Rational Inattention in Consumer Inflation Forecasts: Assessing Micro-level Evidence from Europe*

[Preliminary and Incomplete.]

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Abstract

We contribute to the empirical literature on rational inattention by assessing the evidence in the context of consumer inflation expectations. Using micro-survey data for European countries obtained from Eurobarometer surveys, we estimate econometric models regarding the probability and size of "forecast failure" in inflation forecasts. We document that higher inflation uncertainty and higher inflation rates, reduce the probability of making a forecast error as well as the probability of making large mistakes, providing evidence in line with rational inattention theory. We also provide some novel evidence regarding the effect of inflation variability and actual inflation rate on the likelihood of making large mistakes in inflation forecasts.

Keywords: Rational Inattention, Survey data, Inflation expectations, Discrete Choice Models

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1. Introduction

Recent work on the attentiveness of individuals (e.g. consumers, investors, firms etc) poses that all information is potentially available to agents but due to their limited information processing ability, they add noise to what they observe. In particular, the decision-makers have to choose optimally which information to attend carefully and less carefully depending on the costs and benefits of paying attention to a specific volatile variable (Sims, 2003; Wiederholt, 2010).

Theoretical and empirical implications of Rational Inattention focus on both consumers' and producers' behavior. As far as producers are concerned, when idiosyncratic conditions are more variable (or important) than aggregate conditions, firms tend to pay more attention to the former than the latter. As a consequence, prices respond strongly and quickly to idiosyncratic shocks and slowly to aggregate shocks (Maćkowiak and Wiederholt, 2009).

However micro-level empirical evidence in favor of rational inattention, are scarce at best, with Alvarez et al. (2012) being among the few exceptions. However most existing empirical work centers on optimal consumption/saving plans of individuals and/or the pricing decision of firms. To date no study has provided evidence disregarding one important aspect important to the conduct of monetary policy, namely the formation of inflation expectations. This paper tries to fill this gap.

In particular, employing micro-level survey for various European countries we aim at assessing the relevance of rational inattention theory, focusing on two of its implications. First, that in more uncertain environments people tend to be more attentive and thereby tend to make smaller mistakes. Second, that when country-specific inflation is high, individuals also tend to be more attentive.[1]

Our results are summarized as follows. First, we find evidence that higher country-specific inflation volatility leads to lower probability of forecast errors. Similarly, we find that when inflation rate is high, again the probability of making forecast errors is reduced. Second, we find that similar results hold for error size of forecast error: the probability of making such large errors is lower in highly uncertain environments and when inflation is high. Third, a

[1] This follows from the work of Maćkowiak, Moench and Wiederholt (2009) who find that prices tend to respond more to sector-specific shocks, which are also found to be larger.

novel set of results concerns the effect of inflation uncertainty and its level on the probability of making large mistakes. We find that while higher volatility and inflation rates reduce significantly the probability of making "wrong predictions" about future inflation, when agents actually commit such mistakes the likelihood that these mistakes are large is increasing in inflation uncertainty and the inflation rate.

[**To Be Completed**]

The rest of the paper is organized as follows. Section 2 gives a detailed description of the data we use, while Section 3 presents our econometric methodology. The empirical results are discussed in Section 4 and some robustness results are presented in Section 5. The last section concludes.

2. Data Issues and Background Analysis

2.1. Dependent Variables

The data utilized in this study come from annual Eurobarometer issues, covering the period 2007-2013. The Eurobarometer is a micro-level survey, in which representative samples of individuals are surveyed periodically across countries. In particular, the surveys we use refer to individuals residing in Austria, Belgium, Cyprus, Germany, Estonia, Greece, Spain, Finland, France, Ireland, Italy, Luxembourg, Malta, Netherland, Portugal, Slovenia and Slovakia. Table A.1 in the appendix reports the number of observations by country and by Eurobarometer survey.

It should be noted that these surveys run each year between September and November. What is of special interest to our analysis is the survey question regarding individuals' expectations about inflation's trajectory. More precisely, interviewed individuals are asked about their inflation expectations for the current year (which ends after two to four months depending on the survey). The exact question posed is as follows:

"*What is your expectation regarding the inflation rate this year? Compared to last year, will it be*:

Higher
Lower
The Same
DK/NA ”

Based on the above answers, we define an ordered variable, capturing individuals’ inflation expectations, regarding inflation’s future trajectory:

$$\Delta\pi^{e}_{i,j,t|t-1} \equiv \left(\pi^{e}_{i,j,t} - \pi_{t-1}\right)\cdot 100 = \begin{cases} 0, \text{ if lower } \left(\Delta\pi^{e} < 0\right) \\ 1, \text{ if same } \left(\Delta\pi^{e} = 0\right) \\ 2, \text{ if higher} \left(\Delta\pi^{e} > 0\right) \end{cases}, \tag{1}$$

for individual i, in country j, during year/survey t. The last category/answer of the survey question (DK/NA) is excluded from our sample.

Then using the actual (realized/ex-post), annual inflation rates in country j obtained from *Eurostat*, we calculate the corresponding realization of (1):

$$\Delta\pi^{A}_{j,t} \equiv \left(\pi_{j,t} - \pi_{j,t-1}\right)\cdot 100 = \begin{cases} 0, \text{ if lower } \left(\Delta\pi^{A} < 0\right) \\ 1, \text{ if same } \left(\Delta\pi^{A} = 0\right) \\ 2, \text{ if higher} \left(\Delta\pi^{A} > 0\right) \end{cases}. \tag{2}$$

A graphical display of the average forecast of inflation trajectory and the actual inflation trajectory is given in Figure 1. We note while in some case average predicted inflation is close to the realized one (for instance for Ireland, the two are closely aligned), there is a systematic deviation of the predicted direction of inflation from the actual one. In general, people tend to overestimate the direction of inflation movement, relative to the direction of the realized inflation rate.

[Insert Figure 1 about here]

Combining the information in (1) and (2), it is possible to define the “error” or the “distance” between the expected and realized trajectories of inflation. Given the discrete and ordered nature of the two variables involved, our measure of “distance” attains the following values:

$$Dist_{i,j,t} = \Delta\pi^{e}_{i,j,t|t-1} - \Delta\pi^{A}_{j,t} = \begin{cases} -2 \\ -1 \\ 0 \\ 1 \\ 2 \end{cases} \tag{3}$$

Note that our *Dist* variable carries important information. For instance:

- zero (nonzero) values identify correct (incorrect) forecasts of inflation trajectory;
- when it is nonzero its absolute value indicates the order of magnitude of the "forecast error";
- positive (negative) values identify overestimation (underestimation) of inflation's trajectory

Our empirical work focuses on the probability of failing to predict correctly the trajectory of inflation, as well as the size of the "mistake" on the part of the interviewee. In order to proceed, we define a binary variable, which identifies individuals whose forecasts were incorrect, as follows:

$$Failure_{i,j,t} = \begin{cases} 0 & \text{if respondent } i \text{ in country } j \text{ at survey } t\text{, had a correct inflation trajectory forecast} \\ 1 & \text{if respondent } i \text{ in country } j \text{ at survey } t\text{, had an incorrect inflation trajectory forecast} \end{cases} \tag{4}$$

It should be clear that *Failure* attains values of zero (unity) if and only if *Dist* attains zero (nonzero) values.

As mentioned earlier, non-zero values of *Dist* carry information regarding the order of magnitude of the "forecast error". For instance, *Dist* attains the value -2 when an individual has stated that inflation is going to be lower, while actual inflation turned out to be higher. Similarly, *Dist* attains the value +2 when an individual has stated that inflation is going to be higher, while actual inflation turned out to be lower. In other words, in our discrete variables context, a forecast in the wrong direction results in "forecast errors" of the highest order. By the same token, values of –1/+1 indicate cases where forecasts were incorrect, albeit of a lower magnitude. For instance, *Dist* takes the value 1 when an individual has stated that inflation is going to be higher, while actual inflation turned out to be the same; or an individual has stated that inflation is going to be the same, while actual inflation turned out to be lower.

Using this information and conditional on $Failure_{i,j,t}$ attaining the value of 1 – i.e. the forecast was incorrect – we may also define the *size* of the 'forecast error' as:

$$Size_{i,j,t} = \begin{cases} 0 \text{ if respondent } i \text{ in country } j \text{ at survey } t, \text{ had a 'small' forecast error} \\ 1 \text{ if respondent } i \text{ in country } j \text{ at survey } t, \text{ had a 'substantial' forecast error} \end{cases} \quad (5)$$

Table 1 reports the raw probabilities of failure whereas Table 2 reports raw probabilities of the size of error.

[Insert Tables 1 and 2 about here.]

Inspecting Table 1, we note that 11 from the 17 European countries indicate the highest probability of failure of "inflation forecast" in 2012 with Austria (0.916), Germany (0.952), Finland (0.935) and Slovakia (0.915) being among them. The peak value of year's mean of probability of "inflation forecast" failure is recorded for Estonia (0.74) while at countries level the highest mean value was 0.825 in 2013. Belgium (0.925), Malta (0.939) and Greece (0.811) illustrate substantial failure probability scores in 2007, 2009 and 2011, respectively.

Regarding the size of forecast failure in Table 2, countries with increased forecast error size is Malta (0.797) in 2009 while Greece follows with 0.777 in 2011. Besides, Portugal (0.8) and Slovakia (0.782) show high error sizes in 2012. Indicatively, considering the survey year, apart from 2012, substantial forecast errors are present to Belgium in 2007 (0.681) and Slovenia (0.660) in 2013.

2.2. Explanatory Variables

The implications of rational inattention around which we base our analysis, are that in more volatile (uncertain) and higher inflation environments, the cost of inattentiveness increases (Sims, 2003; Wiederholt, 2010; Maćkowiak, Moench and Wiederholt, 2009). To operationalize and assess empirically these implications, we construct two macroeconomic explanatory variables. First, using monthly data of annualized inflation rates from *Eurostat*, we estimate the volatility of inflation. In particular, we proxy inflation uncertainty by its standard deviation: we use a 12-month window prior to each Eurobarometer survey.[2] That is we estimate:

$$\sigma_{j,t}^{\pi} = \sqrt{\sum_{\tau=1}^{12}\left(\pi_{j,t-1,\tau} - \overline{\pi}_{j,t-1}\right)^2 / 12} \tag{6}$$

where j, and t denote country and survey/year respectively, and τ denotes a particular month. So $\pi_{j,t-1,\tau}$ denotes the inflation in country j, during month τ, just before survey t takes place.

Second, we construct a dichotomous variable that flags whether a country's inflation in a given year, is above that year's cross-country median, as follows:

$$\pi_{j,t}^{h} = \begin{cases} 1 & \text{if } \pi_{j,t} > \pi_t^{median} \\ 0 & \text{otherwise} \end{cases} \tag{7}$$

where again j, t denote country and year respectively.

In Table 3, we report the average values of inflation's standard deviation by country. We also report the median inflation by country; and we also present percentage of times during which, a country's inflation has been above the cross-country median inflation. We note that Cyprus and Estonia have the highest (1.075) and lowest (0.3776) (average) inflation standard deviations. Moreover, Estonia, Finland and Luxembourg tend to have inflation rates that are well above the cross-country median (100%, 85.69%, 81.85% of time respectively).

[Insert Table 3 about here.]

Apart from the two macroeconomic variables of interest, our results control for various individual-level characteristics. From each issue of the Eurobarometer survey we also collect various demographic indicators about the respondents. In some detail, we employ information about age, age of stopping full-time education, gender, occupation and living area. An overview of these variables and their coding is given in Table A.2 in the appendix.

[2] For instance, if the survey takes place in November we use monthly observations of annualized inflation between November of the previous year and October of the current year.

3. Econometric Methodology

Our research aim is to investigate whether there is evidence in favor or against rational inattention in inflation forecasts. In order to empirically evaluate this, we employ two reduced-form models. The first considers the probability of failing to predict the direction of inflation correctly; the second looks at the probability that the size of the "forecast error" is large. The two models may be expressed as:

$$\mathbf{1}(Failure_{i,j,t}=1)=\beta_0+\beta_1\sigma^{\pi}_{j,t}+\beta_2\pi^{h}_{j,t}+\boldsymbol{\gamma}'\mathbf{X}_{i,j,t}+\alpha_j+\delta_t \tag{8}$$

$$\mathbf{1}(Size_{i,j,t}=1)=\lambda_0+\lambda_1\sigma^{\pi}_{j,t}+\lambda_2\Pi^{h}_{j,t}+\kappa'\mathbf{X}_{ijt}+\varphi_j+\psi_t \tag{9}$$

where the β's, and γ's are parameters; $\sigma^{\pi}_{j,t}$ and $\pi^{h}_{j,t}$ denote inflation volatility and above-the-median inflation indicator, respectively; $\mathbf{X}_{i,j,t}$ is a vector of individuals' characteristics such as age, age of stopping full-time education, gender, occupation and area in which they reside; finally α_j, φ_j and δ_t, ψ_t are country and time fixed effects, respectively.

In case rational inattention is valid, we expect β_1 (λ_1) and β_2 (λ_2) to be negative, suggesting that in more volatile and higher inflation environments, the probability of incorrect forecast and the probability of making large forecast errors is lower. The reason is that under rational inattention, higher volatility and higher inflation imply higher cost of inattention, and therefore more attentiveness. Hence, support for rational inattention requires the rejection of the following hypotheses in favor for their alternative:

$$\begin{array}{lcl} H_0:\beta_1=0\ \ (\lambda_1=0) & & H_0:\beta_2=0\ \ (\lambda_2=0) \\ & \text{and} & \\ H_1:\beta_1<0\ \ (\lambda_1<0) & & H_1:\beta_2<0\ \ (\lambda_2<0) \end{array}$$

It is also worthwhile to consider the size of error, conditional on the probability of failure. This will allow us to capture the size of "forecast error" individuals tend to fall into, in situation of more volatile and higher inflation rates (above the median level). For this reason we also estimate a model that accounts for sample selection bias, in the spirit of Heckman: our *selection* equation is similar to (8), while the outcome equation is similar to (9).

4. Empirical Results

In Tables 4 and 5 we report the estimated marginal effects obtained from various probit models. We report results from different probit models for the sake of comparison, but we focus our discussion on a version that includes country and time dummies along with inflation standard deviation, higher inflation (above the median level) and demographic characteristics (column 4). Looking at the probability of failure (Table 4) and how well data fit the econometric models, the full probit model (column 4) has 12.11% explanatory power. Comparing predicted with actual outcomes, we obtain a different measure of goodness of fit, the percentage of correctly classified observations. In case of full model (column 4), the percentage of correctly specified values is 69.22%, quite high.

The effect of $\sigma^{\pi}_{j,t}$ on the probability of forecast failure is negative and statistically significant, finding which is in line with rational inattention. In particular, a unit increase in country-specific inflation uncertainty, $\sigma^{\pi}_{j,t}$, reduces the probability of forecast failure by roughly 16 percentage points! This implies that the higher is country-specific inflation uncertainty ($\sigma^{\pi}_{j,t}$), the more attentive are individuals towards inflation, and, consequently, the more correct are, on average, their predictions about inflation's future path.

Focusing on the effect of $\pi^{h}_{j,t}$ on the probability of forecast failure, we note that it is negative and statistically significant. In particular, for an individual residing in a high-inflation country (i.e. a county whose inflation is above the cross-sectional median), the probability of making a forecast error is reduced by roughly 5 percentage points.[3]

Considering the individual characteristics, older people are less likely to make incorrect inflation forecasts, with a very low estimated marginal effect of 0.06 percentage points. Similarly, agents who quit the full-time education later in their lives indicate lower levels of incorrect forecasts, lessening the probability by only 0.04 percentage points. Males seem to make more correct forecasts affecting negatively the failure probability (-1.5%). Using respondents who are *Retired* as the baseline category, we find that people who are

[3] Discussion of the marginal effects of individual characteristics is available upon request.

employees and belong to last category of Other profession display a failure probability reduction of 5.35%.

[Insert Table 4 about here.]

Table 5 reports result looking at the "size" of the forecast error, and in particular it reports the effects of various covariates on the probability of making a "large forecast error". Focusing again on the full-version model (column 4), we note that has explanatory power of about 6.85%, with the fraction of corrected classified observations being 62.38%. Focusing on marginal effects, we note that a higher country-specific inflation uncertainty reduces the probability of making a large "forecast error" by approximately 4%. Again the intuition behind this result in line with the implications of rational inattention: the higher the inflation uncertainty, the more attention is paid to it, resulting in lower "forecast errors". Contrary to this, the marginal effect of $\pi^{h}_{j,t}$ is significantly positive and seems, at first glance, that it does square well with rational inattention framework. We return to this issue below in our sensitivity analysis.

Regarding the demographic characteristics, males have a significant negative impact to the size of failure as they reduce it by 5.18%. For people who are self-employed and, more specifically, *Professionals* (lawyer, medical practitioner e.t.c.) and *Managers of a Company*, exhibit lower probability of making large forecast errors reducing significantly the size of it by 7.51% and 3.73%, respectively, compared to the base category of *Retired* people. Furthermore, agents who work as *Professional employees* (i.e. accountant, employed doctor), people who are in *General Management*, *director or top management* and individuals who work at *Middle Management* they, also, seem to decrease the inflation forecast error by 4.67%, 4.91% and 5.48% correspondingly.

[Insert Table 5 about here.]

Recall that the "size of error" is defined conditional on an incorrect inflation forecast. Table 6 presents estimates which take this "selection" process into account. Looking first at Panel B (the "selection" equation), we note again that the higher is inflation uncertainty and the higher is the inflation rate, the less likely it is that the interviewee makes a serious "forecast error". However, once a "mistake" is made, the higher is inflation volatility and the rate of inflation, the more substantial is the error that respondents tend to fall into. Panel A (the "outcome" equation) shows that coefficient inflation volatility is positive and statistically significantly, increasing the probability of making a "large error" by roughly 12%. Similarly, if "mistake" is made by an individual, and the country's inflation rate is above the cross-country median, then the probability of making a substantial forecast error increases by about 3%.[4]

Addressing the individual's characteristics results, we find that agents who live in *Urban areas*, are *Unskilled manual workers*, *Looking after home* or *Seeking a job* are likely to make larger errors in their forecasts, conditional their responses about future inflation are incorrect.

[Insert Table 6 about here.]

5. Sensitivity Analysis

In order to assess the sensitivity of our analysis thus far we proceed as follows. For each year in our sample, we classify inflation uncertainty and the rate of inflation into four categories. These categories are qualitative variables, which assume the value one when inflation volatility or the inflation rates take values in a particular quartile of the cross-country distribution in a given year.[5] We report our results from these experiments in Table 7.[6] In general, our findings are, again, in line with the predictions of rational inattention.

[4] Again a discussion of the marginal effects of individual characteristics is available upon request.

[5] For instance, we define $\sigma^{\pi}_{j,t}(1-24)$ to be a dummy variable that takes the value 1 if inflation volatility in country j during year t is in the lower quartile of the distribution of $\sigma^{\pi}_{j,t}$. Similarly, we define $\pi^{h}_{j,t}(50-74)$ to take the value 1 when the inflation rate in country j during year t falls between the 50th and the 74th percentile of the cross-country inflation distribution.

[6] We focus again only on the marginal effects of inflation uncertainty and the inflation rate. The marginal effects of individual-level characteristics are available upon request.

[Insert Table 7 about here.]

Looking first at the probability of "forecast failure" we note that increases of inflation volatility and the inflation rate reduce significantly the probability of making a mistake. What is of particular interest is the finding when inflation volatility is in the top 25% of its cross-country distribution, this leads to a reduction of the probability of "forecast failure" by 9.82% relative to the base category (when inflation volatility is in the lowest 25% of its cross-country distribution). Similarly, having an inflation rate which is in- the top 25% of its cross-country distribution reduces the probability of "forecast failure" by 10.25% relative to the base category (when the inflation rate is in the lowest 25% of its cross-country distribution).

The results regarding "large forecast errors" again indicate that higher inflation uncertainty leads to lower probability of making such errors (albeit not always significantly lower from the base category). Instead the results regarding higher inflation again show that it has either a negative but insignificant effect, or a positive and significant effect on the probability of making a "large forecast error".

As this last finding could be driven by our definition high inflation and/or inflation uncertainty, we define two new categories. We classify inflation and/or inflation volatility to be high if they belong in the top 25% of their cross-country distribution. The results reported in Panel B of Table 7 show, much more clearly now, that both higher inflation uncertainty and higher inflation rates lead to significantly lower probability of making "forecast errors", either small or large.

6. Conclusion

Our study contributes to the understanding of the formation of inflation expectations at the level of consumers. Employing micro-survey data from European countries from various Eurobarometer surveys, our goal has been to assess if there is evidence in favor of rational inattention in consumer inflation forecasts. By estimating two econometric models, one for inflation "forecast failure" and one for the "size of error", we obtained a series of interesting results.

First, we found robust evidence that higher country-specific inflation volatility leads to lower probability of forecast errors: in such cases, individuals tend to be more attentive, thereby making it less likely that they commit forecast errors, in line with the implications of rational inattention theory. Moreover, we find that when inflation rate is high, again the probability of making forecast errors is reduced: again high inflation rates attract more attention and, result in lower probability of forecast failure. Moreover, in line with the existing literature, we find that demographics also play an important role in forecast accuracy.

Second, we find that similar results hold for error size of forecast error: the probability of making such large errors is lower in highly uncertain environments. The results regarding higher inflation are less clear cut in this case. But when we define inflation to be high when it belongs to the top 25% of its cross-country distribution, we find that it leads to a significant reduction in the probability of making “large forecast errors”.

Third, a novel set of results concerns the effect of inflation uncertainty and its level on the probability of making large mistakes. We find that while higher volatility and inflation rates reduce significantly the probability of making “wrong predictions” regarding the path of future inflation, when agents actually commit such mistakes the likelihood that these mistakes are large is increasing in inflation uncertainty and the inflation rate. That is, when consumers fail in making a correct prediction about the future trajectory of inflation, it is more likely that they fail badly in highly uncertain environments, when inflation is also high.

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Appendix

Table A.1. Number of Respondents (max. number of observations) by Country and Eurobarometer survey

	ZA:4979 (Q18b)	ZA:4982 (Q15b)	ZA:5438 (Q15b)	ZA:5459 (Q14b)	ZA:5681 (Q13b)	ZA:5880 (Q13b)	ZA:5901 (Q13b)	Total
Austria	1005	1000	1011	1008	1000	1000	1001	7025
Belgium	1004	1000	1010	1004	1003	1000	1003	7024
Cyprus	–	1002	1001	1000	500	500	504	4507
Germany	1006	1003	1003	1004	1000	1000	1000	7016
Estonia	_	_	_	_	1002	1000	1000	3002
Greece	1004	1001	1002	1007	1000	1001	1000	7015
Spain	1002	1011	1001	1002	1000	1000	1000	7016
Finland	1005	1002	1002	1005	1001	1003	1004	7022
France	1000	1009	1004	1001	1007	1001	1006	7028
Ireland	1000	1000	1000	1000	1000	1000	1000	7000
Italy	1001	1000	1000	1000	1003	1003	1000	7007
Luxembourg	1000	1008	1002	1004	503	502	503	5522
Malta	_	1005	1009	1000	502	503	502	4521
Netherlands	1002	1004	1005	1002	1000	1006	1003	7022
Portugal	1002	1007	1003	1004	1000	1000	1000	7016
Slovenia	1000	1000	1001	1012	1000	1000	1001	7014
Slovakia	_	_	1013	1020	1000	1000	1001	5034
Total	13031	15052	16067	16073	15521	15519	15528	106791

Notes: These are based on various Eurobarometer surveys from 2007 to 2013. The heading in each column shows the survey (ZA:xxxx) and the relevant question regarding inflation expectations.

Table A.2. Variable Coding

Age	Age of respondent
Age Education	Age stopping full-time education
Gender	Equals 1 if respondent is male, 0 otherwise
Metropolitan zone	Equals 1 if respondent lives in Metropolitan zone, 0 otherwise
Other town/Urban centre	Equals 1 if respondent lives in Other town/Urban centre, 0 otherwise
Rural zone	Equals 1 if respondent lives in Rural zone, 0 otherwise
DK/NA	Equals 1 if respondent refuses to answer or DK, 0 otherwise
	Self-employed
Farmer	Equals 1 if respondent is a Farmer, Forester, Fisherman, 0 otherwise
Craftsman	Equals 1 if respondent is a Craftsman, Owner of a shop, 0 otherwise
Professional	Equals 1 if respondent is a Professional (lawyer, medical practitioner e.t.c.), 0 otherwise
Manager	Equals 1 if respondent is a Manager of a company, 0 otherwise
Other	Equals 1 if respondent belongs to Other category, 0 otherwise
	Employee
Professional	Equals 1 if respondent is a Professional (employed doctor, accountant e.t.c.), 0 otherwise
General Management	Equals 1 if respondent is a General Management, director or top management, 0 otherwise
Middle Management	Equals 1 if respondent is a Middle Management, 0 otherwise
Civil servant	Equals 1 if respondent is a Civil servant, 0 otherwise
Office clerk	Equals 1 if respondent is a Office clerk, 0 otherwise
Other employee	Equals 1 if respondent is a Other employee (e.g salesman, nurse), 0 otherwise
Other	Equals 1 if respondent belongs to Other category, 0 otherwise
	Manual worker
Supervisor	Equals 1 if respondent is a Supervisor/Foreman (team manager e.t.c.), 0 otherwise
Manual worker	Equals 1 if respondent is a Manual worker, 0 otherwise
Unskilled manual worker	Equals 1 if respondent is a Unskilled manual worker, 0 otherwise
Other	Equals 1 if respondent belongs to Other category, 0 otherwise
	Without a professional activity
Looking after the home	Equals 1 if respondent Looking after the home, 0 otherwise
Student	Equals 1 if respondent is a Student (full-time), 0 otherwise
Retired	Equals 1 if respondent is Retired, 0 otherwise
Seeking a job	Equals 1 if respondent Seeking a job, 0 otherwise
Other	Equals 1 if respondent belongs to Other category, 0 otherwise
NA	Equals 1 if respondent refuses to answer, 0 otherwise

TABLES

Table 1. Raw probability of Failure by Country and Year

	2007	2008	2009	2010	2011	2012	2013	All years
AT	0.430	0.289	0.697	0.567	0.397	0.916	0.844	0.59
BE	0.925	0.219	0.722	0.469	0.348	0.856	0.801	0.62
CY	_	0.339	0.791	0.388	0.359	0.851	0.751	0.58
DE	0.497	0.289	0.749	0.611	0.351	0.952	0.926	0.62
EE	_	_	_	_	0.513	0.874	0.834	0.74
EL	0.761	0.278	0.774	0.267	0.811	0.819	0.750	0.64
ES	0.841	0.191	0.642	0.548	0.528	0.860	0.722	0.62
FI	0.459	0.301	0.669	0.464	0.441	0.935	0.869	0.59
FR	0.843	0.314	0.722	0.576	0.414	0.900	0.865	0.66
IE	0.299	0.224	0.507	0.517	0.405	0.461	0.873	0.47
IT	0.864	0.298	0.692	0.460	0.354	0.384	0.827	0.55
LU	0.888	0.376	0.726	0.677	0.502	0.890	0.882	0.71
MT	_	0.202	0.939	0.434	0.513	0.401	0.701	0.53
NL	0.888	0.295	0.752	0.853	0.351	0.466	0.814	0.63
PT	0.854	0.351	0.764	0.337	0.276	0.878	0.849	0.62
SI	0.146	0.456	0.693	0.462	0.667	0.312	0.894	0.52
SK	_	_	0.822	0.875	0.213	0.915	0.821	0.73
All countries	0.669	0.295	0.729	0.532	0.438	0.745	0.825	*0.607*

Author’s calculations based on Eurobarometer files from 2007 to 2013.

Table 2. Raw probabilities of Small vs. Substantial Forecast Error by Country and Year

		2007	2008	2009	2010	2011	2012	2013	All years
AT	Small	0.785	0.728	0.484	0.735	0.810	0.454	0.578	0.653
	Substantial	0.215	0.272	0.516	0.265	0.190	0.546	0.422	0.347
BE	Small	0.319	0.716	0.399	0.592	0.639	0.401	0.511	0.511
	Substantial	0.681	0.284	0.601	0.408	0.361	0.599	0.489	0.489
CY	Small	_	0.577	0.291	0.630	0.656	0.223	0.322	0.450
	Substantial	_	0.423	0.709	0.370	0.344	0.777	0.678	0.550
DE	Small	0.786	0.835	0.463	0.749	0.821	0.344	0.461	0.637
	Substantial	0.214	0.165	0.537	0.251	0.179	0.656	0.539	0.363
EE	Small	_	_	_	_	0.716	0.363	0.526	0.535
	Substantial	_	_	_	_	0.284	0.637	0.474	0.465
EL	Small	0.306	0.628	0.299	0.470	0.223	0.233	0.455	0.373
	Substantial	0.694	0.372	0.701	0.530	0.777	0.767	0.545	0.627
ES	Small	0.279	0.525	0.317	0.622	0.589	0.257	0.468	0.437
	Substantial	0.721	0.475	0.683	0.378	0.411	0.743	0.532	0.563
FI	Small	0.892	0.788	0.527	0.722	0.840	0.393	0.568	0.676
	Substantial	0.108	0.212	0.473	0.278	0.160	0.607	0.432	0.324
FR	Small	0.361	0.620	0.428	0.642	0.732	0.355	0.519	0.522
	Substantial	0.639	0.380	0.572	0.358	0.268	0.645	0.481	0.478
IE	Small	0.738	0.591	0.372	0.660	0.723	0.752	0.504	0.620
	Substantial	0.262	0.409	0.628	0.340	0.277	0.248	0.496	0.380
IT	Small	0.331	0.733	0.459	0.681	0.655	0.667	0.362	0.555
	Substantial	0.669	0.267	0.541	0.319	0.345	0.333	0.638	0.445
LU	Small	0.460	0.835	0.570	0.783	0.661	0.408	0.561	0.611
	Substantial	0.540	0.165	0.430	0.217	0.339	0.592	0.439	0.389
MT	Small	_	0.784	0.203	0.687	0.833	0.702	0.539	0.625
	Substantial	_	0.216	0.797	0.313	0.167	0.298	0.461	0.375
NL	Small	0.481	0.782	0.422	0.449	0.680	0.727	0.543	0.584
	Substantial	0.519	0.218	0.578	0.551	0.320	0.273	0.457	0.416
PT	Small	0.325	0.620	0.401	0.710	0.589	0.200	0.431	0.468
	Substantial	0.675	0.380	0.599	0.290	0.411	0.800	0.569	0.532
SI	Small	0.720	0.656	0.492	0.717	1.000	0.768	0.340	0.671
	Substantial	0.280	0.344	0.508	0.283	0.000	0.232	0.660	0.329
SK	Small	_	_	0.312	0.275	0.683	0.218	0.402	0.378
	Substantial	_	_	0.688	0.725	0.317	0.782	0.598	0.622
All countries		0.500	0.500	0.500	0.500	0.500	0.500	0.500	*0.5*

Author's calculations based on Eurobarometer files from 2007 to 2013.

TABLE 3: Inflation Uncertainty and Median Inflation

	$\sigma_{j,t}^{\pi}$	Median Inflation	% of times above median inflation
Austria	0.6406	2.2	57.22
Belgium	0.9543	2.3	42.81
Cyprus	1.0757	2.6	66.61
Germany	0.4758	2.1	14.25
Estonia	0.3776	4.2	100.00
Greece	0.9403	3.0	57.22
Spain	0.8190	2.4	42.97
Finland	0.5984	2.2	85.69
France	0.5543	1.7	14.24
Ireland	0.7468	1.2	14.29
Italy	0.6093	2.0	28.59
Luxembourg	0.8549	2.8	81.85
Malta	1.0709	2.0	77.79
Netherlands	0.4539	2.2	28.6
Portugal	0.7494	2.4	28.53
Slovenia	0.8345	2.1	71.49
Slovakia	0.9304	1.5	59.85

Notes: Authors' calculations based on Eurostat data and on Eurobarometer files from 2007 to 2013

TABLE 4. Models for the Probability of "Forecast Failure"

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inflation standard deviation	–	-0.1551*** (0.005675)	–	-0.1589*** (0.005669)	-0.044*** (0.003452)	-0.1078*** (0.004769)	-0.0397*** (0.003172)
Higher inflation (above median)	–	–	-0.0432*** (0.003451)	-0.0474*** (0.003438)	-0.0782*** (0.003551)	-0.0142*** (0.002966)	-0.0453*** (0.003125)
Gender (male=1)	-0.0150*** (0.003076)	-0.0149*** (0.003064)	-0.015*** (0.003075)	-0.015*** (0.003062)	-0.0114*** (0.003271)	-0.0155*** (0.003080)	-0.014*** (0.003294)
Age	-0.0006*** (0.000131)	-0.0006*** (0.000130)	-0.0006*** (0.000131)	-0.0006*** (0.000130)	-0.0003** (0.000141)	-0.0008*** (0.000131)	-0.0004*** (0.000141)
Age of stopping full-time education	-0.00043*** (0.000113)	-0.0004*** (0.000113)	-0.0004*** (0.000113)	-0.0004*** (0.000113)	0.0032*** (0.000125)	-0.0004*** (0.000114)	0.0032*** (0.000125)
Metropolitan zone	-0.00183 (0.004045)	-0.0008 (0.004029)	-0.0029 (0.004045)	-0.0021 (0.004029)	0.0085** (0.004257)	-0.0058 (0.004006)	0.0083** (0.004218)
Other town/ Urban centre	0.00061 (0.003330)	0.0002 (0.003314)	0.0016 (0.003329)	0.0013 (0.003313)	-0.0009 (0.003559)	0.0008 (0.003291)	-0.0021 (0.003541)
Profession/Employment Dummies	Included	Included	Included	Included	Included	Included	Included
Constant	1.3181*** (35.16)	1.6570*** (42.08)	1.3911*** (36.36)	1.7464*** (43.31)	0.7337*** (20.92)	1.3398*** (39.82)	0.3154*** (10.79)
Country fixed effects	Included	Included	Included	Included	Included	–	–
Time fixed effects	Included	Included	Included	Included	–	Included	–
Pseudo-R^2	0.1140	0.1197	0.1152	0.1211	0.0266	0.1067	0.0119
% Correctly classified	67.91%	68.88%	68.57%	69.22%	60.78%	68.62%	60.81%
N	97228	97228	97228	97228	97228	97228	97228

Notes: The table reports estimates of the effect of covariates on the probability of "Forecast Failure". The numbers reported are the marginal effects, while the numbers in parentheses are the standard errors. The baseline category for occupation is Retired people, while for Area is Rural zone. *,** and *** denote significance on the 10, 5 and 1% significance level, respectively.

TABLE 5. Models for the Probability of "Large Size of Forecast Failure"

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inflation standard deviation	–	-0.0453*** (0.008816)	_	-0.0394*** (0.008931)	0.0138*** (0.004483)	0.0486*** (0.007269)	0.0346*** (0.004138)
Higher inflation (above median)	_	_	0.0219*** (0.004690)	0.0182*** (0.00475)	0.0115** (0.004725)	-0.0082** (0.004090)	-0.0226*** (-0.004133)
Gender (male=1)	-0.052*** (0.004160)	-0.0519*** (0.004160)	-0.0519*** (0.004159)	-0.0518*** (0.004159)	-0.0551*** (0.004245)	-0.0559*** (0.004219)	-0.0592*** (0.004311)
Age	0.0004** (0.000179)	0.0004** (0.000179)	0.0004** (0.000179)	0.0004** (0.000179)	0.0005*** (0.000183)	-0.0002 (0.000181)	-0.00003 (0.000185)
Age of stopping full-time education	0.0002 (0.000142)	0.0002 (0.000142)	0.0002 (0.000142)	0.0002 (0.000142)	0.0022*** (0.000136)	-0.0001 (0.000143)	0.0019*** (0.000136)
Metropolitan zone	-0.0072 (0.005444)	-0.0071 (0.005443)	-0.0069 (0.005442)	-0.0068 (0.005442)	-0.0095* (0.005536)	0.0055 (0.005437)	0.00487 (0.005524)
Other town/ Urban centre	0.00186 (0.004537)	0.00155 (0.004535)	0.00135 (0.004538)	0.00117 (0.004536)	0.0006 (0.004644)	0.02047*** (0.004560)	0.0204*** (0.004668)
Profession/Employment Dummies	Included	Included	Included	Included	Included	Included	Included
Constant	0.5274*** (11.84)	0.6027*** (12.88)	0.4983*** (11.07)	0.5685*** (11.94)	0.3365*** (7x.74)	0.0867** (2.13)	-0.0558 (-1.51)
Country fixed effects	Included	Included	Included	Included	Included	_	_
Time fixed effects	Included	Included	Included	Included	_	Included	_
Pseudo-R^2	0.0680	0.0683	0.0683	0.0685	0.0371	0.0430	0.0100
% Correctly classified	62.30%	62.35%	62.30%	62.38%	59.50%	60.59%	55.09%
N	58809	58809	58809	58809	58809	58809	58809

Notes: The table reports estimates of the effect of covariates on the probability of "Large Size of Forecast Failure". The numbers reported are the marginal effects, while the numbers in parentheses are the standard errors. The baseline category for occupation is Retired people, while for Area is Rural zone. *,** and *** denote significance on the 10, 5 and 1% significance level, respectively.

TABLE 6. Sample Selection Models for the probability of "Large Size of Forecast Failure"

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Outcome equation for "Large Size of Failure"						
Inflation Standard Deviation	0.1188***	0.1183***	0.1185***	0.1188***	0.1205***	0.1224***
	(0.008591)	(0.008581)	(0.008571)	(0.008592)	(0.008562)	(0.008537)
Higher Inflation (Above median)	0.0268***	0.0267***	0.0268***	0.0276***	0.0287***	0.0255***
	(0.008514)	(0.008513)	(0.008514)	(0.008514)	(0.008495)	(0.008475)
Gender	-0.0818***	-0.0819***	-0.0818***	–	-0.0820***	-0.0941***
(male=1)	(0.008908)	(0.008907)	(0.008908)		(0.008895)	(0.008509)
Age	0.0004	–	0.0004	0.0005	0.0004	0.0011***
	(0.000381)		(0.000381)	(0.000381)	(0.000379)	(0.000243)
Age of stopping	0.0002	0.0002	–	0.0002	0.0002	-0.00004
full-time education	(0.000299)	(0.000298)		(0.000299)	(0.000296)	(0.000295)
Metropolitan zone	-0.0043	-0.0042	-0.0041	-0.005	–	-0.0115
	(0.011396)	(0.011395)	(0.011392)	(0.011396)		(0.011287)
Other town/	0.0374***	0.0375***	0.0375***	0.0377***	–	0.0357***
Urban centre	(0.009614)	(0.009613)	(0.009612)	(0.009615)		(0.00955)
Constant	0.4347***	0.4667***	0.4387***	0.3961***	0.4497***	0.3869***
	(0.029999)	(0.013765)	(0.029296)	(0.029706)	(0.029427)	(0.01762)
Profession/Employment Dummies	Included	Included	Included	Included	Included	Not Included
Country fixed effects	Not Included	Not Included	Not Included	Not Included	Not Included	Not Included
Time fixed effects	Not Included	Not Included	Not Included	Not Included	Not Included	Not Included

Table 6 Continued

Panel B: Selection equation for "Large Size of Failure"						
Inflation Standard Deviation	-0.1022***	-0.1019***	-0.1021***	-0.1019***	-0.1048***	-0.1027***
	(0.008317)	(0.008314)	(0.008314)	(0.008319)	(0.008293)	(0.008296)
Higher Inflation (Above median)	-0.1172***	-0.1171***	-0.1172***	-0.1175***	-0.1202***	-0.1167***
	(0.008237)	(0.008237)	(0.008237)	(0.008239)	(0.008216)	(0.008223)
Gender (male=1)	-0.0340***	-0.034***	-0.0341***	-0.0772***	-0.0342***	-0.0276***
	(0.008638)	(0.008638)	(0.008637)	(0.007257)	(0.008618)	(0.008526)
Age	-0.0010***	-0.0008***	-0.001***	0.0126***	-0.0011***	-0.0013***
	(0.000366)	(0.000310)	(0.000366)	(0.048654)	(0.000364)	(0.000333)
Age of stopping full-time education	0.0089***	0.0089***	0.009***	0.0089***	0.0088***	0.0089***
	(0.000298)	(0.000298)	(0.000279)	(0.000298)	(0.000295)	(0.000295)
Metropolitan zone	0.0217*	0.0216*	0.0216*	0.0224**	0.2256***	0.0251**
	(0.011082)	(0.011081)	(0.011081)	(0.011085)	(0.043402)	(0.011046)
Other town/ Urban centre	-0.0062*	-0.0063	-0.0063	-0.0061	0.2196***	-0.0061
	(0.009271)	(0.009271)	(0.009271)	(0.009274)	(0.043062)	(0.009245)
Constant	0.3324***	0.3218***	0.3311***	0.3479***	0.1229**	0.1332**
	(0.036606)	(0.035524)	(0.036540)	(0.036576)	(0.055988)	(0.067554)
Profession/Employment Dummies	Included	Included	Included	Included	Included	Included
Country fixed effects	Not Included	Not Included	Not Included	Not Included	Not Included	Not Included
Time fixed effects	Not Included	Not Included	Not Included	Not Included	Not Included	Not Included
Censored Observations	38419	38419	38419	38419	38679	38517
Uncensored Observations	58809	58809	58809	58809	59041	58950

***Notes*:** The group *Retired* was excluded from the Outcome equation for identification purposes. *,** and *** denote significance at the 10, 5, and 1% level, respectively.

Table 7: Sensitivity Analysis

	Panel A: Effects by Quartile				*Panel B: Further Sensitivity*			
	Probit Model for Failure		Probit Model for Size		Probit Model for Failure		Probit Model for Size	
	M.E.	***Std.Err.***	***M.E.***	***Std.Err.***	***M.E.***	***Std.Err.***	***M.E.***	***Std.Err.***
$\sigma^{\pi}_{j,t}(25-49)$	0.0281***	0.0043	-0.0243***	0.0063				
$\sigma^{\pi}_{j,t}(50-74)$	-0.0309***	0.0046	-0.0064	0.0065				
$\sigma^{\pi}_{j,t}(75-99)$	-0.0982***	0.0049	-0.0229***	0.0075	-0.0736***	0.0038	-0.0206***	0.0055
$\Pi^{h}_{j,t}(25-49)$	-0.0418***	0.0051	0.0003	0.0068				
$\Pi^{h}_{j,t}(50-74)$	-0.0461***	0.0046	0.0331***	0.0061				
$\Pi^{h}_{j,t}(75-99)$	-0.1025***	0.0049	-0.0010	0.0069	-0.0732***	0.0042	-0.0142**	0.0062
Demographics	Included		Included		Included		Included	
Country fixed effects	Included		Included		Included		Included	
Time fixed effects	Included		Included		Included		Included	
Pseudo-R^2	0.1217		0.0688		0.1202		0.0682	
% Correctly classified	69.93%		62.49%		69.83%		62.44%	
N	97228		58809		97228		58809	
AIC	114717.491		76029.515		114902.043		76071.267	
BIC	-15268.481		-5031.021		-15121.868		-5025.197	

Notes: *,** and *** denote significance at the 10, 5, and 1% level, respectively.

GRAPHS

Figure 1. Average inflation expectation ($\Delta\Pi^{e}_{i,j,t}$) vs. average realized inflation paths ($\Delta\Pi^{A}_{j,t}$) by country, across all waves.