Inflation illiteracy – a micro-data analysis

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Using micro-level survey data from the National Institute of Economic Research's *Economic Tendency Survey*, we find that a relatively large share of Swedish households is ill-informed about the rate of inflation in the economy, with perceived and expected rates of inflation deviating substantially from official measures. Probit analysis of the data indicates that such inflation illiteracy is related to respondent characteristics, including income, education and sex. Finally, we show that the treatment of extreme-value answers has a substantial effect on the aggregated time series typically reported and discussed.

1 Introduction

Surveys of households' perceptions and expectations concerning the macroeconomy, financial matters, and their own economic situation provide important information to both analysts and policymakers. However, survey responses to macroeconomic questions tend to show a fair amount of heterogeneity across respondents. One explanation for this heterogeneity is varying degrees of economic and financial literacy – a feature that has been broadly established in the literature; see, for example, Calvet et al. (2009), Duca and Kumar (2014), Lusardi and Mitchell (2014), Lipshits et al. (2019), and Rumler and Valderrama (2020). Since the degree of economic and financial literacy can also affect households' behaviour, for example with respect to consumption and investment, it has the potential to matter for economic policy; understanding heterogeneity with respect to this issue is accordingly important.[1]

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[1] Heterogeneity in expectations can matter for economic policy as pointed out by, for example, Hommes et al. (2018) and Andrade et al. (2019).

In this article, we study the economic literacy of Swedish households. Data are collected from Sweden's largest household survey – the *Economic Tendency Survey* of the National Institute of Economic Research (NIER). The survey contains two key variables of interest: 1) the perceived present rate of inflation and 2) the expected rate of inflation one year from now. Using micro-level data from the survey, we find that a substantial share of respondents gives what can be termed "ill-informed" answers – that is, answers that substantially deviate from the official measure of inflation. We denote these respondents as being *inflation illiterate*. Using probit models, we show that the inflation illiteracy relates to key characteristics of the respondents.

In conducting this analysis, we provide further empirical evidence on the issue of heterogeneity among households when it comes to their perceptions and expectations concerning the macroeconomy. Heterogeneity in expectations concerning inflation, interest rates and housing prices has been established by, for example, Bryan and Venkatu (2001a, 2001b), Vissing-Jorgensen (2003), Windsor et al. (2015), Malmendier and Nagel (2016), Ehrmann et al. (2017), and Hjalmarsson and Österholm (2019, 2020, 2021). However, unlike the previous literature, we have in this article an explicit focus on households that are ill-informed about the state of the macroeconomy. New information – regarding both the size of this group and its characteristics – is accordingly provided.

The remainder of the article is organized as follows: In Section 2, we describe the data on perceived inflation and inflation expectations. We present the econometric framework employed and our empirical results in Section 3. Finally, Section 4 provides a discussion regarding the implications of our findings and concludes.

2 Data and descriptive statistics regarding perceived and expected inflation

We employ data from the NIER's *Economic Tendency Survey*. Approximately 1,500 randomly chosen households participate in the survey each month. They answer questions that relate to both their own economic situation and the aggregate Swedish economy. In addition, some of the respondent's personal characteristics – such as income, sex and age – are also recorded in the survey. Answers are collected through telephone interviews and an online questionnaire. The survey was initiated in 1978 and has undergone several revisions since then.[2,3]

The analysis in this article concerns the households' perceived and expected rates of inflation. In the survey, these two questions are phrased as below:[4]

[2] For more information about the survey, see NIER (2022b).

[3] Micro data from the survey have previously been used by, for example, Jonung (1981), Jonung and Laidler (1988), Palmqvist and Strömberg (2004), and Hjalmarsson and Österholm (2019, 2020, 2021) to study various aspects of Swedish households' expectations formation.

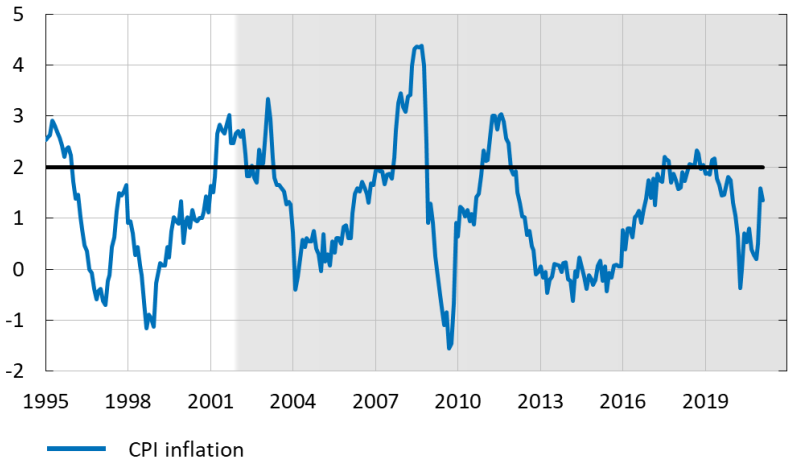
[4] This is the English translation of the questions as presented in NIER (2022b). The actual survey is conducted in Swedish and the original phrasing of the questions can be found in NIER (2022a).

- *Compared with 12 months ago, how much higher in per cent do you think that prices are now?*
- *Compared with today, how much in per cent do you think that prices will go up (i.e. the rate of inflation 12 months from now)?*

Our sample covers the period from January 2002 to February 2021, which is a period characterized by low and stable inflation following the introduction of the inflation target of two per cent in 1995 (see Figure 1). During this period, inflation, measured by the consumer price index, varied between −1.6 and 4.4 per cent; the average was 1.3 per cent.

Figure 1. CPI inflation

Per cent



Note: Shaded area indicates the sample period for which we have micro data on inflation expectations. The horizontal line represents the Riksbank's inflation target of 2 per cent.[5]

Source: Macrobond.

Most responses to the questions regarding the perceived and expected rates of inflation fall within a range that might be considered reasonable given the historical variation of actual inflation. However, a non-negligible share of the respondents provides an answer of −5 per cent or less, or 10 per cent or more.[6] As Figure 2 illustrates, approximately ten per cent – sometimes as much as twenty per cent – of all households in the survey provide an answer to the two inflation questions outside the −5 to 10 per cent interval.[7] As these responses deviate substantially from the official measure of inflation, we define these respondents as being inflation illiterate. The two cut-off points employed can of course be discussed. An answer of 10 per cent (or more) is obviously not unreasonable in the wake of the dramatic increase in inflation that we have seen during the second half of 2021 and 2022, where, for

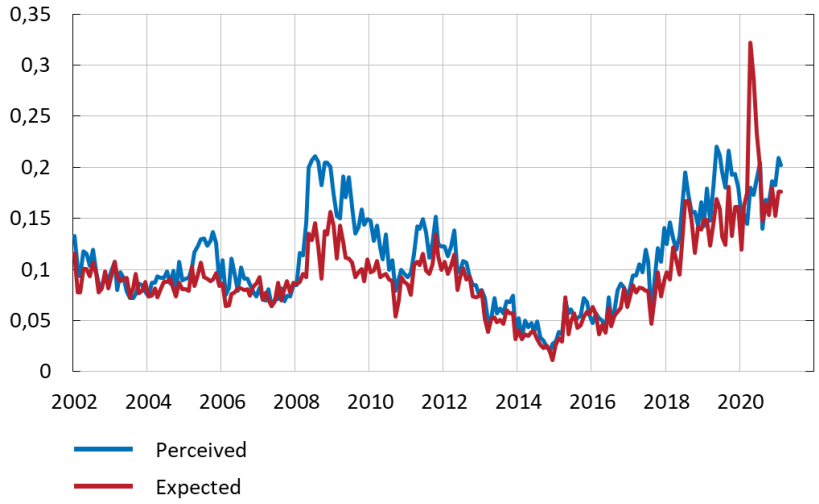
[5] It can be noted that since September 2017, the Riksbank's inflation target is expressed in terms of CPIF inflation. Before then, the target was expressed in terms of CPI inflation. The target level has always been two per cent though.

[6] Pooling all observations in our sample, the correlation between respondents' answers to the two questions is 0.52.

[7] These shares are calculated as the number of respondents who are inflation illiterate divided by the number of respondents who provided an answer to that specific question.

example, CPI inflation in Sweden reached 10.8 per cent in September 2022. However, we believe that the cut-off points are appropriate given the stable economic environment of the sample.[8]

Figure 2. Share of respondents that gives the answer ≤-5 per cent or ≥10 per cent



Source: Authors' own calculations.

In order to provide some more information concerning the distribution of the answers, Figures 3 and 4 show time series of the mean, the 10th percentile, the median and the 90th percentile for perceived and expected inflation respectively. Noteworthy is the fact that for both variables, the 10th percentile is almost always given by the number 0. In addition, 0 is also often the median for perceived inflation, pointing to a very large share of the respondents choosing this answer. There also appears to be clustering of answers at 5 and 10, indicated by the fact that P90 for both variables often is given by one of these two numbers.[9] The cluster of answers on certain numbers can also be illustrated using histograms; pooling data across all surveys, this is done in Figures 5 and 6. These figures show that most of the ill-informed responses fall within the range of 10 to 20 per cent; only a very small fraction is less than −5 per cent. Two per cent of all responses indicate an inflation rate of 20 per cent or more, with the highest response being 300 per cent (truncated from the figure).[10]

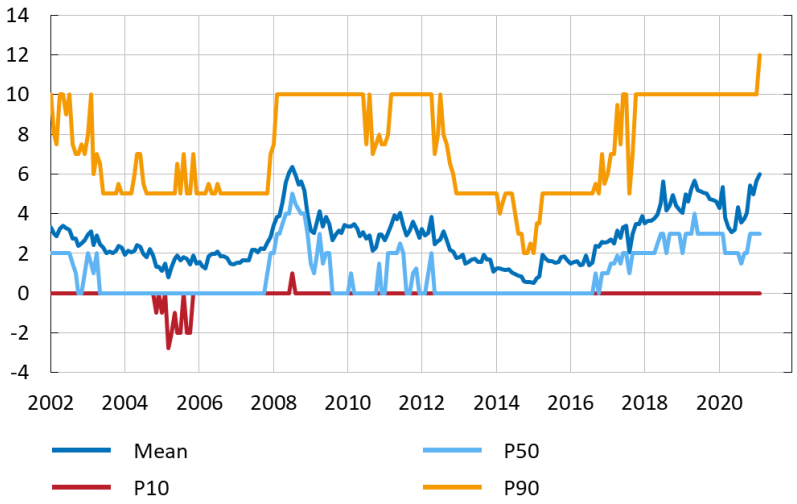
[8] The definition of "reasonable" is after all dependent on the environment that the respondent encounters. For example, consider the task of predicting the temperature tomorrow in Stockholm. The answer "−10 degrees Celsius" might be highly reasonable in January. However, a respondent giving such an answer in July is clearly not well-informed.

[9] The tendency of respondents in a survey to prefer "round" numbers – possibly as a sign of uncertainty – has been pointed out by, for example, Kleinjans and van Soest (2014) and Binder (2017).

[10] Extreme answers could be a matter of a respondent not taking the survey seriously (or wanting to "protest") rather than inflation illiteracy. However, we cannot distinguish between these cases and therefore treat all answers that are −5 per cent or less, or 10 per cent or more as a sign of illiteracy as it seems likely that respondents in general answer the survey with good intent.

Figure 3. Mean and selected percentiles over time – perceived inflation

Per cent

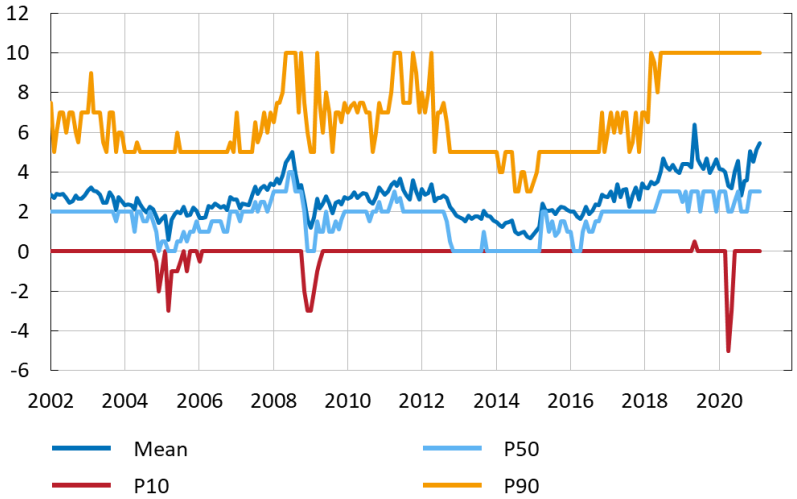


Note: P10 is the 10th percentile. P50 is the median. P90 is the 90th percentile.

Source: Authors' own calculations.

Figure 4. Mean and selected percentiles over time – expected inflation

Per cent

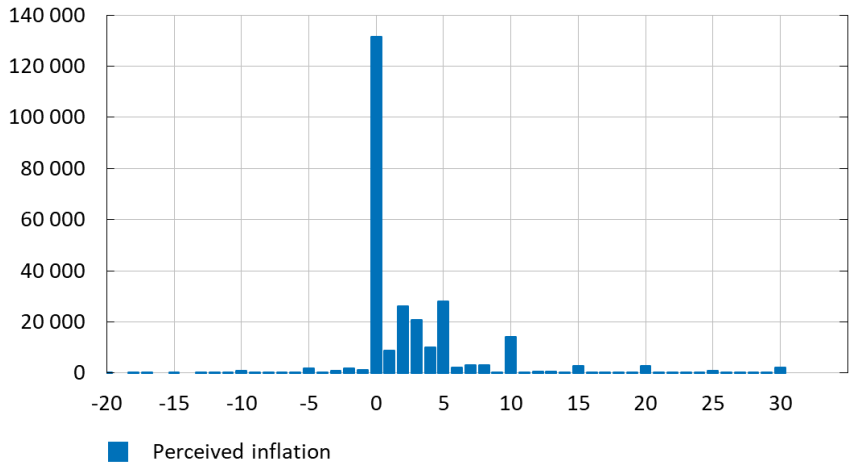


Note: P10 is the 10th percentile. P50 is the median. P90 is the 90th percentile.

Source: Authors' own calculations.

Figure 5. Distribution of answers for perceived present rate of inflation

Frequency on vertical axis. Per cent on horizontal axis.

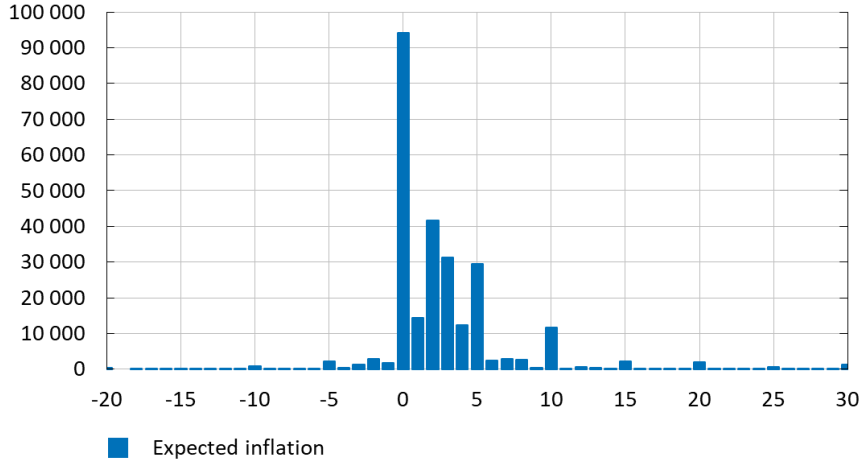


Note: Answers pooled across all surveys. Answers above 30% and below −20% are counted as equal to 30% and -20%, respectively, when creating the figure.

Source: Authors' own calculations

Figure 6. Distribution of answers for expected rate of inflation

Frequency on vertical axis. Per cent on horizontal axis.



Note: Answers pooled across all surveys. Answers above 30% and below −20% are counted as equal to 30% and -20%, respectively, when creating the figure.

Source: Authors' own calculations

3 Econometric analysis and results

To explore whether inflation illiteracy is related to the characteristics of the respondents, we generate two binary variables: y_t^p, which relates to perceived inflation, and y_t^e, which relates to inflation expectations. y_t^p takes on the value one if the respondent states that perceived inflation is *a)* −5 per cent or lower or *b)* 10 per cent or higher; for values of perceived inflation between −5 and 10, y_t^p takes on the value 0. y_t^e is generated according to the same principle – that is, it takes on the value

0 for values of expected inflation between −5 per cent and 10 per cent (and 1 otherwise). These variables constitute the dependent variables in the two probit models that we estimate. Explanatory variables in these regressions are dummy variables, which reflect different respondent characteristics; these have been created following Hjalmarsson and Österholm (2019). We present the explanatory variables in Table 1, where we also indicate which category has been excluded for each set of dummy variables. Also included in the estimations are time dummies to control for business cycle variations. Since not all respondents provide an answer to all questions regarding characteristics, the samples which we use for estimation of our models are smaller than those used to calculate the shares in Figure 2. Pooling the observations from all monthly surveys, we estimate probit models with y_t^p and y_t^e as dependent variables, respectively.

The regression results are shown in Table 2. To make them easily interpretable, we present them as average marginal effects. Thus, since all variables in the regression are dummy variables, each estimate can be interpreted as the average change in probability of an "illiterate" response when the corresponding variable changes from zero to one. For instance, looking at perceived present inflation, a low-income respondent is 5.5 percentage points more likely to exhibit illiteracy than a high-income respondent (the omitted category). The corresponding effect for expected inflation is 5.1 percentage points.

Overall, the results show that the estimated effects are mostly similar for perceived and expected inflation. Inflation illiteracy is strongly related to many of the characteristics of the respondents. In particular – and in line with the general results from the literature on economic and financial literacy – households with lower levels of income and education are more likely to provide an ill-informed answer; see, for example, Calvet et al. (2009) and Campbell et al. (2011).[11] Lower income or education each increases the probability of inflation illiteracy by about 4 to 5 percentage points. Other socioeconomic characteristics are also found to be significant, but the estimated effects are often relatively small.

Sex and age also tend to be significant explanatory variables, although the age effect is considerably weaker for perceived inflation. Women and younger households are more likely to be inflation illiterate, with marginal effects of around 3 percentage points for expected inflation.

[11] Households that have chosen not to state their income ("missing income" category) also have a higher probability. As pointed out by Hjalmarsson and Österholm (2020), these individuals tend to have lower education and are more likely not to be employed, compared to the respondents who state their income.

Table 1. Respondent characteristics

Variable	Division in survey	Regression label
Income	First quartile Second quartile Third quartile Fourth quartile	LOW_INCOME MED_LOW_INCOME MED_HIGH_INCOME *Excluded category* MISSING_INCOME
Education	Basic Upper secondary Tertiary	LOW_EDUCATION MED_EDUCATION *Excluded category*
Sex	Female Male	FEMALE *Excluded category*
Employment	Not employed Employed	NOT_EMPLOYED *Excluded category*
Age	16-24 25-34 35-49 50-64 65-	LOW_AGE MED_LOW_AGE MED_AGE MED_HIGH_AGE *Excluded category*
Type of housing	Owned apartment Owned house Rental apartment Other	*Combined to* OWN_HOUSE_APT *Combined to* OWN_HOUSE_APT *Combined to excluded category* *Combined to excluded category*
Family	Single without children Single with children Married/cohabiting with children Other Married/cohabiting without children	HH_SINGLE HH_SINGLE_CHILD HH_MARRIED_CHILD HH_OTHER *Excluded category*
Region	Big city county Forest county Other	BIG_CITY *Excluded category* LOCATION_OTHER

Note: The category “MISSING_INCOME” consists of the individuals who did not respond to the question regarding income.

Table 2. Results from probit regressions – average marginal effects

	Dependent variable: Perceived present inflation	Dependent variable: Expected inflation one year from now
MISSING_INCOME	0.046*** (0.002)	0.047*** (0.002)
LOW_INCOME	0.055*** (0.003)	0.051*** (0.002)
MED_LOW_INCOME	0.046*** (0.002)	0.043*** (0.002)
MED_HIGH_INCOME	0.024*** (0.002)	0.023*** (0.002)
LOW_EDUCATION	0.041*** (0.002)	0.043*** (0.002)
MED_EDUCATION	0.039*** (0.001)	0.037*** (0.001)
FEMALE	0.029*** (0.001)	0.031*** (0.001)
NOT_EMPLOYED	0.012*** (0.002)	0.006*** (0.001)
LOW_AGE	0.012*** (0.003)	0.035*** (0.003)
MED_LOW_AGE	0.003 (0.003)	0.021*** (0.002)
MED_AGE	0.007*** (0.003)	0.019*** (0.002)
MED_HIGH_AGE	0.008*** (0.002)	0.017*** (0.002)
OWN_HOUSE_APT	-0.017*** (0.002)	-0.018*** (0.001)
HH_SINGLE	-0.013*** (0.002)	-0.012*** (0.002)
HH_SINGLE_CHILD	0.023*** (0.003)	0.018*** (0.003)
HH_MARRIED_CHILD	0.017*** (0.002)	0.012*** (0.002)
HH_OTHER	0.015*** (0.002)	0.013*** (0.002)
BIG_CITY	0.006*** (0.002)	0.003** (0.002)
LOCATION_OTHER	0.002 (0.002)	0.001 (0.002)
Number of observations	264,725	260,903

Note: Average marginal effects are presented. Standard errors are clustered on time and given in parentheses (). ***, ** and * indicate significance at the 1, 5 and 10 per cent levels respectively. Time dummies are included in both regressions.

4 Implications and conclusion

The data from the NIER's *Economic Tendency Survey* clearly suggest that a large share of the respondents is what can be defined as inflation illiterate. We find that inflation illiteracy is robustly related to several characteristics of the respondents, including education, income and sex.

Since the level of education matters, our results indicate that the degree of understanding of economic concepts is relevant for inflation illiteracy. However, since sex and age are also significant explanatory variables, other channels are also likely to be part of the story. Differences in experiences, consumption baskets, willingness to collect and process information, or time available for processing information may all be of relevance when explaining this heterogeneity, in line with suggestions by, for example, Jonung (1981), Malmendier and Nagel (2016) and Cavallo et al. (2017).

Establishing the presence of inflation illiteracy and how this property is related to respondent characteristics are important issues of general interest. In addition, we want to highlight two practical implications from our analysis.

First, the fact that a considerable share of Swedish households might be inflation illiterate should be relevant both when modelling the economy and conducting economic policy since it is not unlikely that these households take poorly founded economic decisions.

Second, when it comes to household surveys, extreme-value answers risk influencing aggregated time series (such as the mean inflation expectation) in an unwanted way and could mislead policy makers who analyse them. Household surveys should therefore be adjusted for outliers using a reliable method before aggregated time series are calculated.

The NIER does have a procedure for outlier adjustment, in which observations that are judged as outliers according to an algorithm based on the quartiles of the data are removed.[12] Together with a level adjustment of parts of the time series, the outlier-adjusted data are then used to calculate the official time series for perceived and expected inflation that the NIER publishes in the *Economic Tendency Survey*;[13] these series are shown in Figures 7 and 8, where they are denoted "NIER, official".[14]

[12] More specifically, outliers are treated as follows in a given cross section. The first (Q1) and third (Q3) quartiles of the responses are calculated, as well as the inter-quartile range, QR=Q3−Q1. Responses greater than Q3+3QR or smaller than Q1−3QR are omitted. See National Institute of Economic Research (2022a, p 15) for details.

[13] The method for gathering the data of the *Economic Tendency Survey* was changed in November 2019. Historically, the survey used to be conducted purely by telephone but nowadays some respondents give their answers on the telephone whereas others do it through an online form. Between October 2019 and January 2020, the two methods were used in parallel and could accordingly be compared. The differences observed during this period are used to adjust historical data to make them more comparable to those gathered by the present method; see National Institute of Economic Research (2020) for details. For perceived and expected inflation, this means that the historical (that is, prior to November 2019) cross-sectional means are shifted up by 1.65 and 0.67 percentage points respectively.

[14] An EU harmonisation of the survey meant that the questions concerning inflation in the *Economic Tendency Survey* were changed in April 2015. At the same time, the NIER also changed its method for

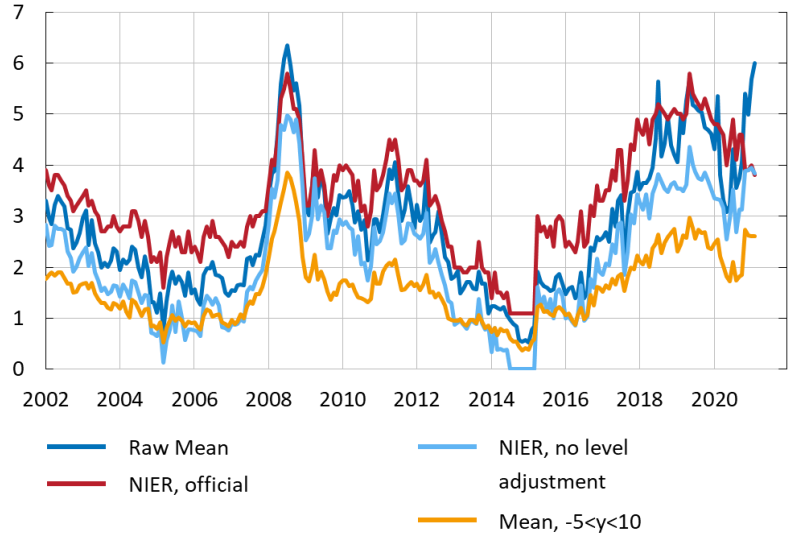
However, aggregated time series may differ substantially depending on the choice of methodology when it comes to outlier adjustment. We illustrate this in Figures 7 and 8 by showing different measures of perceived and expected inflation, using various ways of controlling for outliers. The "raw mean" series are simply the cross-sectional averages across all respondents that provide an answer to the survey question and thus provide the unadjusted aggregate benchmark. The "NIER, no level adjustment" series represent our calculations of what the aggregated series looks like after following NIER's documentation on how outliers are controlled for but where no level adjustment is made. Finally, the series "mean, –5<y<10" are cross-sectional means taken after having removed all responses that we classify as inflation illiterate. It should be noted that removing observations based on our illiteracy measure is not a method that we suggest should be implemented in practice; while we believe that it is a reasonable definition for the sample in question, it is too rigid to be used in general. This is exemplified by the simple fact that we pointed out above: Under present conditions – with very high actual inflation numbers – stating that perceived and/or expected inflation is 10 per cent (or more) is obviously not unreasonable. Using the illiteracy measure as a criterion for removing observations serves here only as an illustration.

Two observations are immediately evident from studying Figures 7 and 8: 1) adjusting for outliers can have a substantial effect on the aggregate numbers and 2) different approaches may lead to quite different time series. In most periods, the removal of observations based on our illiteracy classification results in the largest effect, and often reduces the aggregate measures by a full percentage point or more. The NIER's official series and our own proxy differ markedly, but they both show that the NIER's method generates a less aggressive adjustment to the raw mean than when observations are removed based on our illiteracy measure. This shows that the choice of outlier control mechanism can have first-order effects when creating aggregated means.

calculating perceived and expected inflation; see National Institute of Economic Research (2022b) for details. The time series using this new method begin in April 2015. "NIER, official" is therefore given by the time series which the NIER denotes as based on the "old method" between January 2002 and March 2015, and the time series using the present method between April 2015 and February 2021.

Figure 7. Perceived inflation

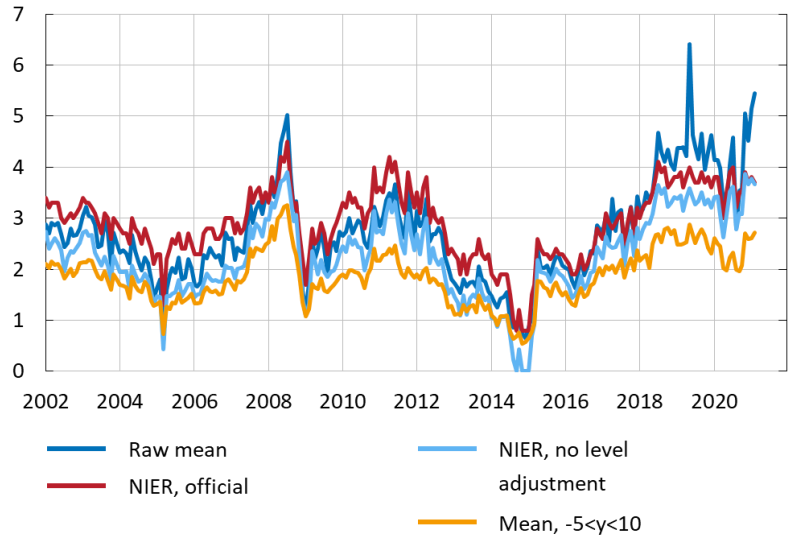
Per cent



Source: National Institute of Economic Research and authors' own calculations.

Figure 8. Expected inflation

Per cent



Source: National Institute of Economic Research and authors' own calculations.

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