Sources of Dispersion in Inflation Forecasts

by

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Abstract

Cross-section dispersion of expected inflation is often explained by differences in information sets across agents, but there is little empirical evidence attesting to that. The purpose of this paper is to examine whether dispersion in consumer forecasts of inflation is generated by factors such as relative price observations, different perceptions of monetary policy, and personal characteristics. We use unique data that allow us to examine such effects at the micro level.

JEL Classification: E31 Price Level; Inflation; Deflation; Perceptions; Expectations.

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Sources of Dispersion in Consumer Inflation Forecasts

1. Introduction.

Starting with Lucas (1972), much theoretical work has been based on the assumption that agents interpret changes in relative prices as evidence for changes in the overall price level.\(^1\) Empirically, that claim appears to be supported by the observation that forecast dispersion obtained from surveys is greater in periods of relative price changes. The problem with such an interpretation is that significant relative price shifts usually occur along with higher levels of inflation. Therefore, it is not clear whether the forecast dispersion is generated by relative price changes or by the uncertainty associated with higher inflation.

Using UK consumer data, Batchelor and Orr (1991) attempt to separate the two effects but conclude that it is policy factors and not observed past and current prices that generate disagreement among agents. Earlier Solow (1980), in criticizing rational expectations, mentions the “undocumented assertion” that information sets differ.

Several empirical studies, however, find substantial dispersion not only in forecasts but also in agents’ perceptions of past inflation.\(^2\) While such dispersion of perceptions is suggestive of the influence of personal price experiences or of other differences in information sets, for lack of suitable data these papers provide little direct evidence for these hypotheses.\(^3\)

In this paper, we use unique data from a consumer survey in Bulgaria to address these questions. The survey asks about perceived past inflation and about expected future inflation. It also includes questions designed to identify whether respondents are influenced by their personal price experiences.

In addition, Bulgaria introduced a currency board several months before the survey. Agents were likely to have different opinions about the achievements of the

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\(^1\) Cukierman and Wachtel (1979, 1982)
\(^3\) Indirect evidence for the effect of information on forecast dispersion is presented by Carlson (1981, p. 27): “there is not nearly as much variance in the forecasts of inflation [in the Livingston survey] as is found in the surveys of households. This is presumably because, being knowledgeable observers of the economy, these respondents know pretty well what the rate of inflation has been in the last year or so. Since differences in perceptions of inflation account for much of the differences in a household’s stated expectations, this major source of variation is not present in the Livingston survey.”
currency board thus far and about its future implications for inflation. Thus attitudes toward the monetary regime probably had an influence.

As in earlier studies we find substantial disagreement across agents about past inflation. We also provide supporting evidence for the hypothesis that personal price experiences contribute significantly to that dispersion.

Many agents extrapolate from perceived past inflation when they forecast future inflation. Thus, the dispersion in perceptions of inflation generates much of the dispersion in expected future inflation.

We also find that opinions about inflation differ depending on the political affiliation of respondents. Those who support the government are more likely to expect lower future inflation and, interestingly, are more likely to have perceived lower past inflation.

The results of the paper have to be viewed in the economic and political context in the country at that time. We provide such background in the next section. Following that, we analyze the link between perceived past and expected future inflation as well as sources of dispersion in each. We conclude with final remarks.

2. Information sets.

The survey used in this paper asks a representative sample of Bulgarians to report the direction and magnitude of changes in the general price level during the six months before the survey and to give their forecast of inflation for the six months after the survey. The survey was taken in May, 1998.

Ten months earlier, Bulgaria introduced a currency board following a severe financial crisis during which price changes touched hyperinflation levels. The social unrest grew to a point where the government stepped down and new Parliamentary elections were held. Financial stabilization with a currency board was high on the agenda of the new administration.

Currency boards are monetary regimes, which operate similarly to a gold standard, establishing an automatic link between the balance of payments and changes in the money stock. They extend credibility to a fixed exchange rate by removing discretion
over monetary policy, introducing full convertibility, and maintaining large foreign exchange reserves at the central bank.

Bulgarians have experienced unprecedented price stability since the currency board was introduced. Official inflation declined very rapidly, from around 3 to around 1 percent per month in the first 3-4 months after the currency board was introduced. By the time the survey was taken, prices on average had been stable for several months.

Yet the currency board did not eliminate all uncertainty about inflation. First, the peg is to the German mark, while a large part of the international trade, most notably oil and natural gas is in dollars. Changes in the mark-dollar exchange rate cause domestic price movements. Second, the economy was undergoing significant structural reform, which produced erratic individual price movements. Third, the Bulgarian currency board is not orthodox and leaves some room for monetary discretion. For example, the monetary authority can provide liquidity to the banking system. Fourth, prices have had periods of stability followed by periods of sharp increases throughout the 10-year transition period from socialism. To establish credibility given such a track record may take longer than a year.

Because of the continuous drop in real incomes during transition, significant changes took place in the consumption basket of the average Bulgarian, most notably a steady increase in the portion of income spent on food and utilities. Yet, weights used in the calculation of official inflation have been slow to reflect those changes.

That has opened the door for two problems. First, Bulgarians do not view the official reports on inflation with full confidence and probably rely more on their personal price experiences to estimate the actual inflation. Second, in reporting official inflation, different media sources may tend to express concern that the official estimate is not correct and to report that actual inflation is probably higher. That information would be found mostly in the opposition papers. Thus the political affiliation of a respondent may be an indication of sources of information about price movements.

Given the uncertainties about inflation described earlier and the relatively new history of the currency board, observers could also have had somewhat different expectations of inflation over the medium and long-term. The divide is also likely to be
along political lines, with those supporting the government generally having a more favorable view on the prospects.

Finally, we should note that the economy is generally monetized, with little barter and at the time of the survey, the local currency was used in most transactions. Therefore, price inflation is important to most Bulgarians. Exceptions can be found in some villages where food items are self-provided.

3. **Perceived and expected inflation.**

The data were obtained from a national survey conducted in the last week of May 1998 in Bulgaria. The sample size, 1000 respondents, is considered representative for the country. The survey was one of a series of surveys for a research project to study inflation convergence following the introduction of the currency board. The survey was taken through personal interviews by a national polling organization.

There were four questions regarding perceived and expected inflation. The first question asks whether prices in general have increased, decreased or remained the same in the last six months, and the second question requests a percentage estimate if the respondent had perceived a decrease or an increase in prices. The third and the fourth questions ask whether prices in general would increase, decrease or remain the same in the next six months and, if a change is expected, by what percentage.

In answer to the qualitative question about perceived inflation, four percent of the respondents did not indicate whether they thought there had been an increase, decrease or no change in prices in the last six months. Of those who provided an answer, 40 percent reported an increase, 11 percent a decrease, and 49 percent reported no change.

Eighty-five percent of those who perceived a decrease and 77 percent of those who perceived an increase in prices provided a numerical estimate. If we assume that “no change” means zero inflation, then average perceived inflation is 6.59 percent, very close to the actual inflation, 5.86 percent, over the prior six months.

In answer to the qualitative question about expected inflation, six percent of the respondents did not report an expected increase, decrease or no change in prices over the next six months. Of those who answered, 37 percent indicated an increase, 7 percent a decrease and 56 percent no expected change in prices. If we assume that “no change”
means zero, average expected inflation is 5.56 percent, close to the average perceived past inflation.

Despite the history of failed stabilization efforts during the ten year transition period, the currency board appears to have curbed expected inflation quite successfully. That is particularly interesting given the very high level of expected inflation just one week before the currency board was introduced.\(^4\)

How closely did the dispersion in perceived past inflation map into forecast dispersion? The next section examines that question. In order to employ a greater number of observations, for the remainder of the paper we concentrate on the qualitative answers (increase/decrease/no change).

\section*{4. The link between perceived past inflation and expected future inflation.}

Table 1 reports a cross-tabulation of respondents who reported both perceptions and expectations about the direction of price changes. The numbers in parentheses are the percentages of those in each group of perceived change who reported a particular direction for expected price changes.

Seventy one percent of those who perceived an “increase” also expect an “increase,” 83 percent of those who perceived “no change” also expect “no change”, and only 33 percent of those who perceived a “decrease” expect a “decrease”. As in Jonung (1981), Jonung and Laidler (1988), Vartia and Mankinen (1984), and Simmons and Weiserbs (1992) the large majority of respondents (73 percent) extrapolated future price movements from observed past price changes.

There are some interesting additional observations. A number of respondents who perceived a decrease or an increase in prices over the prior six months indicated that they expected no change over the next six months. As a result, the dispersion of expected future inflation is somewhat smaller that the dispersion in expected future inflation.\(^5\) One would normally anticipate the reverse on the grounds that expectations contain more uncertainty and noise, as Vartia and Mankinen (1984) find in the Finnish data. The result in the Bulgarian data obtains perhaps because of the ongoing convergence in prices.

\(^4\)See Carlson and Valev (2000)
\(^5\)Smaller dispersion in perceptions is observed in the quantitative answers as well. Statistical tests of differences in variance confirm that.
following the introduction of the currency board. Agents on average expected large fluctuations in prices gradually to subside with the currency board system settling in. The result lends support to empirical studies that have used forecast dispersion to proxy for inflation uncertainty.\(^6\)

There is also an asymmetry in that those who perceived a decrease are much less likely to expect a further decrease in prices than those who perceived an increase are likely to expect a further increase in prices. Presumably this asymmetry can be attributed to a generally perceived longer-run upward trend in prices.

Finally, there is a tendency for some respondents to expect a reversal of the most recent perceived change and for some of those who perceived no change in price to expect a decrease in prices as well as others to expect an increase. These responses suggest some random noise in the response patterns.

5. **Sources of dispersion in perceived past inflation.**

In this section we examine influences on the dispersion of perceived past inflation. We explore two factors. First, as discussed in section 2, agents may be influenced by exposure to different interpretation of the official inflation estimates. Second, agents have different personal price experiences, which may affect their perception of changes in the overall price level.

To test the first hypothesis, we assume that agents’ political affiliation, indicated by their answer to the question about which party they vote for, proxies for differences in the information they receive about official inflation estimates. In particular, the information about actual inflation of those who oppose the government may come from sources that tend to interpret the official statistics on inflation with an “upward adjustment.” The political affiliation of a respondent is captured by a variable \(\text{Vote} (V)\) equal to 1 if she/he voted for the government, zero otherwise.

To test the second hypothesis we use a question in the survey which asked respondents to name at most three products from the prices of which they draw their

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\(^6\) Batchelor and Dua (1996) provide a list of papers that have used disagreement proxy for uncertainty in macroeconomics.
perceptions of inflation. They could name any goods or services or could say that “prices in general” have changed.\footnote{As we discuss in the appendix, there were significant relative price changes during the six-month period before the survey.}

To quantify the effect of personal price experiences, we created two variables – \textit{Price increase (PI)} equals one if a respondent named a product the relative price of which had actually increased during the period, and zero otherwise, and \textit{Price decrease (PD)} if the respondent had mentioned a product the relative price of which had decreased, zero otherwise. We estimated an ordered probit model where these variables along with political affiliation explain the likelihood that a respondent perceived a decrease, an increase or no change in the general price level. The dependent variable \textit{Perceived inflation} is ordered from decrease to no change to increase in prices.

The ordered probit procedure involves assigning a value $v$ to each observation, in our case:

\begin{equation}
\begin{aligned}
v = b_1 PD + b_2 PI + b_3 V
\end{aligned}
\end{equation}

Let $u$ be a standard normal variable (with zero mean and variance of one). Define the probabilities:

\begin{align}
\Pr[&\text{Perceived decrease in prices} \mid PD, PI, V] = \Pr(v + u < k_1) = \Pr(u < k_1 - v) \\
\Pr[&\text{Perceived no change} \mid PD, PI, V] = \Pr(k_1 < v + u < k_2) = \\
&= \Pr(k_1 - v < u < k_2 - v) \\
\Pr[&\text{Perceived increase in prices} \mid PD, PI, V] = \Pr(k_2 < v + u ) = \Pr(k_2 - v < u)
\end{align}

The ordered-probit procedure produces maximum likelihood estimates of the coefficients $b$ and the two additional “cut-point” parameters $k_1$ and $k_2$. The estimated coefficients $b$ indicate whether a certain characteristic of a respondent would influences her/his perception of past inflation upward or downward. The coefficients $b$ along with the cut-points $k$ can be used to calculate the probability that an agent with particular characteristics would be in each of the three groups.

Table 2, column 1, reports estimates of the $b$ and $k$ parameters. Column 2 shows estimates from an equation in which we also control for age, gender, and level of education, i.e. we add three variables to equation (1).
From Table 2, agents who mentioned products the prices of which had actually declined were on average more likely to perceive lower inflation. Similarly, those who mentioned products that actually increased in price on average perceived higher inflation. Thus, personal price experiences did influence perceptions of past inflation.

Those respondents who support the government perceived lower inflation than those who oppose it. It appears that political differences did produce different sets of information about price changes.

6. Sources of dispersion in expected inflation.

Table 3 reports the estimates of an ordered probit procedure where expected inflation is explained by respondent characteristics. The equation reported in column 1 includes Price increase, Price decrease, and Vote as explanatory variables. The political affiliation matters here because, those who support the government may have more favorable expectations of inflation over the medium run given the new monetary regime. Column 2 shows the estimates with three additional demographic variables: age, gender, and education. In the third equation, column 3, the explanatory variables are the perceptions of respondents, political affiliation, and demographics. In all three equations, the dependent variable for Expected inflation is ordered from decrease to no change to increase in prices.

As with perceived inflation, none of the demographic factors – education, gender, age -- has any apparent effect on forecasts of inflation.

Personal price experiences clearly influence the forecasts. Those who mentioned products the price of which increased/decreased in the past tend to have higher/lower expectations of future inflation.

Political affiliation is of importance as well. Those who support the government are more likely to expect lower inflation. Note that this result obtains even when perceptions are included in the regression (column 3). In other words, political affiliation affects agents’ expectations through two channels: by influencing their perceptions of past inflation which then influence expected inflation, and by affecting expected inflation directly.
7. **Conclusion.**

This paper examines the variations in expected inflation across individuals. Using survey data from Bulgaria, we find evidence that expectations contain a strong adaptive component. Dispersion in perceived past inflation generates a significant portion of the dispersion in forecasts.

The variation in perceived inflation, in turn, is explained by the combination of observed relative price shifts and different expenditure patterns across individuals. Personal price experiences influence perceptions and therefore expectations.

In the context of Bulgaria at that time, with a new monetary regime and a strong political divide, we also find that political affiliation influences not only agents' expectations about the future success of the new regime but also their perceptions of its success so far.

Forecast dispersion is often used in the empirical literature as a proxy for subjective uncertainty about future inflation. Our results indicate however that observable factors, which derive from economic and political circumstances, explain a substantial part of the disagreement among agents. In that sense, disagreement is not simply the result of a random component in expectations. That suggests some caution when interpreting dispersion as uncertainty.
References


Table 1
Perceived and Expected Inflation.

<table>
<thead>
<tr>
<th></th>
<th>Respondents who expect a decrease in prices</th>
<th>Respondents who expect no change in prices</th>
<th>Respondents who expect an increase in prices</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>The group of those who perceived a decrease in prices</td>
<td>32 (33)</td>
<td>45 (46)</td>
<td>20 (21)</td>
<td>97 (100)</td>
</tr>
<tr>
<td>The group of those who perceived no change in prices</td>
<td>21 (5)</td>
<td>369 (83)</td>
<td>55 (12)</td>
<td>445 (100)</td>
</tr>
<tr>
<td>The group of those who perceived an increase in prices</td>
<td>12 (3)</td>
<td>88 (26)</td>
<td>244 (71)</td>
<td>344 (100)</td>
</tr>
<tr>
<td>Totals</td>
<td>65</td>
<td>502</td>
<td>319</td>
<td>886</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are percentages.
## Table 2
Perceived past inflation.
Bulgaria, May 1998

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: Perceived past inflation</th>
<th>Dependent variable: Perceived past inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative price decrease</td>
<td>-1.26*** (0.14)</td>
<td>-1.23*** (0.15)</td>
</tr>
<tr>
<td>Relative price increase</td>
<td>2.04*** (0.22)</td>
<td>2.04*** (0.22)</td>
</tr>
<tr>
<td>Vote (1 if supporter of the government)</td>
<td>-0.49*** (0.08)</td>
<td>-0.47*** (0.08)</td>
</tr>
<tr>
<td>Education (1 if higher education)</td>
<td>-0.02 (0.09)</td>
<td></td>
</tr>
<tr>
<td>Female (1 if female)</td>
<td>-0.15 (0.08)</td>
<td></td>
</tr>
<tr>
<td>Age (1 if over 45)</td>
<td>0.09 (0.09)</td>
<td></td>
</tr>
<tr>
<td>( k_1 )</td>
<td>-1.56</td>
<td>-1.56</td>
</tr>
<tr>
<td>( k_2 )</td>
<td>0.19</td>
<td>0.21</td>
</tr>
<tr>
<td>Pseudo R(^2)</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Number of observations</td>
<td>921</td>
<td>905</td>
</tr>
</tbody>
</table>

Notes: Ordered probit. Standard errors in parentheses. *** significant at the 1 percent level.
Perceived past inflation is ordered from decrease to no change to increase in prices.
Relative price decrease (increase): equals 1 if respondent mentioned a product that actually decreased (increased) relative to the average of all prices, 0 otherwise.
Table 3
Expected future inflation.
Bulgaria, May 1998

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: Expected inflation</th>
<th>Dependent variable: Expected inflation</th>
<th>Dependent variable: Expected inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative price decrease</td>
<td>-0.37***</td>
<td>-0.33**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>Relative price increase</td>
<td>0.80***</td>
<td>0.78***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>Perceived decrease</td>
<td></td>
<td></td>
<td>-0.25*</td>
</tr>
<tr>
<td>(1 if reported a decrease</td>
<td></td>
<td></td>
<td>(0.14)</td>
</tr>
<tr>
<td>in prices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived increase</td>
<td></td>
<td></td>
<td>1.35***</td>
</tr>
<tr>
<td>(1 if reported an increase</td>
<td></td>
<td></td>
<td>(0.10)</td>
</tr>
<tr>
<td>in prices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vote (1 if supporter of</td>
<td>-0.61***</td>
<td>-0.61***</td>
<td>-0.51***</td>
</tr>
<tr>
<td>the government)</td>
<td>(0.08)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Education (1 if higher</td>
<td></td>
<td>-0.09</td>
<td>-0.12</td>
</tr>
<tr>
<td>education)</td>
<td></td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Female (1 if female)</td>
<td></td>
<td>0.03</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Age (1 if over 45)</td>
<td></td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>k1</td>
<td>-1.75</td>
<td>-1.79</td>
<td>-1.57</td>
</tr>
<tr>
<td>k2</td>
<td>0.20</td>
<td>0.17</td>
<td>0.67</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.07</td>
<td>0.17</td>
<td>0.21</td>
</tr>
<tr>
<td>Number of observations</td>
<td>897</td>
<td>921</td>
<td>857</td>
</tr>
</tbody>
</table>

Notes: Ordered probit. Standard errors in parentheses. ***(**,*) significant at the 1(5, 10) percent level. Expected inflation is ordered from decrease to no change to increase expected in the general price level.
Appendix: Relative price changes.

There were significant changes in the prices of several products that are important in the Bulgarian consumption basket. Table 4 identifies those products and shows the cumulative percentage change in their prices in the December – May period as well as their weight in the CPI. Included are products that represent at least 0.05 percent of the CPI and the prices of which have either increased by more than 16% or decreased by more than 4% (10 percentage points or more difference from the actual increase in the overall CPI index, 5.86 percent).

Table 4
Price changes, Bulgaria
December 97 – May 98

<table>
<thead>
<tr>
<th>Goods with Relative price increases 12/97-05/98</th>
<th>Weight in the CPI index</th>
<th>Percent change in prices 12/97-05/98</th>
<th>Goods with Relative price decreases 12/97-05/98</th>
<th>Weight in the CPI index</th>
<th>Percent change in prices 12/97-05/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh vegetables</td>
<td>3.68</td>
<td>119.5</td>
<td>Meat</td>
<td>6.04</td>
<td>-13.0</td>
</tr>
<tr>
<td>Fresh fruits</td>
<td>1.57</td>
<td>31.8</td>
<td>Deli meats</td>
<td>3.94</td>
<td>-13.3</td>
</tr>
<tr>
<td>Cooking oil</td>
<td>2.05</td>
<td>25.6</td>
<td>Feta cheese</td>
<td>3.48</td>
<td>-8.3</td>
</tr>
<tr>
<td>Public transportation</td>
<td>1.89</td>
<td>16.9</td>
<td>Gasoline</td>
<td>2.97</td>
<td>-17.6</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1.11</td>
<td>215.1</td>
<td>Eggs</td>
<td>0.98</td>
<td>-20.8</td>
</tr>
<tr>
<td>Water</td>
<td>1.17</td>
<td>25.5</td>
<td>Cheese</td>
<td>0.92</td>
<td>-8.3</td>
</tr>
<tr>
<td>Residential rent</td>
<td>0.09</td>
<td>40.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entertainment</td>
<td>0.07</td>
<td>25.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: National Statistical Institute, Sofia, Bulgaria.