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Working Paper

Drawbacks of household panel data on inflation perceptions and expectations: Non-representativeness and selectivity

MAGKS Joint Discussion Paper Series in Economics, No. 14-2025

Provided in Cooperation with:

Faculty of Business Administration and Economics, University of Marburg

Suggested Citation: Hayo, Bernd; Bui, Dzung (2025) : Drawbacks of household panel data on inflation perceptions and expectations: Non-representativeness and selectivity, MAGKS Joint Discussion Paper Series in Economics, No. 14-2025, Philipps-University Marburg, School of Business and Economics, Marburg

This Version is available at:

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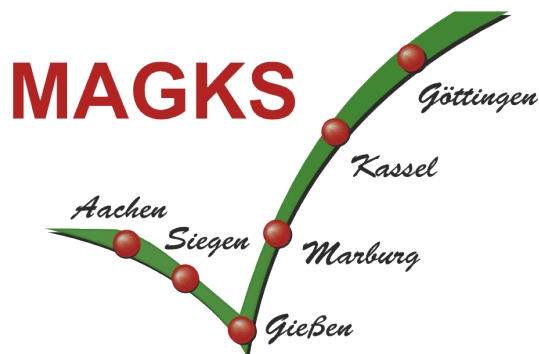
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**Joint Discussion Paper Series in
Economics**

by the Universities of
Aachen • Gießen • Göttingen
Kassel • Marburg • Siegen

ISSN 1867-3678

No. 14-2025

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Drawbacks of Household Panel Data on Inflation Perceptions and Expectations: Non-Representativeness and Selectivity

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This version: 19 May 2025

Abstract

By comparing the Bundesbank’s BOP-HH and the ECB’s CES-ECB household panel surveys focusing on inflation perceptions and expectations with omnibus surveys conducted in Germany in December 2021 and 2022, this paper examines potential sample selection bias stemming from (i) individuals’ willingness to participate in a household panel, and (ii) the ‘learning effect’ associated with repeated survey exposure. Our findings show that focusing on newcomers to the panel does not resolve these issues, as they also exhibit selection bias and are unrepresentative of the broader population. We construct new population weights for this subgroup and identify substantial differences in opinions between inexperienced and experienced respondents during the high-inflation period of 2022. Additionally, we observe notable variation in means, medians, and variances across the three surveys for both years and inflation measures.

Keywords: Inflation expectations; inflation perceptions; panel household surveys; selection bias; Germany.

JEL classification: C83, D83, D84, E31, E37.

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1 Introduction

Understanding how laypersons perceive and form expectations about inflation has received considerable attention (see, e.g., [Weber et al., 2022](#); [D’Acunto et al., 2023](#); [D’Acunto et al., 2024](#)). The central argument is that households play an important role in shaping private consumption, and their spending behaviour may be influenced by their perceptions of past and future price changes. Moreover, these inflation perceptions and expectations may affect wage setting, credit demand, and other relevant macroeconomic variables.

Methodologically, the common approach to studying people’s inflation perceptions and expectations is through representative household surveys see [Jonung \(1981\)](#) for an early contribution and [D’Acunto and Weber \(2024\)](#) for a more recent one). These surveys are typically of two types: (i) cross-sectional surveys and (ii) household panels. Cross-sectional surveys are either one-off studies or repeated with different participants. They are often part of omnibus surveys, which cover multiple topics in a single questionnaire, but can also focus exclusively on inflation.

In principle, household panels track the same individuals repeatedly over time. However, for various reasons — such as loss of interest, time constraints, or illness — it is common for some participants to drop out of the panel and require replacement. This attrition implies that household panels, to some extent, are subject to changes in their respondent composition. While most household panels tend to focus on a single theme, there is often a section with varying questions on related topics.

Panel household surveys are often the preferred type, since they allow researchers to observe the development of an individual’s attitudes and opinions over time. Moreover, they enable the inclusion of individual fixed effects, which can control for time-invariant differences between the respondents. In contrast, even large cross-sectional surveys may omit important individual characteristics. A major obstacle to conducting panel studies is their high cost, which is why most panels are managed by large institutions – typically central banks in the case of monetary topics.¹

However, we believe it is important to emphasise that household panels are not only advantageous, but also suffer from serious drawbacks, which should make us more cautious when drawing inferences about the entire population. Few researchers have acknowledged that household panels may lack representativeness of the population, and those who have focus exclusively on inflation expectations not perceptions of current or past inflation. The main criticism is based on the ‘learning effect’ of respondents in panel surveys with

¹A number of central banks conduct regular household panels, such as the monthly Federal Reserve Bank of New York’s Survey of Consumer Expectations ([Armantier et al., 2016](#)), the monthly European Central Bank’s Consumer Expectation Survey ([Bańkowska et al., 2021](#)), the monthly Bundesbank Online Panel-Households ([BOP-HH Team, 2024](#)), the quarterly Bank of Canada’s Canadian Survey of Consumer Expectations ([Gosselin and Khan, 2015](#)), the biannual Bank of England/NMG Survey of Household Finances ([Anderson et al., 2016](#)), and the annual De Nederlandsche Bank’s Household Survey ([Teppa and Vis, 2012](#)).

fixed participants.² Using both the Federal Reserve Bank of New York’s Survey of Consumer Expectations (Fed NY SCE) and the Canadian Survey of Consumer Expectations, [Bellemare et al. \(2020\)](#) argue that participants incorporate information and lower their inflation expectations after the first round of participating in the survey. More specifically, [Kim and Binder \(2023\)](#) examine the Fed NY SCE and find that experienced respondents have a keen interest in following current economic trends, revising inflation expectations and uncertainty downward. Most recently, this argument has been supported by evidence in [Mitchell et al. \(2024\)](#), who claim that the more times interviewees participate, the more accurate and less uncertain their forecasts become. [Comerford \(2024\)](#) finds that in the first round some respondents have lower cognitive reflection than others but improve their forecast accuracy with repeated survey participation. In light of this, [Kim and Binder \(2023\)](#) argue that the opinions of all participants in panel surveys do not reflect the average view of the population. To address this, they suggest focusing on, and expanding, the subgroup of new participants. Along similar lines, [Mitchell et al. \(2024\)](#) propose reporting results separately according to participants’ tenure.

In this paper, we argue that implementing these recommendations is insufficient to overcome the drawbacks of household panels. Instead, we suggest that the problem is much broader and more deep-rooted than previously acknowledged. First, there may be issues with the representativeness of the group, as first-time respondents may not meet the quota criteria necessary to claim that the sample is representative of the total population. Second, there may be issues with selectivity, since participation in a panel on a specific topic likely reflects an above-average interest in that topic. Third, the existing literature relies on only one panel survey for one country per study, and there is no comparison of the results with other panel and cross-sectional surveys from the same country at specific points in time. Fourth, the literature on the ‘learning effect’ has focused exclusively on the United States and it is important to assess the external validity of this finding in other countries.

Against this background, this paper aims to address the issues associated with household panels by comparing two widely employed surveys, the Bundesbank Online Panel Households (BOP-HH) and the Consumer Expectation Survey of the European Central Bank (CES-ECB), with an omnibus survey ([Hayo, 2022, 2023](#); hereafter GfK) conducted in Germany by GfK in December 2021 and December 2022. These time periods are particularly interesting, as they allow us to examine how responses to the inflation questions change, conditional on the actual inflationary environment. By December 2021, households were already exposed to visible, though still moderate, increases in the inflation rate. However, by December 2022, they were clearly affected by a surge in inflation.³ We consider both inflation perceptions and expectations, as some studies have shown that

²This effect is also called ‘panel conditioning’ in [Weber et al. \(2022\)](#).

³For 2021, the German consumer price index recorded an annual increase of about 3%, and for 2022, it was about 7%. In November 2021, the year-on-year inflation rate was nearly 5%, rising to almost 9% in November 2022 ([Statistisches Bundesamt, 2025](#)).

inflation perceptions are not only interesting in themselves, but are also highly correlated with inflation expectations.⁴

This study (i) analyses potential sample selection bias in the panel surveys, (ii) examines whether focusing on a subsample of first-time participants, as recommended by [Kim and Binder \(2023\)](#), addresses the ‘learning effect’ in panel surveys, (iii) compares our results for both inflation perceptions and expectations in the case of Germany, and (iv) investigates the impact on average inflation perceptions and expectations in the household panels once we re-weight the respondents to align with the actual population shares.

Our analysis indicates that about 40% of the participants in the omnibus surveys did not provide a quantitative value for the inflation rate during times of moderate inflation, and this value declines to 30% in times of high inflation. This suggests that people’s attention to price developments depends on the prevailing inflation environment ([Weber et al., 2025](#)). However, even in a situation of high inflation, a substantial number of people remain unwilling or unable to provide a numerical estimate of inflation if they have the choice to do so.

We find that the new participants in panel surveys do not appear to represent average laypersons. They are relatively more dedicated to answering the surveys and more knowledgeable about the topic of inflation. We can also confirm the ‘ready-to-learn’ attitude observed by [Kim and Binder \(2023\)](#) for Germany: participants who stay in the panel for more waves tend to have relatively higher response rates on the inflation questions.

However, we discover that it is not always possible to replicate a representative cross-sectional survey using the subsample of first-time panellists. For instance, the CES-ECB survey conducted in December 2021 did not include any respondents from the oldest age category — those aged over 70. In this case, it is impossible to use population weights to generate a sample that can be considered representative of the population. In other cases (BOP-HH in December 2021 and 2022 and CES-ECS in December 2022), our findings for Germany are consistent with those of [Bellemare et al. \(2020\)](#); [Kim and Binder \(2023\)](#); [Mitchell et al. \(2024\)](#). On average, new participants have different opinions from the average participant in the panel survey, especially when the inflationary environment changes.

Focusing on the new panel participants, we find no difference in the means and medians of perceived and expected inflation rates under the two types of weights (the survey’s original weights and our newly constructed weights). Interestingly, with the newly constructed weights, we find evidence of a reduction in the variance of point forecasts in 2022.

⁴There is a large body of literature on this result, dating back to [Jonung \(1981\)](#), who examined Swedish households. For example, [Hayo and Neumeier \(2022\)](#) show a strong correlation between inflation perceptions and expectations in New Zealand. Using the BOP-HH surveys, [Huber et al. \(2023\)](#) find a consistent link between German households’ inflation perceptions and inflation expectations during both low- and high-inflation periods.

When applying the newly constructed weights to newcomers, our paper reveals significant differences in quantitative inflation responses across the three surveys with respect to the mean, median, and variance. BOP-HH participants report lower point estimates than GfK participants, possibly reflecting relatively greater interest in, and knowledge of, monetary affairs. We observe the highest variance in inflation answers for the CES-ECB, which may be due to respondents being required to provide a numerical answer. The selection of panel participants does not seem strict enough to ensure that only respondents who actively monitor the inflation rate and have clear opinions remain. But including respondents with non-attitudes typically generates a great deal of noise in the responses (see [Zaller, 1992](#)).

In general, our findings suggest that researchers studying inflation perceptions and expectations should be cautious of the pitfalls associated with using household panels. The results are likely biased estimates of the underlying population values for inflation perceptions and expectations due to both a selection effect and lack of representativeness.

This paper makes five main contributions. First, it is the first study to use both panel and cross-sectional surveys to compare households’ opinions on inflation, revealing selectivity issues even for new participants. Second, this research contributes to a better understanding of both perceived and expected inflation in panel household surveys. Third, our paper critically assesses [Kim and Binder’s \(2023\)](#) recommendation to focus on new participants, and finds that while this approach mitigates certain issues, it also gives rise to new problems. Fourth, using German data, we offer external reliability for the importance of the ‘learning effect’ ([Kim and Binder, 2023](#)) in household panels. Finally, we contribute to the literature on how to design survey inflation questions by highlighting the inadequacy of omitting ‘don’t know’ and ‘don’t care’ as answer options.

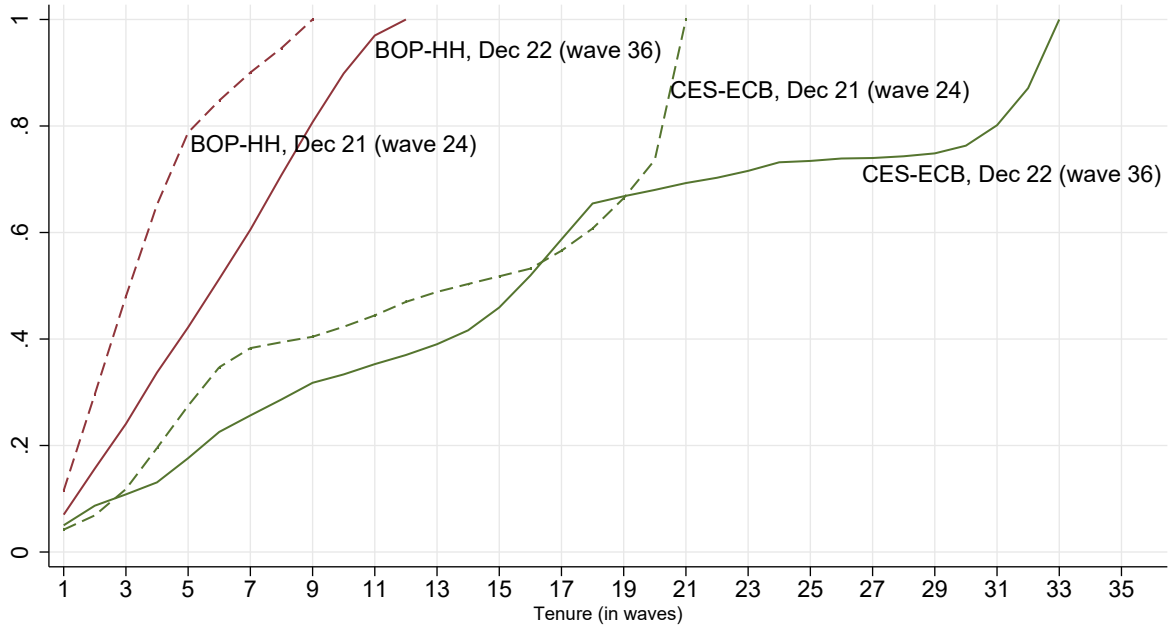
The rest of this paper is organised as follows. We briefly describe the data used in Section 2. In Section 3, we present the potential bias associated with using panel household surveys. Section 4 constructs population weights for the new participants of the panel surveys. We also report the new weighted means and variances of inflation perceptions and inflation expectations and compare them to the original weighted ones. Conclusions and implications are given in Section 5.

2 Data

Sample structure This paper uses data for Germany sourced from three reputable institutions: two household panel surveys, BOP-HH and CES-ECB, carried out by Forsa (Forsa Gesellschaft für Sozialforschung und statistische Analysen mbH) and IPSOS Public Affairs (Ipsos SA), respectively, in December 2021 (wave 24) and December 2022 (wave 36). Our third data source consists of two representative cross-sectional household surveys designed by [Hayo \(2022, 2023\)](#) and conducted by GfK (Gesellschaft für Konsumforschung) in December 2021 and December 2022, which serve as a benchmark for comparison.

Both CES-ECB and BOP-HH are online surveys conducted on a monthly basis, starting from April 2020, with sample sizes ranging from approximately 3,000 to 4,000 participants, respectively. Each wave is made up of repeat participants and newcomers who participate for the first time or return after a long break following their rotation out of the panel (Bańkowska et al., 2021; BOP-HH Team, 2024). Typically, a much higher proportion of participants stay in the survey for periods ranging from 12 to 24 months, compared to the share of newcomers. Figure A1 in the Appendix provides a brief overview of how the BOP-HH and CES-ECB panels are constructed.⁵ Figure 1 shows that after 24 waves (December 2021), 20% of the respondents in the BOP-HH and 65% of the respondents in the CES-ECB respondents had participated in more than 5 waves. These numbers increase to around 60% and 80%, respectively, in Wave 36 (December 2022).

Figure 1: Empirical cumulative of participated waves in BOP and CES surveys



Our cross-sectional comparison data for December 2021 and December 2022 come from Hayo (2022, 2023). The inflation questions were included in online omnibus surveys conducted by GfK, one of the largest private research companies in Germany specialising in market research and public opinion polling. Respondents in each wave were randomly selected from a panel of approximately 60,000 participants, with quotas based on the Microcensus – an official survey organised by the Federal Statistical Office that covers 1% of German households. These quotas were applied to sex, age, household size, community

⁵The methodology used to construct these household panels is similar to that employed in the online monthly New York Fed’s Survey of Consumer Expectations (Armantier et al., 2016) starting in June 2013 and the quarterly Bank of Canada’s Survey of Consumer Expectations (Gosselin and Khan, 2015), starting from the fourth quarter of 2014.

size, educational attainment of the head of household, and region. Given the sampling process, meaningful overlap between the 2021 and 2022 respondents is unlikely.

Questions In this paper, we analyse questions concerning the quantitative perceptions and expectations of inflation rates over the past 12 months and the next 12 months, respectively. While both BOP-HH and GfK directly ask about inflation rates, the CES-ECB inquires about the growth rate of general prices. Although the questions differ slightly, we find the concepts to be reasonably similar, allowing us to compare the numerical perceptions and expectations of inflation rates in Germany. Although differences in the phrasing of inflation questions (Bruine de Bruin et al., 2017) and answer options (Hayo and Méon, 2023) may influence results, researchers often use these questions in a comparable manner. The exact wording of the questions and answer options is as follows:

Perceived Inflation Questions

BOP-HH: What do you think the rate of inflation or deflation in Germany was over the past twelve months? Note: If you assume there was deflation, please enter a negative value. Values may have one decimal place. Please enter a value here: _____ percent.

GfK: What do you think is the current inflation rate in Germany? Please write the percentage here. a) _____% b) I don't monitor the inflation rate. c) Don't know.

CES-ECB: How much higher (lower) do you think prices in general are now compared with 12 months ago in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place. _____._%

Expected Inflation Questions

BOP-HH: What do you think the rate of inflation (or deflation) will roughly be over the next twelve months? Note: Inflation is the percentage increase in the general price level. It is mostly measured using the consumer price index. A decrease in the price level is generally described as deflation. Please enter a value in the input field (values may have one decimal place) _____ percent.

GfK: What do you expect the inflation rate to be next year? Please write the percentage here. a) _____% b) I don't form opinions about future rates of inflation. c) Don't know.

CES-ECB: How much higher (lower) do you think prices in general will be 12 months from now in the country you currently live in? Please give your best

guess of the change in percentage terms. You can provide a number up to one decimal place. _____._%

Although the inflation rate questions in GfK refer to the current calendar year for perceptions and the upcoming year for expectations, these time spans closely align with the past 12 months and next 12 months used in BOP-HH and CES-ECB, as all three surveys were conducted in December.

3 Potential Sample Selection Bias in Panel Surveys

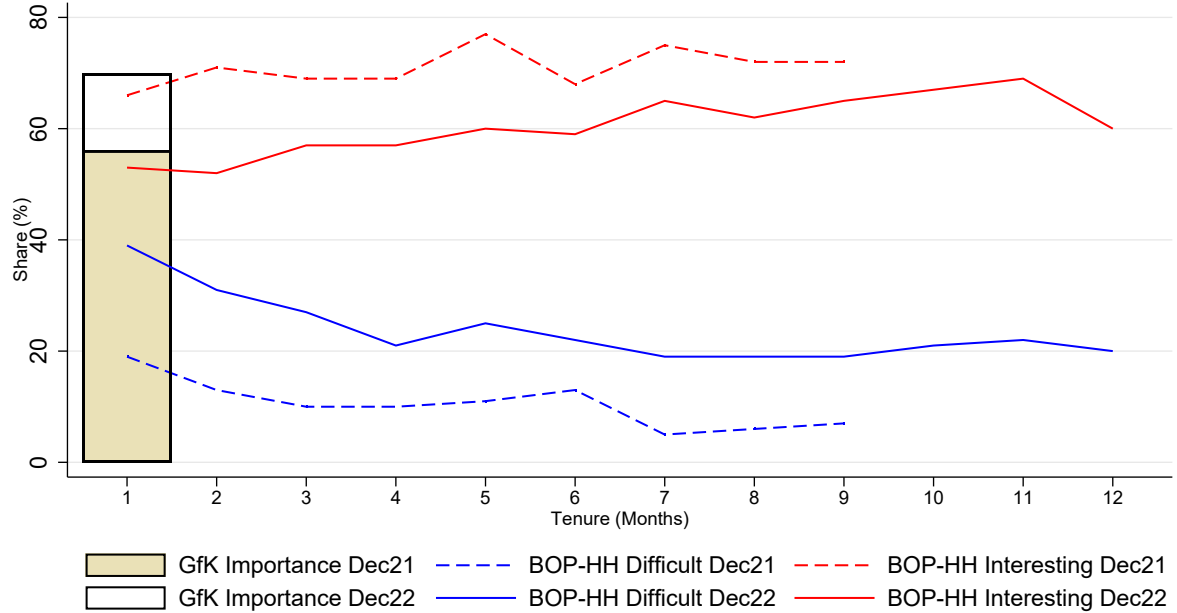
This section explores the possibility of sample selection bias arising from (i) individuals' willingness to join a household panel and (ii) repeated participation in the survey, referred to as the 'learning effect'.

Participants in omnibus surveys, which cover a wide range of often unrelated topics, do not necessarily have a specific interest in inflation-related issues. This contrasts with respondents who voluntarily join panel surveys on monetary topics. Previous studies have shown that laypersons generally have limited interest in and knowledge of monetary matters (see [Hayo and Neuenkirch \(2018\)](#) for evidence on Germany), indicating that panel surveys tend to attract individuals with greater expertise and engagement in these topics. Unlike respondents in omnibus surveys, panellists agree to participate on a recurring basis. A defining feature of panel surveys is that respondents are informed in advance that they will be contacted repeatedly. This 'ready-to-learn' attitude, combined with the repeated experience of answering similar surveys, familiarises participants with the subject matter. Consequently, panel members are likely to be more attentive to news and developments on the topic than the average person in the population.

Figure 2 shows how survey participants' interest in the topic and their perceived difficulty in completing the questionnaire evolve over time. In the BOP-HH surveys, we observe that panellists' interest in answering the questions increases with panel tenure. Repeat respondents also report finding the survey easier to complete than new participants. A comparison between 2021 and 2022 in the GfK cross-sectional surveys shows that rising inflation rates coincide with increased interest in the topic: in December 2022, a greater proportion of respondents considered inflation to be 'important' compared to December 2021. These changes are unsurprising, as the sharp rise in inflation rates in 2022 raised public awareness of monetary issues. Survey experiments in a comparative study across several countries by [Weber et al. \(2025\)](#) provide evidence that this relationship may be causal. Such behaviour supports the imperfect information perspective proposed by [Sims \(2003\)](#) and [Caplin and Dean \(2015\)](#), which has been applied to the present context by [Cavallo et al. \(2017\)](#), who emphasise information frictions, and by [Bracha and Tang \(2024\)](#), who highlight (in)attention. In all approaches, the argument is that consumers are more sensitive and pay closer attention to inflation when inflation rates are high. Un-

fortunately, we cannot compare the results from the CES-ECB, as comparable variables are not included in the publicly available dataset.

Figure 2: How interesting and difficult is it to answer the BOP-HH surveys, and how important is monetary policy and inflation in the GfK surveys?



Note: In this figure, the lines for BOP-HH Difficult Dec22 and BOP-HH Interesting Dec22 are consistently lower and higher, respectively, than those for Dec21. The underlying feedback questions – ‘How interesting did you find the survey overall?’ and ‘How easy or difficult was it overall to answer the questions?’ – are consistently included towards the end of each questionnaire. This pattern is somewhat puzzling, particularly in relation to the interest question. The reason is unclear, though differences in questionnaire content between the two waves may help explain the result.

We find that both BOP-HH and CES-ECB participants are more likely to provide numerical answers to questions about inflation rates, with non-substantive response rates — the share of respondents who choose options such as ‘don’t know’ or skip the question — being exceptionally low. [Bracha and Tang \(2024\)](#) use the share of individuals who answer ‘Don’t know’ as a measure of inattention. However, we believe that this is problematic, as ‘Don’t know’ could mean ‘I don’t know how to answer this question’, or it could mean ‘I do know how to answer this question but I am not sure about the current or future inflation rate’. In any case, the social science literature on conducting surveys considers the inclusion of a ‘Don’t know’ option standard practice (see, e.g., [Zaller, 1992](#)). This recommendation has also been echoed more recently in economics (see, e.g., [Stantcheva, 2023](#)).

In contrast to these recommendations, the CES-ECB questions require participants to provide a number in the input field, as no alternative answer options are offered. The benefit is that the response rate is 100%; however, the cost is the inclusion of highly noisy answers from individuals who have not formed a perception or expectation and are thus compelled to construct one on the spot. This presents a methodological challenge, as it

assumes the existence of an underlying belief or expectation that can be passively observed, rather than being potentially created by the act of measurement itself. Following [Campbell et al. \(1960\)](#), these answers, which arise solely because of the interview, can be characterised as ‘non-attitudes’. Note that this issue should not be confused with the tendency of respondents to withhold their true attitudes, which stems from social desirability bias and the experimenter demand effect in the experimental economics literature.

Unlike CES-ECB, BOP-HH offers the possibility of responding with ‘don’t know’ and ‘no answer’. Nevertheless, the total shares of numerical answers are still remarkably high, namely over 97% in both waves for both inflation measures (see [Table 1](#)). Moreover, [Table A2](#) reports similarly high shares when focusing on first-time participants, which suggests that this outcome is not due to a tenure effect. Perhaps it stems from a complex combination of social desirability bias, the experimenter demand effect and respondents’ perceptions of the Deutsche Bundesbank.

Table 1: Item response rates for inflation perceptions and expectations

	BOP-HH		CES-ECB		GfK	
	Perceived	Expected	Perceived	Expected	Perceived	Expected
Dec 21						
Total Sample	495	3365	3040	3040	2007	2007
Numerical Sample	481	3318	3040	3040	1295	1135
% of Total Sample	97.2	98.6	100	100	64.5	56.6
Truncated Sample	446	3075	2771	2753	1172	1063
% of Total Sample	90.1	91.4	91.2	90.6	58.4	53
Dec 22						
Total Sample	4687	4687	3103	3103	2013	2013
Numerical Sample	4611	4616	3103	3103	1470	1285
% of Total Sample	98.4	98.5	100	100	73	63.8
Truncated Sample	4206	4263	2852	2825	1340	1168
% of Total Sample	89.7	91	91.9	91	66.6	58

Note: BOP surveys allow ‘don’t know’ answers, whereas CES surveys do not. GfK surveys allow both ‘don’t know’ and ‘don’t monitor/don’t form an opinion’. The truncated sample includes 90% of the distribution to remove outliers due to high dispersion in consumer inflation expectations ([Mankiw et al., 2003](#)).

The GfK surveys contain both ‘Don’t know’ and ‘I do not monitor the rate’ in the question on perceived inflation and ‘Don’t know’ and ‘I do not form opinions about future inflation rates’ in the question on expected inflation. These options allow us to measure the extent of inattention to inflation rates more accurately, as in this case, ‘Don’t know’ does not imply that respondents are uninterested in the topic but rather that they are unable to provide a concrete number at this point in time. [Table 1](#) reveals a notable share of missing numerical responses in the GfK survey, namely 36% (December 2021) and 27% (December 2022) for perceived inflation and 43% (December 2021) and 36% (December 2022) for expected inflation. Of those who did not give a numeric answer, about half chose ‘Don’t know’, while the other half selected ‘Do not form an opinion’ or ‘Do not

monitor the rate’.⁶ This finding suggests that Bracha and Tang (2024), by interpreting a ‘Don’t know’ response as inattention, overestimate its prevalence.

In summary, this section provides further evidence of a potential sample selection bias when using panel surveys to collect opinions on inflation. Participants in household panels tend to display stronger commitment, greater interest, and/or better knowledge regarding inflation rates compared to the general population. It is important to clarify that this selection effect is methodologically distinct from the ‘learning effect’ identified by Kim and Binder (2023), since we observe no significant difference between first-time and repeat respondents.

4 Refreshers in Panel Surveys

To address the issue of the ‘learning-effect’, Kim and Binder (2023) suggest focusing on new participants and increasing the size of this subsample. However, this approach may introduce new issues, as it could compromise the representativeness of the sample. In this section, we demonstrate that first-time participants in panel surveys are not representative of the overall population. We then construct appropriate population weights for these participants and recalculate the mean and variance of both perceived and expected inflation rates.

4.1 The representativeness issue

While each wave of a household panel survey intends to represent the underlying population, the subsample of new respondents often deviates from this aim. To assess the representativeness of each survey wave, we concentrate on three widely used quota variables in population surveys: age, gender, and education level.⁷ Since the question on educational attainment differs across the three surveys, we have harmonised the categories in BOP-HH and GfK to align with those in CES-ECB (see Table A1 in the Appendix). We then recoded the data from the former surveys according to the category definitions used in the later survey to ensure comparability.

Table 2 reports the weighted percentages (using the original weights) of age groups in the sample survey waves of first-time respondents (columns 2 to 7), compared to those in the population (column 8).⁸ The new respondent samples in BOP-HH and CES-ECB from December 2021 and December 2022 are substantially overrepresented by the youngest age group, which is approximately 1.5 times larger in BOP-HH and 3 times larger in CES-ECB than in the population. Similarly, the oldest groups in BOP-HH (December

⁶Tables A4 and A5 provide some demographic statistics for each group.

⁷‘Region’ and ‘residential area’ are also commonly used as quota variables; however, we cannot include them due to their absence in the published CES-ECB dataset. Similarly, these variables are unavailable in the BOP-HH survey for December 2022.

⁸Note that the original weight ensures representativeness for the entire sample of each survey-wave.

2021, December 2022) and CES-ECB (December 2022) exceed their population shares by a factor of 2 to 4, respectively. Moreover, there are no observations for individuals aged over 70 in the CES-ECB (December 2021) dataset. Finally, the 35–70 age group is substantially underrepresented in the BOP-HH and CES-ECB waves. Due to the design of the study, these discrepancies are not present in the two GfK samples.

Table 2: Percentages of each age group of first-time participants with original weights

	BOP-HH		CES-ECB		GfK		Pop.
	Dec21	Dec22	Dec21	Dec22	Dec21	Dec22	
Under 35	41.1	57.3	77.4	48.8	26.8	25.7	26.5
35-49	16.6	18.7	16.0	16.3	27.0	28.1	27.5
50-70	30.7	15.2	6.5	17.0	41.8	41.3	41.5
Above 70	11.6	8.7	—	18.0	4.4	4.9	4.5
No of Obs	389	329	128	156	2007	2013	

Note: The column ‘Pop.’ refers to the benchmark population shares. A dash (—) indicates missing data.

For gender and education level, we report the percentages in Table A6 in the Appendix. We find that the male-to-female ratios and the distribution across the three education levels in the BOP-HH and CES-ECB surveys also differ significantly from those in the general population.

Thus, the group of new participants does not represent the entire population. If there are no observations in one or more subgroups, proper reweighting becomes impossible. Even when a few observations are available, applying high weights to these may exacerbate potential idiosyncrasies of the respondents, thereby undermining the validity of inference. Furthermore, even if there is sufficient representation from all subgroups, using the original weight, which is generated for the entire sample of each wave, may not ensure representativeness of the sample relative to the population.

4.2 Reweighting the subsample of new participants

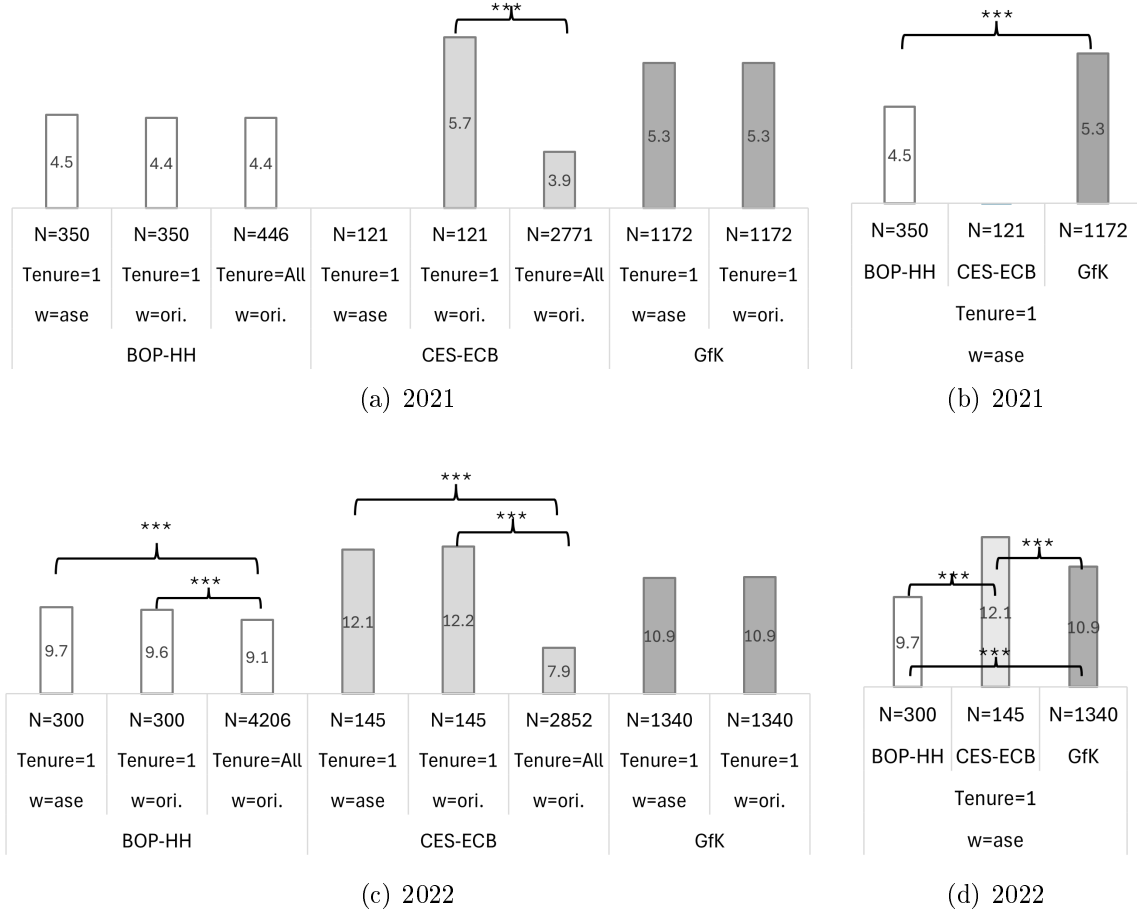
In this section, we recalculate the mean, median, and standard deviation for new participants’ perceived and expected inflation rates using constructed weights – referred to as *ase* weights – based on three criteria: age, sex, and education.⁹ We are interested in both the arithmetic mean and median of the responses to the inflation questions, as they capture different aspects of the distribution (D’Acunto et al., 2024).

⁹As mentioned above, stratification of the weights for the CES-ECB in December 2021 is not possible due to zero observations in the age group over 70.

4.2.1 Inflation perceptions

For each survey, Figures 3a and 3c display the means of the current inflation rates using the full survey samples with original weights compared to those of the subsamples of new participants with original weights and *ase* weights.

Figure 3: Inflation perceptions of the current year



Note: According to [Statistisches Bundesamt \(2025\)](#), actual (consumer price index) inflation rates in 2021 and 2022 were 3.1% and 6.9%, respectively. *ase* weights are based on three criteria: age, sex, and education. Details of the t-test are reported in Table A7. * $p < .05$, ** $p < .01$, *** $p < .001$.

The results for the BOP-HH wave 24 (December 2021) are illustrated in the left panel of Figure 3a. Interestingly, there is no statistical difference in beliefs about Germany's inflation rate in 2021 between new and all respondents (4.4 and 4.5%, respectively), even when applying the *ase* weights to the first-time participants subsample. As seen in the middle of Figure 3a, results from the CES-ECB show a statistically significant difference at the 1% level between the mean inflation rate of the full sample (5.7%) and that of the new participants' subsample (3.9%). For 2021, the weighted mean for GfK respondents remains unchanged at 5.3%, as there is only a slight difference between the original and *ase* weights.

For 2022, BOP-HH respondents believe that the inflation rate in Germany ranges from 9.1% to 9.7%, as depicted in Figure 3c. While the rates are similar in the subsample of new respondents when using the two weights (9.6% and 9.7%), there is a statistically significant difference at the 1% level when comparing the values for new respondents with those of all respondents (9.1%). Likewise, results from the CES-ECB, reported in the middle of Figure 3c, reveal significant differences between the weighted average perceived inflation rates of the first-time participants (12.1% and 12.2%) and those of the full sample (7.9%). The two bars on the right side of Figure 3c show results from the GfK survey in December 2022, where the perceived inflation rate is consistently 10.9% – significantly higher than the actual rate of 6.9

Focusing on the new participants, Figures 3b and 3d compare the means of inflation perceptions with *ase* weights across three surveys. Although we address the representativeness issue by using *ase* weights, we observe that the different surveys still yield varying results. This discrepancy suggests considerable sampling variation, indicating that too much trust should not be placed in any single sample. For example, Figure 3b shows that the *ase*-weighted average inflation rates for first-time respondents in BOP-HH and GfK for 2021 differ significantly, at 4.5% and 5.3%, respectively. According to the December 2022 data depicted in Figure 3d, the numbers for BOP-HH, CES-ECB, and GfK differ at 9.7%, 12.1%, and 10.9%, respectively. Despite the variation across the three surveys, the perceived inflation rates always exceed the actual inflation rates of 3.1% in 2021 and 6.9% in 2022. This result is linked to the argument that past prices are remembered as being cheaper due to agents’ limited memory. Additionally, the stylised fact holds that the most important sources of information on inflation for consumers are shopping experiences, conversations with friends and family, and the media (Hayo and Neuenkirch, 2018; D’Acunto and Weber, 2024; D’Acunto et al., 2024). In both years, the Covid-19 pandemic as well as the fuel price shock left deep impressions of high inflation among the people, especially in a context where inflation had previously been low and stable.

When considering the medians of inflation perceptions across our various samples, we find notable differences only in the case of CES-ECB survey Wave 36 (Tables 3a and 3b). Specifically, there is a 0.5 to 4 percentage point increase in the weighted median when considering new participants rather than all participants in CES-ECB survey Wave 36 at the 5% significance level. The change in weights is not large enough to alter the central values of the distribution of perceived inflation among first-time respondents (Table 3c). However, among new participants in all three surveys, Table 3d shows that the BOP-HH medians are between 0.5 and 1, and between 0.2 and 1 percentage points smaller than the GfK medians for December 2021 and 2022, at the 5% significance level, respectively.

Table 3: Confidence interval for the median difference in inflation perceptions across surveys and weighting schemes

Panel a	Wave	Tenure=All Original Weight	Tenure=1 Original Weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	446	350	0	-0.2	0.2
CES-ECB	24	2771	121	-0.8	-1.5	0
GfK	24	1172	1172	0	0	0
BOP-HH	36	4206	300	0	0	0
CES-ECB	36	2852	145	-2	-3.7	-0.5
GfK	36	1340	1340	0	0	0

Panel b	Wave	Tenure=All Original Weight	Tenure=1 <i>Ase</i> Weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	446	350	0	-0.2	0
GfK	24	1172	1172	0	0	0
BOP-HH	36	4206	300	0	0	0
CES-ECB	36	2852	145	-2	-4	-0.5
GfK	36	1340	1340	0	0	0

Panel c	Wave	Tenure=1 Original Weight	Tenure=1 <i>Ase</i> Weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	350	350	0	-0.3	0
GfK	24	1172	1172	0	0	0
BOP-HH	36	300	300	0	0	0
CES-ECB	36	145	145	0	-1.2	0.5
GfK	36	1340	1340	0	0	0

Panel d	Wave	Tenure=1 <i>Ase</i> Weight	Tenure=1 <i>Ase</i> Weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH vs GfK	24	350	1172	-0.8	-1	-0.5
BOP-HH vs GfK	36	300	1340	-1	-1	-0.2
BOP-HH vs CES-ECB	36	300	145	0	-1.4	0
CES-ECB vs GfK	36	145	1340	0	-1	0

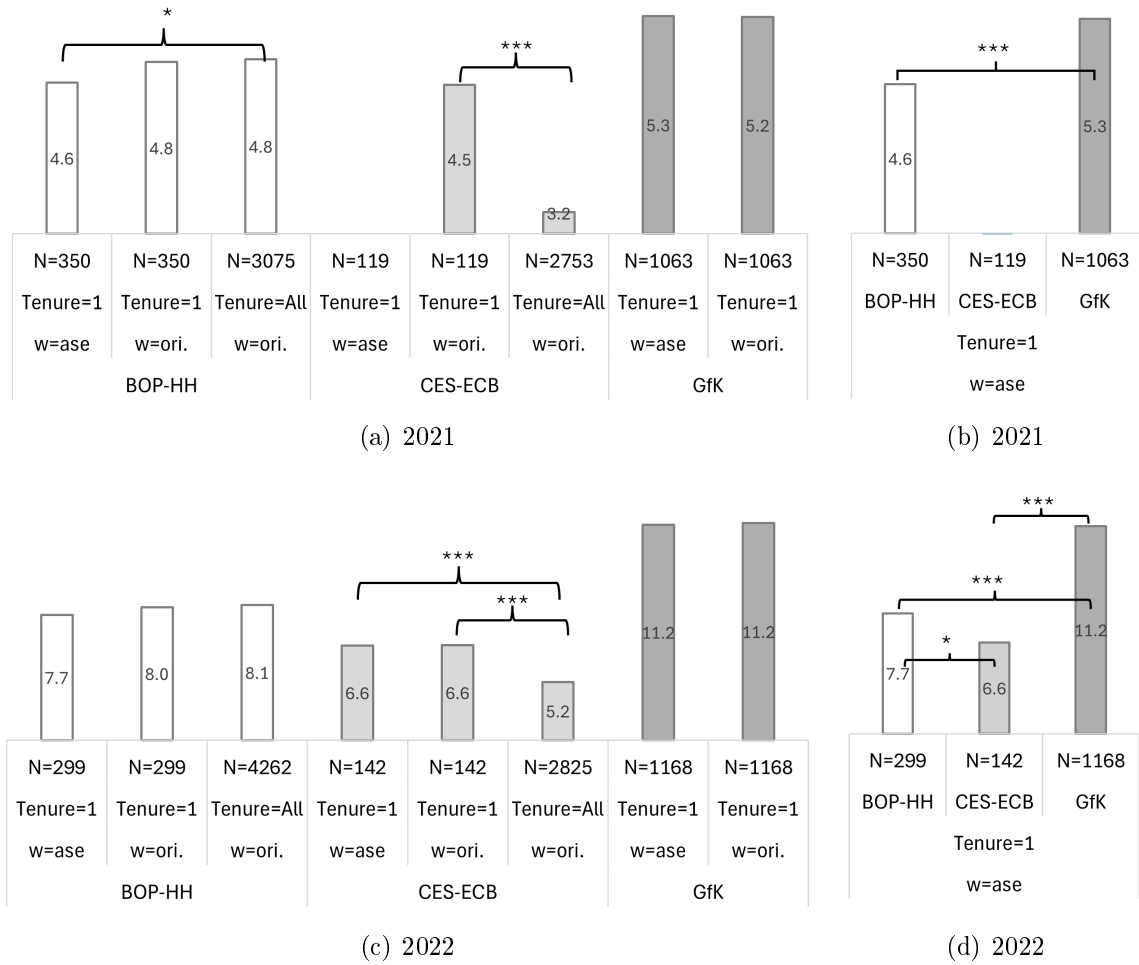
Note: Column 3 and 4 display the number of observations for the original and *ase* weights, respectively. Results are calculated from Hodges-Lehmann median differences.

In summary, for BOP-HH and CES-ECB, even though the subsamples of new participants are not representative of the entire population, the weighted means and medians calculated using the original weights and the *ase* weights are not statistically different.

4.2.2 Inflation expectations

Figures 4a and 4c present the weighted averages of inflation expectations for the next 12 months in Wave 24 (December 2021) and Wave 36 (December 2022) across the three surveys. In contrast, Figures 4b and 4d reveal notable differences between the surveys.

Figure 4: Inflation expectations for the next year



Note: According to [Statistisches Bundesamt \(2025\)](#), actual (consumer price index) inflation rates in 2022 and 2023 were 6.9% and 5.9%, respectively. Details of the t-test are reported in Table A8. * $p < .05$, ** $p < .01$, *** $p < .001$.

In the BOP-HH survey for 2021 (left panel of Figure 4a), the point forecasts of inflation rates range from 4.6% to 4.8% when applying different weighting schemes and samples. There is a small but statistically significant difference at the 5% level in the BOP-HH survey when comparing the subsample of new respondents with *ase* weights to the full sample with original weights. For the GfK survey, the right panel of Figure 4a

shows similar values of weighted inflation expectations, ranging from 5.2% to 5.3%. In contrast, the results from CES-ECB survey (see the light grey bars of Figure 4a) show a 1.3 percentage point difference between the new participants’ average expectation and that of the entire sample, which is significant at the 0.1% level.

When comparing the forecasts of new participants across surveys, the average inflation rates in 2022 were expected to be 4.6% and 5.3% by respondents from BOP-HH and GfK, respectively (see Figure 4b). Notably, the cost shocks from the Russia-Ukraine war and the energy price surge in 2022 led to the unusual situation in which actual inflation exceeded households’ expectations.¹⁰

For 2023, inflation rates in CES-ECB, BOP-HH, and GfK were expected to be much higher than in the previous year, at 6.6%, 7.7%, and 11.2%, respectively. Given that the actual inflation rate was 5.9%, this places us once again in the typical scenario where household expectations exhibit an upward bias. When comparing within each survey, we observe a notable difference in average expectations between CES-ECB’s first-time respondents (6.6%) and the full CES-ECB sample (5.2%), which is significant at the 0.1% level (see Figure 4c). As before, there is no statistically significant difference in the average expected inflation rate between the two differently weighted GfK samples.

In this section, we also test for the difference in the medians of inflation expectations across samples. Within the BOP-HH and GfK surveys, the weighted medians do not differ at the 5% significance level when applying different samples and population weights (Table 4a, 4b, and 4c). However, we find that, in December 2021, half of all participants who took part in CES-ECB Wave 24 expected inflation to be between 0.3 and 1.5 percentage points lower than that of new respondents (Table 4a). Among new participants in all three surveys, Table 4d shows that GfK respondents had significantly higher weighted medians, at the 5% level, exceeding those of BOP-HH by 2 to 3 percentage points and those of CES-ECB by 3 to 5 percentage points.

¹⁰The literature documents a persistent upward bias in households’ inflation expectations. Compared to firms and professional forecasters, household expectations also display larger deviations from actual outcomes and greater uncertainty (Armantier et al., 2013; Weber et al., 2022; D’Acunto et al., 2023; D’Acunto and Weber, 2024).

Table 4: Confidence intervals for differences in the medians of inflation expectations across surveys and weighting schemes

Panel a	Wave	Tenure=All Original weight	Tenure=1 Original weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	3075	350	0	0	0.1
CES-ECB	24	2753	119	-1	-1.5	-0.3
GfK	24	1063	1063	0	0	0
BOP-HH	36	4263	299	0	-1	1.5
CES-ECB	36	2825	142	-1.5	-2.5	0
GfK	36	1168	1168	0	0	0

Panel b	Wave	Tenure=All Original weight	Tenure=1 <i>Ase</i> weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	3075	350	0	0	0.5
GfK	24	1063	1063	0	0	0
BOP-HH	36	4263	299	0.4	0	1
CES-ECB	36	2825	142	-1.4	-2	0
GfK	36	1168	1168	0	0	0

Panel c	Wave	Tenure=1 Original weight	Tenure=1 <i>Ase</i> weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH	24	350	350	0	0	0.5
GfK	24	1063	1063	0	0	0
BOP-HH	36	299	299	0	-1	2
CES-ECB	36	142	142	0	-1	1.5
GfK	36	1168	1168	0	0	0

Panel d	Wave	Tenure=1 <i>Ase</i> weight	Tenure=1 <i>Ase</i> weight	Difference in Medians	95% Lower	Confidence Interval Upper
BOP-HH vs GfK	24	350	1063	-0.5	-1	0
BOP-HH vs GfK	36	299	1168	-2.5	-3	-2
BOP-HH vs CES-ECB	36	299	142	1.9	0	2.5
CES-ECB vs GfK	36	142	1168	-4.1	-5	-3

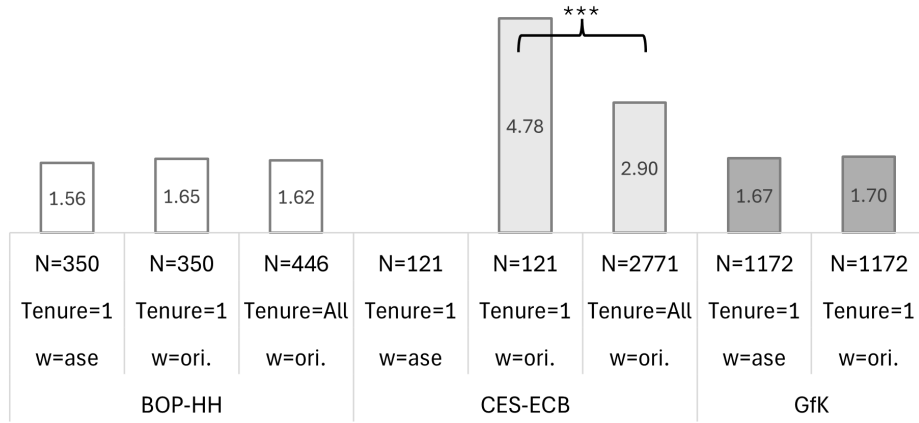
Note: Column 3 and 4 display the number of observations for the original and *ase* weights, respectively. Results are calculated from Hodges-Lehmann median differences.

As we find evidence that the means and medians of inflation perceptions and expectations differ between new participants and all participants, it is worth examining whether the dispersion in inflation attitudes around the respective means differs between old and new panel participants, as well as between differently weighted samples. To measure this variation, we use the standard deviation of the inflation variables.

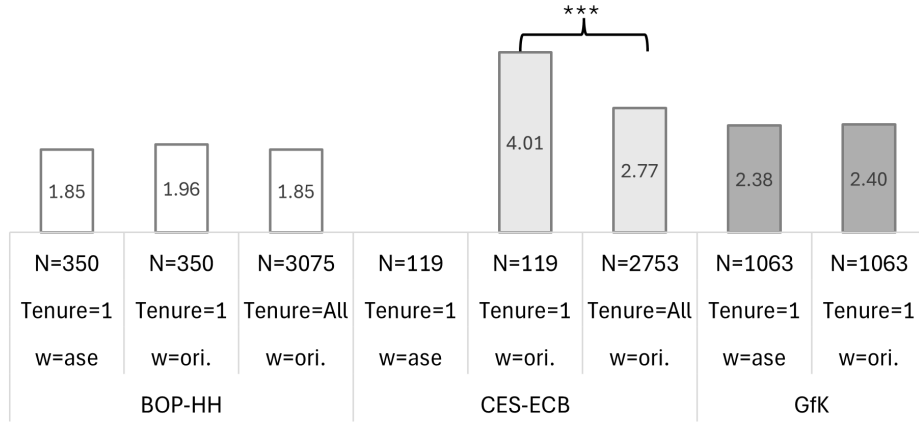
4.2.3 The divergence in opinions

Figure 5 and 6 present the standard deviations of perceived and expected inflation rates for first-time participants and the full samples. We observe that first-time participants show higher values compared to the full sample, suggesting that the variance in opinions decreases with increased survey participation. This finding further supports the ‘learning effect’ discussed earlier. When focusing on new participants and comparing the two population weighting methods, we find evidence of a decrease in the standard deviation of inflation expectations, which is significant at the 5% level in the BOP-HH survey for December 2022 (Figure 6). We find no statistically significant differences in the other survey waves.

Figure 5: Standard deviations of inflation perceptions and expectations for December 2021



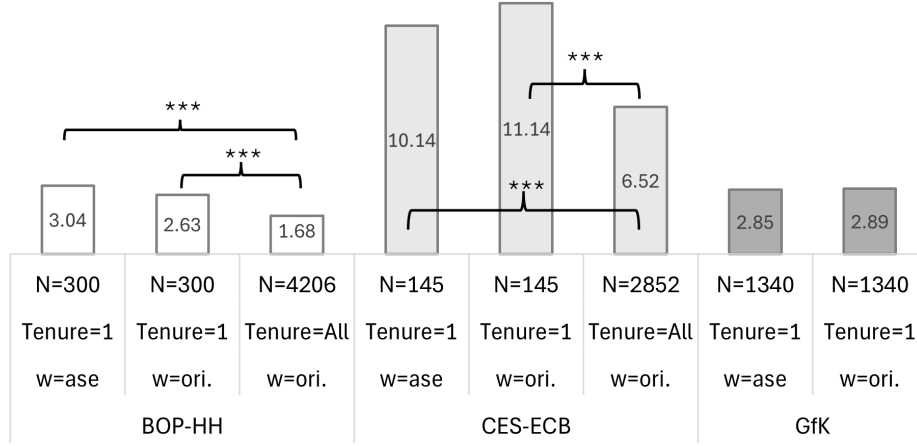
(a) Perceptions



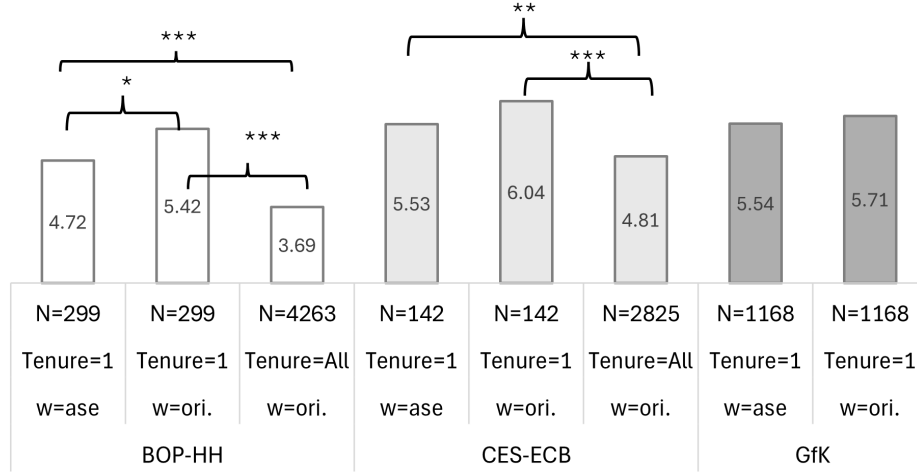
(b) Expectations

Note: Details of the F-test are reported in Table A9 and A10. * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 6: Standard deviations of inflation perceptions and expectations for December 2022



(a) Perceptions

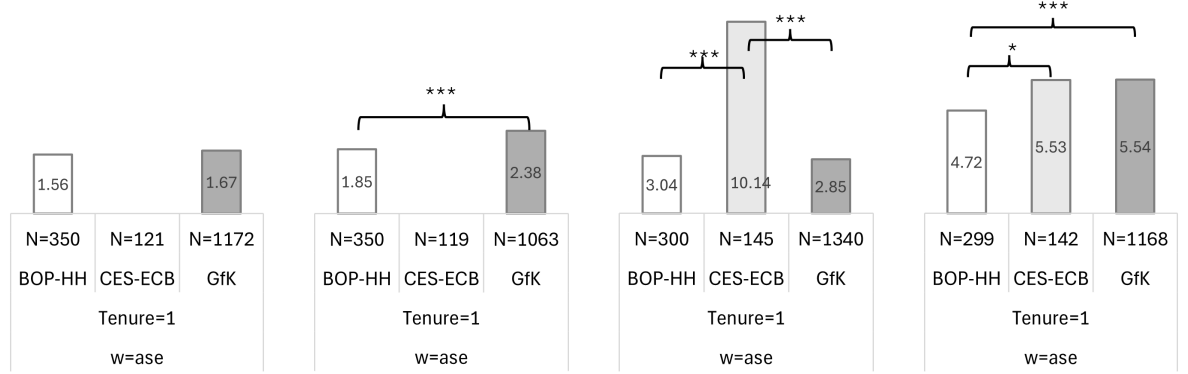


(b) Expectations

Note: Details of the F-test are reported in Table A9 and A10. * $p < .05$, ** $p < .01$, *** $p < .001$.

Across the sub-sample of first-time participants in the three surveys with *ase* weights, we find that there are remarkable differences in the standard deviations of both inflation measures in most cases (Figure 7). The fact that the CES-ECB surveys exhibit the highest standard deviations supports the argument regarding the creation of 'non-attitudes' when respondents are required to provide an answer. It also underscores the higher level of attentiveness and knowledge within a household panel. The former factor is likely to increase the standard deviation, while the latter should decrease it. The lower standard deviations observed in the BOP-HH and GfK surveys may be attributed to their design, which allows participants without clear opinions to abstain from answering.

Figure 7: Standard deviations of inflation perceptions and expectations for December 2021 and December 2022: subsample of new survey participants



(a) Perceptions Dec21 (b) Expectations Dec21 (c) Perceptions Dec22 (d) Expectations Dec22

Note: Details of the F-test are reported in Table A11 and A12. * $p < .05$, ** $p < .01$, *** $p < .001$.

5 Conclusion

Is the use of household panel data more advantageous than cross-sectional surveys when studying laypersons' inflation perceptions and expectations? The literature has already identified a 'learning effect' among panellists who participate in several waves. However, we argue that the limitations of household panels should be examined more comprehensively, including issues of both selection and representativeness.

In this study, we compare the results of quantitative inflation perceptions and expectations from two panel household surveys — the Bundesbank's BOP-HH and the ECB's CES-ECB — with those of an omnibus cross-sectional survey (GfK) for Germany. By examining the three surveys conducted in December 2021 and December 2022, we find evidence of a sample selection issue within the panel surveys.

Our analysis also highlights a representativeness issue, which remains unresolved even if one focuses on the newcomers in the panel. First, we show that this subsample is not representative of the broader population. Second, we demonstrate that applying the population weights used for the full panel does not resolve this issue. Third, we construct new population weights for this subsample based on three widely used quota variables (age, sex, and formal education). This allows us to compare the means, medians, and variances of laypersons' numerical responses to the inflation questions within and across the three surveys. For December 2021, when focusing on first-time participants and applying new weights within each survey, we find no significant effect of reweighting on the average values of the means, medians, and standard deviations. However, for December 2022, we observe higher means, medians, and variances in the new respondent group with our corrected weights, compared to the values derived from the entire sample with original weights.

The contrasting results from the two survey waves underscore the importance of the inflation environments at the time when the surveys were conducted. During the high-inflation period of 2022, opinions diverged markedly between the inexperienced and experienced respondents. Notably, for both years and all measures, there are substantial differences in the means, medians, and variances across the three surveys. Specifically, BOP-HH shows lower means and variances than GfK, whereas CES-ECB exhibits a mixed pattern with the highest variation.

Based on these findings, we offer several recommendations. First, if the goal is to obtain a representative view of inflation perceptions and expectations from the population in a country, cross-sectional surveys — particularly those included in an omnibus survey — cannot be replaced by panel surveys. Second, to address the ‘learning effect’ in household panels on inflation, [Kim and Binder \(2023\)](#) recommend focusing on new panellists. However, we demonstrate that this suggestion is unlikely to solve the issue, as even new panellists suffer from a selection bias. Moreover, this subsample is not representative of the broader population. Therefore, even if the occurrence of a selection bias is not seen as a problem, the subsample of new panellists should only be used after applying appropriate population weights, which differ from those used for the entire household panel.

Thus, while panel surveys have indisputable advantages, particularly the possibility to observe individual respondents across time and to create datasets with large numbers of observations, the results derived from these analyses must be interpreted with caution and should not be used to derive conclusions about the underlying population.

Our study is not without limitations. First, we cannot guarantee that all participants in the omnibus survey are new. However, at least they do not explicitly commit to regular participation and are not influenced by answering similar questionnaires. Moreover, inasmuch as there is overlap between the respondents to the two cross-sectional GfK surveys, it would make it more difficult to identify differences from the panel results. In other words, our analysis would become more conservative. Second, we cannot claim the external reliability of our findings beyond Germany during the analysed time period. Still, our ability to replicate the ‘learning effect’ proposed by [Kim and Binder \(2023\)](#) based on US data suggests that the expectation of external reliability is not unreasonable. Third, the ECB does not publish the full set of variables collected with the CES-ECB, which limits our analysis, especially in terms of constructing appropriate population weights for the subsample of new panellists. Fourth, another methodological issue with the CES-ECB is that the respondents cannot answer ‘don’t know’, which likely creates a lot of noise due to ‘non-attitudes’. We find some evidence supporting this view, as the variance in inflation responses is higher than in the BOP-HH and GfK surveys.

Finally, we have only considered numerical inflation questions regarding perceptions and expectations. Although both the BOP-HH and the CES-ECB questionnaires include more ambitious questions on inflation (i.e., they attempt to measure the degree of uncertainty in the responses about inflation), the GfK did not. This is not purely coincidental,

as [Comerford \(2019\)](#) argue against asking the density forecast on the grounds that a large fraction of the population cannot answer it. Hence, it is not yet possible to compare the dimension of uncertainty across the three surveys. Other studies using household panels focus on different variables, such as laypersons' trust in central banks (see, e.g., [Ehrmann \(2024\)](#) and [Dreher \(2024\)](#), using the CES-ECB surveys). It is also unclear how the selection and representativeness issues affect their results. Therefore, we believe that further research on these issues is important to avoid biased conclusions.

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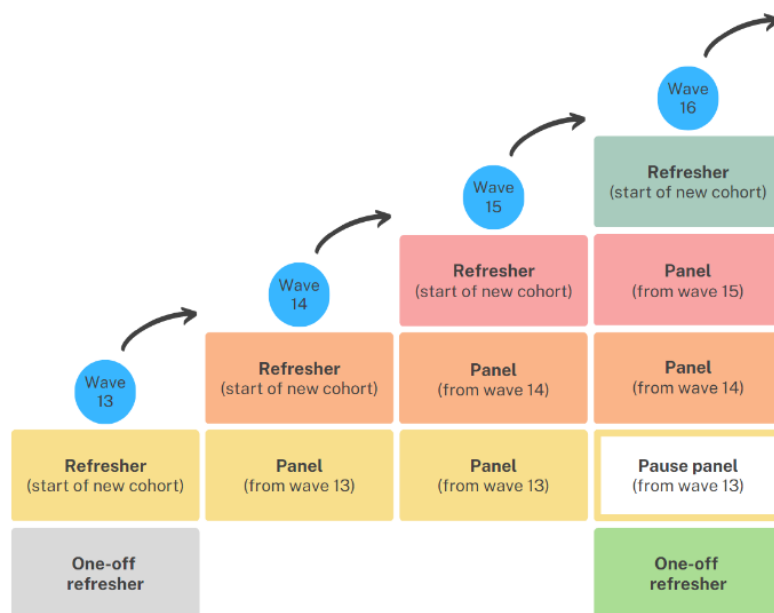
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A Appendix

Figure A1: Panel construction in the BOP-HH and CES-ECB surveys

Diagram of the panel concept

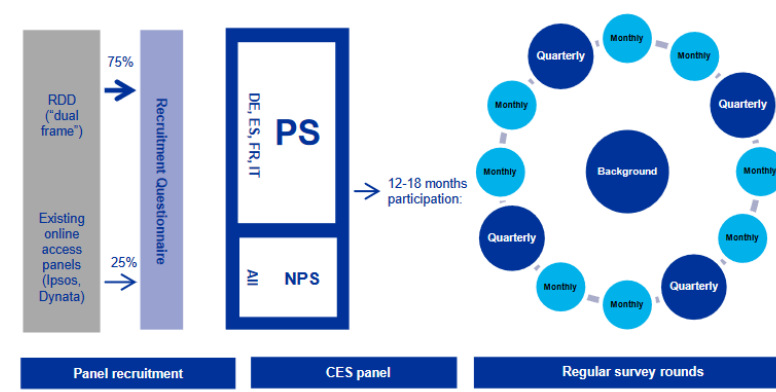


Source: Deutsche Bundesbank, Research Centre, BOP-HH team.

(a) Source: BOP-HH Team (2024)

Figure 1.2

Constructing the CES



(b) Source: Bańkowska et al. (2021)

Table A1: Recoding respondents' formal education indicator

Survey	Question	Answer's Categories		
		1	2	3
CES-ECB	What is the highest level of school you have completed, or the highest degree you have received?	Up to lower secondary education	Higher secondary education	Higher education
GfK	What is the highest level of school you have completed, or the highest degree you have received?	No certified apprenticeship training	Certified apprenticeship Secondary school	University-entrance diploma University-entrance diploma
BOP-HH	What level of vocational training or university degree do you have? Please think of your highest qualification here.	10 No vocational training completed (and currently not in training/higher education)	1 Currently in training or studying (bachelor's degree not yet completed) 2 Completed vocational training (apprenticeship) 3 Completed vocational training (vocational school or commercial college) 4 Completed training at a technical or commercial college, school for master craftsmen or engineers or university of cooperative education with shorter preparation time (up to 880 hours) 5 Completed training at a university of cooperative education with longer preparation time (more than 880 hours)	6 Bachelor's degree, applied sciences degree, completed training at an engineering college 7 Diploma or master's degree, completed teacher training degree 8 Doctorate/postdoctoral qualification obtained 9 Other professional qualification

Table A2: Response rates of new survey participants

	BOP-HH		CES-ECB		GfK	
	Perceived	Expected	Perceived	Expected	Perceived	Expected
Dec 21						
Total Sample	389	389	128	128	2007	2007
Numerical Sample	377	378	128	128	1295	1135
<i>% of Total Sample</i>	96.9	97.2	100	100	64.5	56.6
Truncated Sample	350	350	121	119	1172	1063
<i>% of Total Sample</i>	90	90	94.5	93	58.4	53
Dec 22						
Total Sample	329	329	156	156	2013	2013
Numerical Sample	323	327	156	156	1470	1285
<i>% of Total Sample</i>	98.2	99.4	100	100	73	63.8
Truncated Sample	300	299	145	142	1340	1168
<i>% of Total Sample</i>	91.2	90.9	92.9	91	66.6	58

Note: BOP surveys allow 'don't know' answers, whereas CES surveys do not. GfK surveys allow both 'don't know' and 'don't monitor/don't form an opinion.' The truncated sample includes 90% of the distribution to remove outliers.

Table A3: Shares of respondents selecting 'don't know' or 'don't monitor/form an opinion' for inflation perceptions and expectations in the GfK surveys (in %)

	Inflation Perception		Inflation Expectation	
	Dec 21	Dec 22	Dec 21	Dec 22
Age Group				
Under 35	33.3	38.3	31.3	31.7
35-49	29.4	30.8	29.5	29.7
50-70	34.2	28.8	36.3	33.9
Above 70	3	2.1	2.9	4.7
No of obs	712	543	872	728
Education Level				
Up to lower secondary education	9.9	10.4	9.4	8.5
Higher secondary education	55.1	58.5	54.2	58.2
Higher education	34.9	31.1	36.5	33.3
No of obs	712	540	872	726
Gender				
Male	38.2	34.8	39.2	35.8
Female	61.8	65.2	60.8	64.2
No of obs	712	543	872	728
Region				
West	84.2	85.7	84.9	86.1
East	15.8	14.3	15.1	13.9
No of obs	712	543	872	728
Family Status				
Single Widowed Divorced Separated	44.6	39.2	43	40.5
Married Living with Partner	55.4	60.8	57	59.5
No of obs	711	541	871	725

Table A4: Shares of respondents selecting ‘don’t know’ for inflation perceptions and expectations in the GfK surveys (in %)

		Inflation Perception		Inflation Expectation	
		Dec 21	Dec 22	Dec 21	Dec 22
Age Group					
	Under 35	31.2	28.7	27.8	25.6
	35-49	28.7	34.8	30.5	33.1
	50-70	37.2	33.9	38.9	36.3
	Above 70	2.9	2.6	2.7	4.9
	No of obs	351	291	454	362
Education Level					
	Up to lower secondary education	9.1	9.9	9.7	7.2
	Higher secondary education	56.4	60.9	56	60.6
	Higher education	34.5	29.2	34.3	32.2
	No of obs	351	289	454	360
Gender					
	Male	38.9	33.3	38.9	36.1
	Female	61.1	66.7	61.1	63.9
	No of obs	351	291	454	362
Region					
	West	84.5	85.3	85.2	85
	East	15.5	14.7	14.8	15
	No of obs	351	291	454	362
Family Status					
	Single Widowed Divorced Separated	47.4	37.4	44.1	41.1
	Married Living with Partner	52.6	62.6	55.9	58.9
	No of obs	350	291	454	361

Table A5: Shares of respondents selecting ‘don’t monitor’ for inflation perceptions and ‘don’t form an opinion’ for inflation expectations in the GfK surveys (in %)

		Inflation Perception		Inflation Expectation	
		Dec 21	Dec 22	Dec 21	Dec 22
Age Group					
	Under 35	35.3	50	34.8	37.7
	35-49	30	26	28.4	26.2
	50-70	31.5	22.5	33.7	31.5
	Above 70	3.2	1.4	3.1	4.6
	No of obs	361	252	418	366
Education Level					
	Up to lower secondary education	10.7	11.1	9	9.8
	Higher secondary education	54	55.6	52.4	55.7
	Higher education	35.3	33.3	38.6	34.4
	No of obs	361	251	418	366
Gender					
	Male	37.6	36.8	39.5	35.6
	Female	62.4	63.2	60.5	64.4
	No of obs	361	252	418	366
Region					
	West	84	86.3	84.5	87.1
	East	16	13.7	15.5	12.9
	No of obs	361	252	418	366
Family Status					
	Single Widowed Separated	42	41.3	41.9	39.9
	Married Living with Partner	58	58.7	58.1	60.1
	No of obs	361	250	417	364

Table A6: Shares by sex and formal education using original weights: new participants subsample

		BOP-HH		CES-ECB		GfK		Pop.
		Dec21	Dec22	Dec21	Dec22	Dec21	Dec22	
Gender								
Male		42.7	51.7	45.8	46.3	50.2	50.2	50.0
Female		57.3	48.3	54.2	53.7	49.8	49.8	50.0
No. of obs		389	329	128	156	2007	2013	
Education Level								
Up to lower secondary education		7.9	26.1	10.5	12.2	6.6	5.4	6.0
Higher secondary education		63.0	48.6	50.1	46.8	50.1	51.7	51.0
Higher education		29.2	25.4	39.5	41.0	43.3	42.8	43.0
No. of obs		389	329	128	156	2007	2013	

Table A7: Inflation perceptions: t-tests of equal means

Panel a	Wave	Tenure=All			Tenure=1			P-Value
		Original	Weights		Original	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	446	4.41	1.62	350	4.41	1.65	0.979
CES-ECB	24	2771	3.88	2.90	121	5.67	4.78	0.000***
GfK	24	1,172	5.26	1.70	1,172	5.26	1.70	1.000
BOP-HH	36	4,206	9.13	1.68	300	9.55	2.63	0.000***
CES-ECB	36	2,852	7.93	6.52	145	12.23	11.14	0.000***
GfK	36	1,340	10.94	2.89	1,340	10.94	2.89	1.000

Panel b	Wave	Tenure=All			Tenure=1			P-Value
		Original	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	446	4.41	1.62	350	4.46	1.56	0.670
CES-ECB	24	2771	3.88	2.90				
GfK	24	1,172	5.26	1.70	1,172	5.26	1.67	0.962
BOP-HH	36	4,206	9.13	1.68	300	9.67	3.04	0.000***
CES-ECB	36	2,852	7.93	6.52	145	12.10	10.14	0.000***
GfK	36	1,340	10.94	2.89	1,340	10.90	2.85	0.775

Panel c	Wave	Tenure=1			Tenure=1			P-Value
		Original	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	350	4.41	1.65	350	4.46	1.56	0.708
CES-ECB	24	121	5.67	4.78				
GfK	24	1,172	5.26	1.70	1172	5.26	1.67	0.962
BOP-HH	36	300	9.55	2.63	300	9.67	3.04	0.632
CES-ECB	36	145	12.23	11.14	145	12.10	10.14	0.916
GfK	36	1,340	10.94	2.89	1340	10.90	2.85	0.775

Panel d	Wave	Tenure=1			Tenure=1			P-Value
		Ase	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH vs GfK	24	350	4.46	1.56	1340	10.90	2.85	0.000***
BOP-HH vs CES-ECB	24	350	4.46	1.56				
CES-ECB vs GfK	24				1340	10.90	2.85	
BOP-HH vs GfK	36	300	9.67	3.04	1340	10.90	2.85	0.000***
BOP-HH vs CES-ECB	36	300	9.67	3.04	145	12.10	10.14	0.000***
CES-ECB vs GfK	36	145	12.10	10.14	1340	10.90	2.85	0.001***

Note: For each row, we use a t-test to determine whether the mean in column 4 is significantly different from the mean in column 7. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table A8: Inflation expectations: t-tests of equal means

Part a	Wave	Tenure=All			Tenure=1			P-Value
		Original	Weights		Original	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	3075	4.81	1.85	350	4.78	1.96	0.767
CES-ECB	24	2753	3.22	2.77	119	4.54	4.01	0.000***
GfK	24	1,063	5.24	2.40	1,063	5.24	2.40	1.000
BOP-HH	36	4,262	8.12	3.69	299	8.04	5.42	0.735
CES-ECB	36	2,825	5.20	4.81	142	6.60	6.04	0.001***
GfK	36	1,168	11.22	5.71	1,168	11.22	5.71	1.000

Panel b	Wave	Tenure=All			Tenure=1			P-Value
		Original	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	3075	4.81	1.85	350	4.56	1.85	0.019*
CES-ECB	24	2753	3.22	2.77				
GfK	24	1063	5.24	2.40	1,063	5.25	2.38	0.949
BOP-HH	36	4262	8.12	3.69	299	7.75	4.72	0.098
CES-ECB	36	2825	5.20	4.81	142	6.59	5.53	0.001***
GfK	36	1168	11.22	5.71	1,168	11.17	5.54	0.808

Panel c	Wave	Tenure=1			Tenure=1			P-Value
		Original	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH	24	350	4.78	1.96	350	4.56	1.85	0.139
CES-ECB	24	119	4.54	4.01				
GfK	24	1063	5.24	2.40	1063	5.25	2.38	0.949
BOP-HH	36	299	8.04	5.42	299	7.75	4.72	0.478
CES-ECB	36	142	6.60	6.04	142	6.59	5.53	0.988
GfK	36	1168	11.22	5.71	1168	11.17	5.54	0.808

Panel d	Wave	Tenure=1			Tenure=1			P-Value
		Ase	Weights		Ase	Weights		
		N	Mean	Std.	N	Mean	Std.	
BOP-HH vs GfK	24	350	4.56	1.85	1063	5.25	2.38	0.000***
BOP-HH vs CES-ECB	24	350	4.56	1.85				
CES-ECB vs GfK	24				1063	5.25	2.38	
BOP-HH vs GfK	36	299	7.75	4.72	1168	11.17	5.54	0.000***
BOP-HH vs CES-ECB	36	299	7.75	4.72	142	6.59	5.53	0.023*
CES-ECB vs GfK	36	142	6.59	5.53	1168	11.17	5.54	0.000***

Note: For each row, we use a t-test to determine whether the mean in column 4 is significantly different from the mean in column 7. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table A9: Inflation perceptions: F-tests of equal variance

Panel a	Wave	Tenure=All			Tenure=1			Critical Values		
		Original Weights		Std.	Original Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	N		N	N				
BOP-HH	24	446	1.62		350	1.65		1.04	1.18	1.26 1.36
CES-ECB	24	2771	2.90		121	4.78		2.72***	1.23	1.33 1.46
GfK	24	1172	1.70		1172	1.70		1.00	1.10	1.15 1.20
BOP-HH	36	4206	1.68		300	2.63		2.45***	1.14	1.21 1.28
CES-ECB	36	2852	6.52		145	11.14		2.92***	1.21	1.30 1.42
GfK	36	1340	2.85		1340	2.89		1.00	1.09	1.14 1.18
Panel b	Wave	Tenure=All			Tenure=1			Critical Values		
		Original Weights		Std.	Ase Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	N		N	N				
BOP-HH	24	446	1.62		350	1.56		0.93	1.18	1.26 1.36
CES-ECB	24	2771	2.90							
GfK	24	1172	1.70		1172	1.67		0.97	1.10	1.15 1.20
BOP-HH	36	4206	1.68		300	3.04		3.26***	1.14	1.21 1.28
CES-ECB	36	2852	6.52		145	10.14		2.42***	1.21	1.30 1.42
GfK	36	1340	2.85		1340	2.85		0.98	1.09	1.14 1.18
Panel c	Wave	Tenure=1			Tenure=1			Critical Values		
		Original Weights		Std.	Ase Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	N		N	N				
BOP-HH	24	350	1.65		350	1.56		1.12	1.23	1.32 1.42
CES-ECB	24	121	4.78							
GfK	24	1172	1.70		1172	1.67		1.03	1.12	1.16 1.21
BOP-HH	36	300	2.63		300	3.04		0.75	1.25	1.35 1.47
CES-ECB	36	145	11.14		145	10.14		1.21	1.39	1.54 1.74
GfK	36	1340	2.89		1340	2.85		1.02	1.11	1.15 1.20

Note: For each row, we use an F-test to determine whether the larger standard deviation (in column 4 or 6) is significantly greater than the smaller one. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table A10: Inflation expectations: F-tests of equal variance

Panel a	Wave	Tenure=All			Tenure=1			Critical Values		
		Original Weights		N	Original Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	Std.		N	Std.				
BOP-HH	24	3075	1.85	350	1.96			1.12	1.14	1.20 1.27
CES-ECB	24	2753	2.77	119	4.01			2.10***	1.23	1.34 1.47
GfK	24	1063	2.40	1063	2.40			1.00	1.11	1.15 1.21
BOP-HH	36	4263	3.69	299	5.42			2.16***	1.14	1.21 1.28
CES-ECB	36	2825	4.81	142	6.04			1.57***	1.21	1.31 1.42
GfK	36	1168	5.54	1168	5.71			1.00	1.10	1.15 1.20
Panel b	Wave	Tenure=All			Tenure=1			Critical Values		
		Original Weights		N	Ase Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	Std.		N	Std.				
BOP-HH	24	3075	1.85	350	1.85			1.00	1.14	1.20 1.27
CES-ECB	24	2753	2.77							
GfK	24	1063	2.40	1063	2.38			0.98	1.11	1.15 1.21
BOP-HH	36	4263	3.69	299	4.72			1.64***	1.14	1.21 1.28
CES-ECB	36	2825	4.81	142	5.53			1.32**	1.21	1.31 1.42
GfK	36	1168	5.54	1168	5.54			0.94	1.10	1.15 1.20
Panel c	Wave	Tenure=1			Tenure=1			Critical Values		
		Original Weights		N	Ase Weights		Std.	F-statistics	at 5%	at 1% at 0.1%
		N	Std.		N	Std.				
BOP-HH	24	350	1.96	350	1.85			1.12	1.23	1.32 1.42
CES-ECB	24	119	4.01							
GfK	24	1063	2.40	1063	2.38			1.02	1.13	1.17 1.22
BOP-HH	36	299	5.42	299	4.72			1.32*	1.26	1.35 1.47
CES-ECB	36	142	6.04	142	5.53			1.19	1.39	1.55 1.75
GfK	36	1168	5.71	1168	5.54			1.06	1.12	1.16 1.21

Note: For each row, we use an F-test to determine whether the larger standard deviation (in column 4 or 6) is significantly greater than the smaller one. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table A11: Inflation perceptions: F-tests of equal variance (subsample of new survey participants)

Panel d	Wave	Tenure=1		Tenure=1		F- statistics	Critical Values		
		<i>As</i> N	<i>e</i> Std.	<i>As</i> N	<i>e</i> Std.		at 5%	at 1%	at 0.1%
BOP-HH vs GfK	24	350	1.56	1172	1.67	1.15	1.16	1.23	1.32
BOP-HH vs CES-ECB	24	350	1.56						
CES-ECB vs GfK	24			1172	1.67				
BOP-HH vs GfK	36	300	3.04	1340	2.85	1.13	1.16	1.23	1.31
BOP-HH vs CES-ECB	36	300	3.04	145	10.14	11.16***	1.26	1.39	1.54
CES-ECB vs GfK	36	145	10.14	1340	2.85	12.64***	1.22	1.32	1.44

Note: For each row, we use an F-test to determine whether the larger standard deviation (in column 4 or 6) is significantly greater than the smaller one. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table A12: Inflation expectations: F-tests of equal variance (subsample of new survey participants)

Panel d	Wave	Tenure=1		Tenure=1		F-statistics	Critical Values		
		<i>As</i>	<i>Se</i>	<i>As</i>	<i>Se</i>		at 5%	at 1%	at 0.1%
		N	Std.	N	Std.				
BOP-HH vs GfK	24	350	1.85	1063	2.38	1.66***	1.16	1.23	1.32
BOP-HH vs CES-ECB	24	350	1.85						
CES-ECB vs GfK	24			1063	2.38				
BOP-HH vs GfK	36	299	4.72	1168	5.54	1.38***	1.17	1.25	1.34
BOP-HH vs CES-ECB	36	299	4.72	142	5.53	1.37*	1.26	1.39	1.54
CES-ECB vs GfK	36	142	5.53	1168	5.54	1.00	1.24	1.36	1.52

Note: For each row, we use an F-test to determine whether the larger standard deviation (in column 4 or 6) is significantly greater than the smaller one. * $p < .05$, ** $p < .01$, *** $p < .001$.