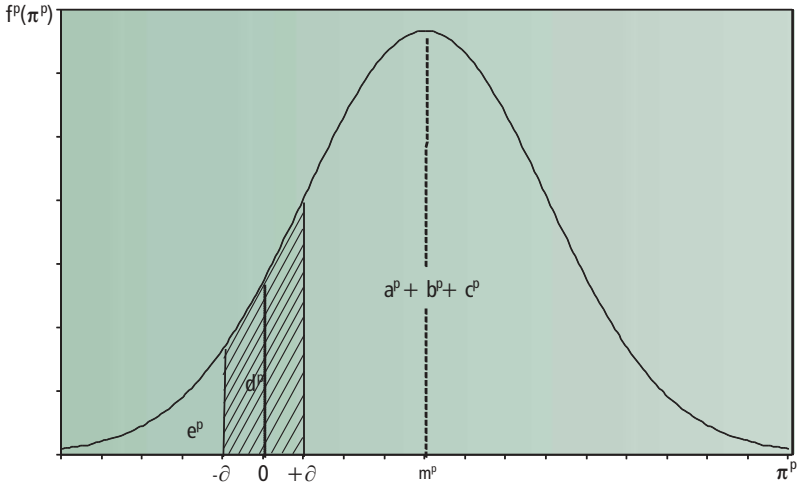
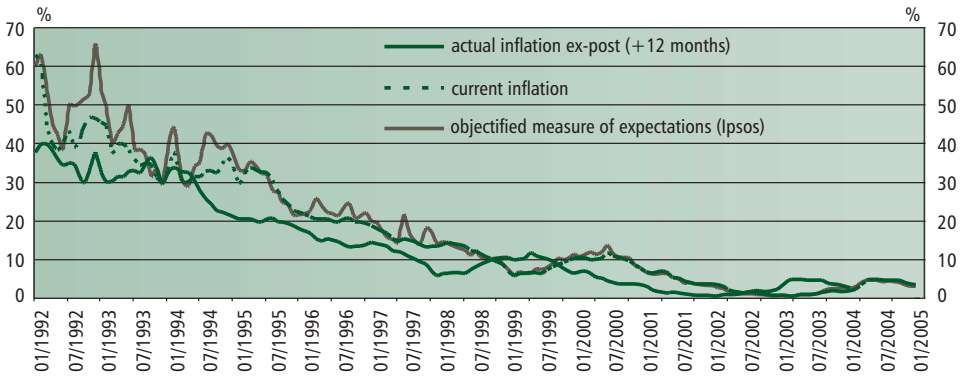
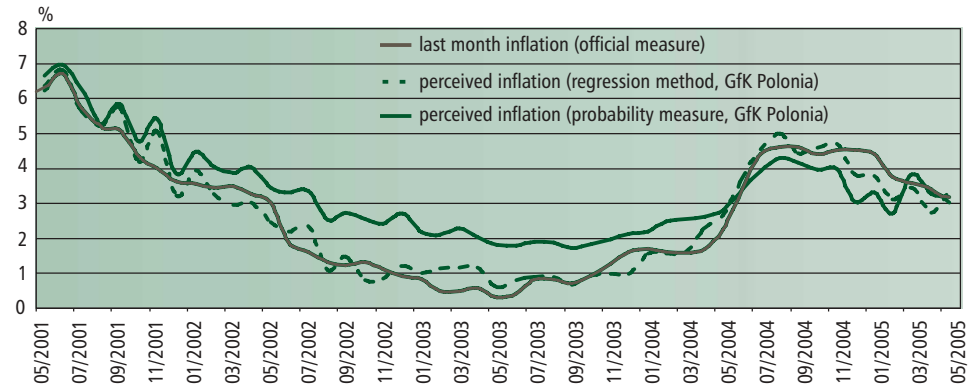


Figure 8. Consumer inflation expectations in Poland, 1992-2005



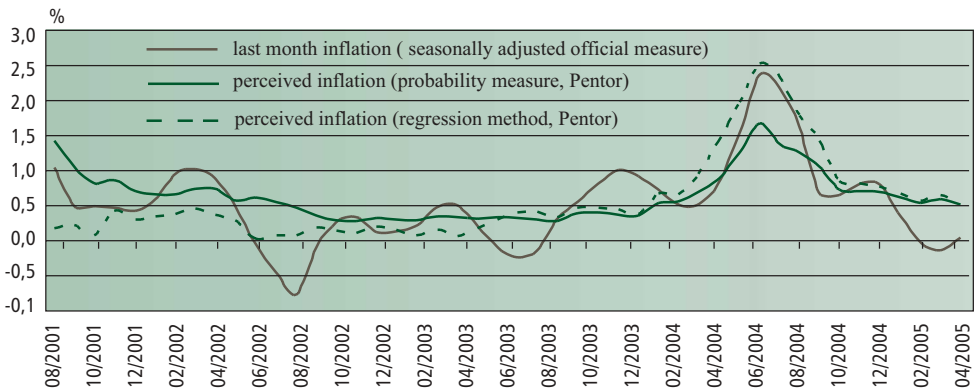
Sources: GUS, GfK Polonia, own calculations.

Figure 9. Perceived inflation and current inflation – 12-month horizon, 2001-2005



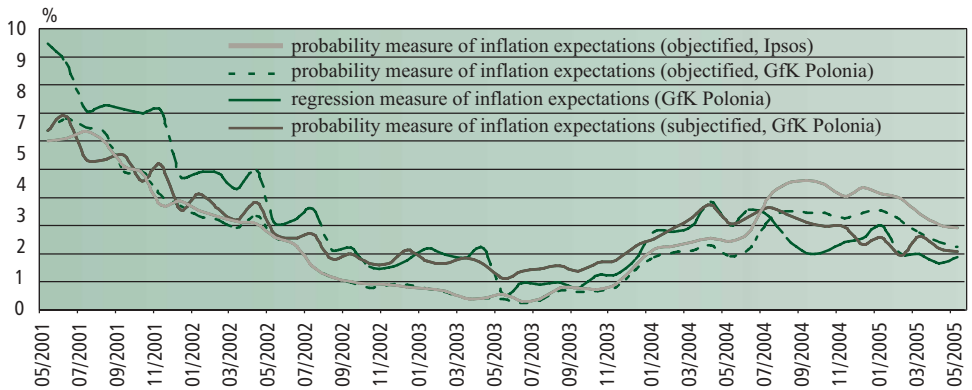
Sources: GUS, GfK Polonia, own calculations.

Figure 10. Perceived inflation and current inflation – 3-month horizon, 2001-2005



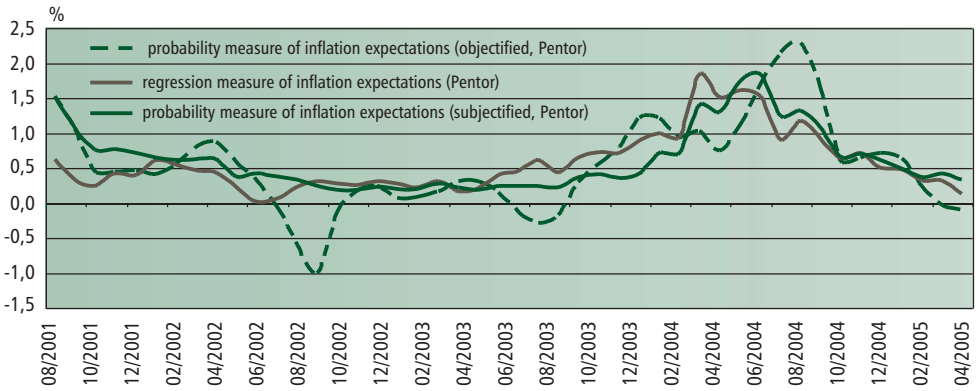
Sources: GUS, Pentor, own calculations.

Figure 11. Expected inflation – 12-month horizon, 2001-2005



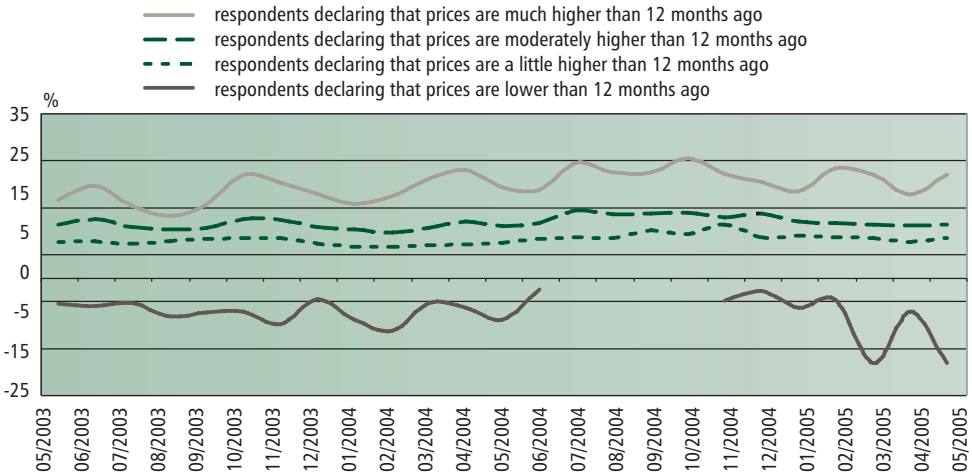
Sources: GUS, Ipsos, own calculations.

Figure 12. Expected inflation – 3-month horizon, 2001-2005



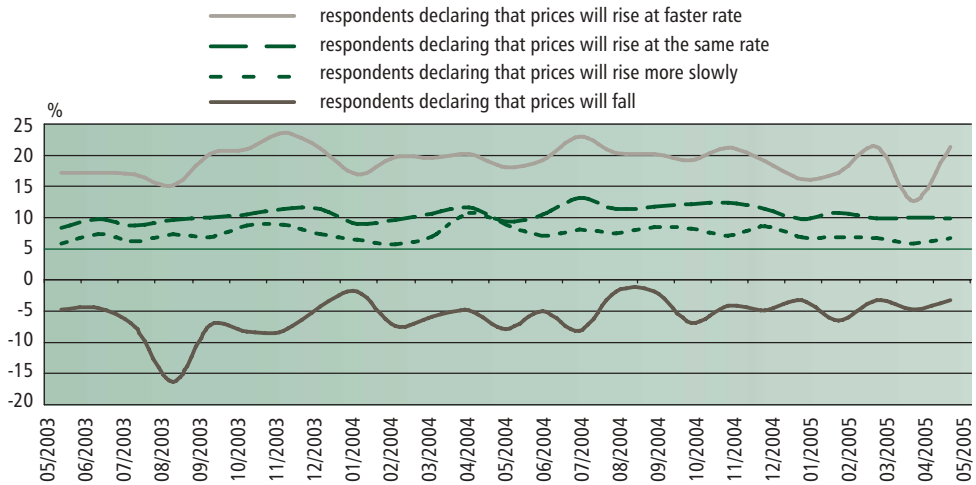
Sources: GUS, Ipsos, own calculations.

Figure 13. Average perceived inflation as reported quantitatively by fractions of respondents answering the qualitative question



Source: GfK Polonia, own calculations.

Figure 14. Average expected inflation as reported quantitatively in fractions of respondents answering the qualitative question



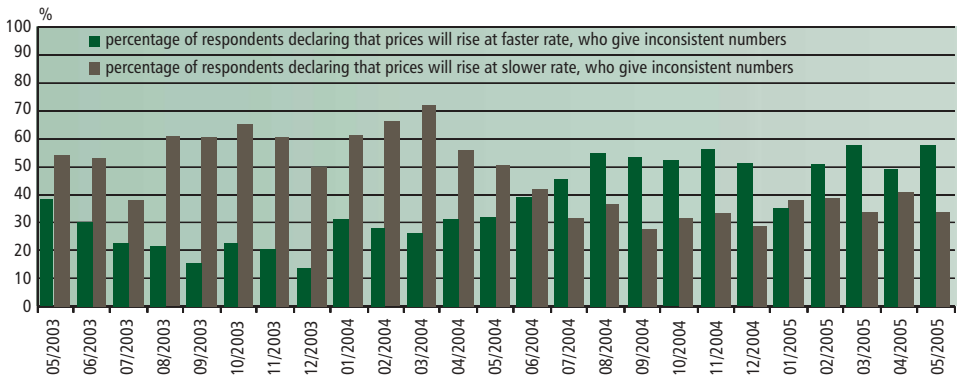
Source: GfK Polonia, own calculations.

Table 2. Basic characteristics of the quantification results, 2001-2005*

	Mean	Standard deviation	Standard deviation relative to the mean
12-month perceived inflation			
official measure	0.027	0.018	65.8%
probability measure, GfK Polonia	0.033	0.013	38.4%
regression method, GfK Polonia	0.028	0.017	62.8%
12-month expected inflation			
objectified probability measure, Ipsos	0.027	0.018	65.5%
objectified probability measure, GfK Polonia	0.025	0.017	70.8%
regression measure, GfK Polonia	0.032	0.022	67.7%
subjectified probability measure, GfK Polonia	0.029	0.014	47.1%
3-month perceived inflation			
official measure	0.005	0.006	116.2%
subjectified probability measure, Pentor	0.006	0.003	54.7%
regression method, Pentor	0.006	0.006	104.9%
3-month expected inflation			
objectified probability measure, Pentor	0.005	0.007	121.4%
regression measure, Pentor	0.005	0.003	52.0%
subjectified probability measure, Pentor	0.006	0.004	73.3%

Sources: GUS, Ipsos, GfK Polonia, Pentor, own calculations.
*Sample: 05.2001-05.2005 for GfK Polonia and Ipsos; 08.2001-05.2005 for Pentor.

Figure 15. Inconsistency between qualitative and quantitative declarations – individual responses



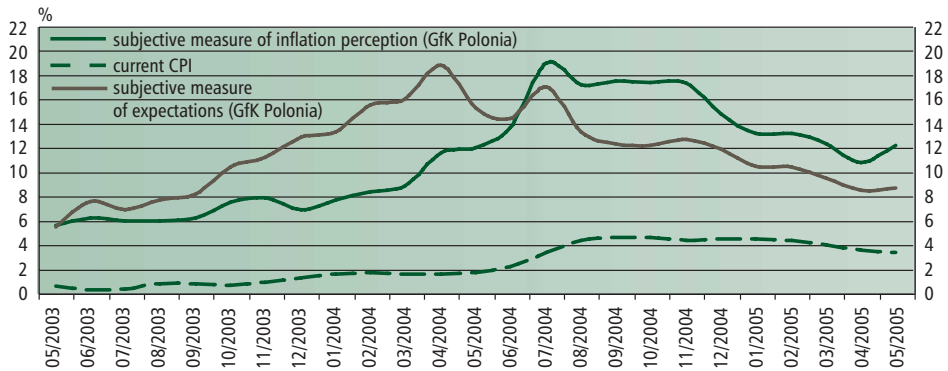
Source: GfK Polonia, own calculations.

Table 3. Percentage of respondents giving specific positive numbers from the range 0-40%

	5%	10%	15%	20%	25%	30%	35%	40%	Total
Perceived inflation (% of respondents)	15.7	26.4	10.3	14.3	2.4	6.7	0.5	1.3	77.5
Expected inflation (% of respondents)	15.9	25.6	9.7	14.6	2.5	6.0	0.5	1.5	76.3

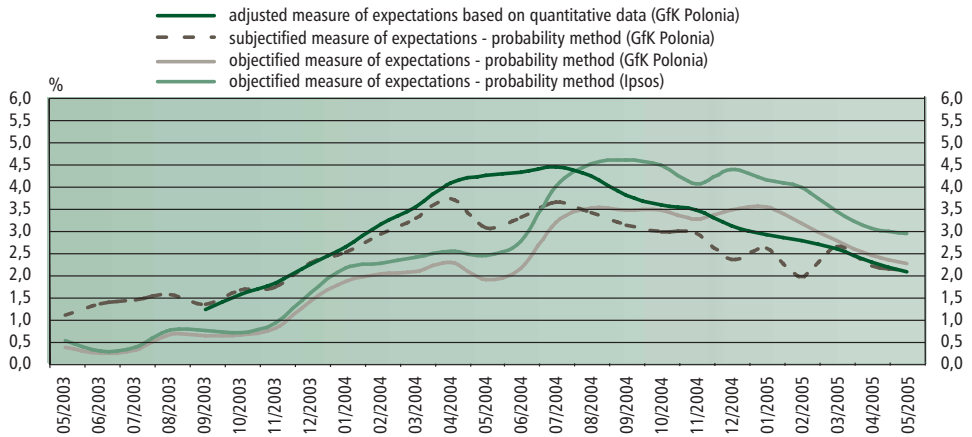
Source: GfK Polonia, own calculations.

Figure 16. Subjective inflation perception and expectations vs. official statistics, 2003-2005



Sources: GUS, GfK Polonia, own calculations.

Figure 17. Adjusted measure of inflation expectations based on quantitative data vs. probability measures



Sources: GUS, Ipsos, GfK Polonia, own calculations.

8
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