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Inflation Expectations, Inflation Target Credibility and the COVID-19 Pandemic: New Evidence from Germany

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Using the exact wording of the ECB's definition of price-stability, we started a representative online survey of German citizens in January 2019 that is designed to measure long-term inflation expectations and the credibility of the inflation target. Our results indicate that credibility has decreased in our sample period, particularly in the course of the deep recession implied by the COVID-19 pandemic. Interestingly, even though inflation rates in Germany have been clearly below 2% for several years, credibility has declined mainly because Germans increasingly expect that inflation will be much higher than 2% over the medium term. We investigate how inflation expectations and the impact of the pandemic depend on personal characteristics including age, gender, education, income, and political attitude.

Keywords: Credibility of Inflation Targets, Household Inflation Expectations, Expectation Formation, Online Surveys, Covid-19 Pandemic

JEL classification: E31, E52, E58,

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1 Introduction

An increasing number of central banks has published quantitative definitions of price-stability to improve the communication and accountability of monetary policy. Since 2004, the European Central Bank (ECB) has repeatedly emphasized that in the pursuit of price stability it aims to maintain inflation rates *below, but close to, 2% over the medium term*. This definition of price stability plays a central role in the communication strategy of the ECB. Even during the Covid-19 pandemic, monetary policy measures of the ECB have been explained to the public by the ultimate goal of steering too low inflation rates in the Euro area back to the below, but close to, 2% level.[1] Yet, the impact of the pandemic on inflation expectations seems to be at odds with standard economic theory. In the U.S., for example, inflation expectations of consumers significantly *increased* at a time when the economy was headed to the largest recession in recent history, see e.g. Dietrich et al. (2020).[2]The aim of our paper is to provide new evidence on the impact of the pandemic on consumer inflation expectations in Germany and, thereby, on the credibility of the ECB's inflation target.

Direct evidence on the credibility of inflation targets is surprisingly scant.[3] The bulk of the empirical literature evaluates a central bank's credibility indirectly via the anchoring of inflation expectations. Since a credible inflation target should anchor long-term inflation expectations, the standard anchoring criterion is that inflation expectations should not respond to economic news, forecast errors or shocks that are unrelated to the inflation target. Following Gürkaynak et al. (2005), it has been widely investigated whether and how expected inflation responds to surprises in macroeconomic news announcements.[4] While this literature provides important insights into the dynamics of inflation expectations, the an-

[1]On 08 July 2021, the ECB presented their revised strategy and defined the new inflation target more symmetrically to be "2% over the medium term".

[2]Gorodnichenko shows that inflation expectations of U.S. consumers have increased with Covid while those of professional forecasters decreased, see e.g. `https://www.suomenpankki.fi/globalassets/en/research/seminars-and-conferences/conferences-and-workshops/documents/cepr2020/gorodnichenko---bank-of-finland----sept-2020.pdf`. We thank a referee for pointing this out.

[3]Ehrmann et al. (2013), for example, analyze data of ECB trust taken from the Eurobarometer survey. Christelis et al. (2020) employ survey data provided by the Dutch National Bank to explore the influence of trust in the ECB on inflation expectations. For the United States, the *Chicago Booth Expectations and Communications Survey* suggests that almost 40% of the respondents believe that the Federal Reserve was targeting an inflation rate of 10% or more, see Coibion et al. (2019).

[4]Bauer (2015) and Nautz et al. (2017) employ news-regressions to investigate the anchoring of inflation expectations in the U.S. and the Euro area. Hachula and Nautz (2018) estimate the response of inflation expectations to macroeconomic news shocks in a structural VAR model.

choring criteria are only loosely connected to the precise definition of price stability used in monetary policy practice. For example, irrespective of their level, *constant* inflation expectations are always well-anchored under the news-criterion. As a result, the degree of central bank credibility might be overestimated in times when inflation expectations are persistently above or below the inflation target.

A further issue of the indirect approach to central bank credibility concerns the interpretation of survey-based measures of household inflation expectations. For instance, in the tradition of the Michigan Consumer Survey, the widely-used Business and Consumer Survey of the European Commission asks households how they *expect that consumer prices will develop over the next 12 months*. One of the answer categories is that prices will "stay about the same" which should imply that the expected inflation rate is zero and, thus, clearly below the policy-intended level. Consequently, Andrade et al. (2020) argue that inflation expectations are de-anchored when an important share of households expects prices to remain about the same. However, for many consumers the mapping between prices and inflation rates is not straightforward. In particular, respondents tend to react differently, depending on whether they are asked about expected changes in prices in general or about expectations for the rate of inflation, see e.g. Arioli et al. (2017). Therefore, it is far from obvious to what extent, for example, a high percentage of "prices will stay about the same"–answers actually indicates the low credibility of a non-zero inflation target.

In view of these problems, this paper introduces a representative online survey of German citizens that is *designed* to measure the credibility of the ECB's inflation target. Using the exact wording of the ECB's definition of price stability, we measure the credibility of the inflation target directly and on a daily basis from January 2019 until May 2021. Our empirical results suggest that the credibility of the ECB's inflation target has decreased significantly during this period. The largest drop in credibility can be related to the economic disturbances stirred by the outbreak of the Covid-19 pandemic. In Germany, inflation rates have been clearly below 2% for several years. Yet, in line with the evidence obtained for the U.S., we find that the credibility of the inflation target has declined mainly because Germans increasingly expect inflation to be clearly above 2% over the medium term.[5]

[5]Cavallo (2020) shows that the COVID-19 pandemic has led to changes in expenditure patterns which contributed to a significant bias in the measurement of U.S. CPI inflation. Therefore, inflation expectations of U.S. consumers might be surprisingly high during the pandemic, partly because CPI inflation underesti-

We contribute to the recent literature on the formation of expectations by re-investigating how inflation expectations evolved with respect to personal characteristics of respondents including age, gender, education, income, and political attitude. In particular, we investigate how these demographic variables influence the impact of the pandemic on inflation expectations.

The rest of our paper is structured as follows. Section 2 introduces the online survey. We define the credibility indicator and show how inflation expectations are affected by the pandemic. Section 3 shows how inflation expectations and the impact of the pandemic depend on personal characteristics of respondents. Section 4 summarizes our main results and offers concluding remarks.

2 The Online Survey

2.1 Survey Description

In order to obtain data on inflation expectations and the credibility of the ECB's inflation target, we cooperate with Civey, Germany's largest company for online surveys. Civey surveys are spread out across more than 25,000 partner websites including major German online-newspapers. The Civey panel consists of approximately one million German citizens that signed up using their email-address and created a user profile that provides further personal information including their age, gender and the respondent's postcode. Additional characteristics of respondents are gathered from other surveys they took part in. Since the launch of our credibility survey in January 2019, the total number of participants has increased steadily to approximately 100,000 respondents in May 2021.

Online surveys can be answered on mobile devices which improves the participation of people working full-time and other households that are "hard-to-reach" by traditional surveys. In practice, there are online surveys with probability and with non-probability sampling. In surveys with probability sampling, data is collected from a fixed and representative sample of, say, 5000 respondents who are repeatedly asked over certain time intervals

mates actual inflation using Covid-consumption baskets. However, as a referee pointed out, Cavallo (2020) further shows that this effect seems to be less important for Germany where Covid-adjusted inflation is even lower than CPI inflation.

to form a panel. Recent examples include the monthly online surveys on consumer expectations introduced by the Federal Reserve Bank and the ECB. These comprehensive and highly elaborate surveys are very useful for investigating how the answer of a specific individual changes over time and for performing controlled experiments, see e.g. Armantier et al. (2016) and Coibion et al. (2019). On the downside, however, surveys with probability sampling are rather expensive and inflexible.

Civey offers the second type of online surveys where the data is collected through non-probability sampling. Online surveys based on non-probability sampling are becoming increasingly popular for market research, election polls and also for economic research, see e.g. Binder (2020). In these surveys, the attention is not restricted to a pre-selected, relatively small sample. In our application, each member of the large Civey panel is allowed to participate. However, in order to avoid self-selection bias e.g., a response given to our survey on a news article about inflation would not enter the sample.[6]

Online surveys with non-probability sampling are easily implemented and can be evaluated at short notice and without any delay. This flexibility could be of particular interest for a central bank monitoring vigilantly how certain news or policy announcements have affected the credibility of its inflation target. Regardless of the important advantages of the monthly surveys run by central banks, our daily survey does not impose that the impatient researcher has to wait up to one month until the next survey is published. Survey participants obtain aggregate results after they have responded. Therefore, near-term second answers are not allowed to rule out that participants adjust their answer in response to the published survey results. In practice, Civey imposes the restriction that respondents can answer the same question a second time only if several months have passed. In fact, the number of respondents that entered our survey twice is negligible.

The use of non-probability online surveys is a convenient way to enlarge the sample but it also implies that size and composition of the sample change on a daily basis. The statistical procedures to achieve representative results are standard. In particular, Civey exploits official socio-demographic data taken from the German statistical office to weight survey responses accordingly. Without weighting, for example, male respondents aged above 50 and a high purchasing power would be clearly over-represented in our sample, see Table 3.

[6]For more technical details about the survey methodology, see Civey (2020).

The representative results, published by Civey on a daily basis, are based on at least 5000 observations. In order to fulfill this requirement, results may include responses given up to two months prior. As a consequence, a daily time series of survey results may underestimate short-run developments. Our empirical analysis of longer-term inflation expectations and the time-varying credibility of the ECB's inflation target is therefore based on tests for breaks in the long-run average of the daily survey data. However, it is important to emphasize that our main results also hold for the unadjusted daily data, see Appendix.

The representativeness and external validity of non-probability surveys are still under debate. In the following section, we compare the results of another Civey survey on short-term inflation expectations with those of a well-established, standard probability survey. The similarity of the results strongly indicate that the external validity of our survey is also very high.

2.2 External Validity

In the monthly Business and Consumer Survey of the European Commission, a representative sample of European citizens including approximately 5000 Germans, is drawn to measure short-term inflation expectations of consumers. Since 2017, Civey has conducted a corresponding survey that adopts exactly the same wording:[7]

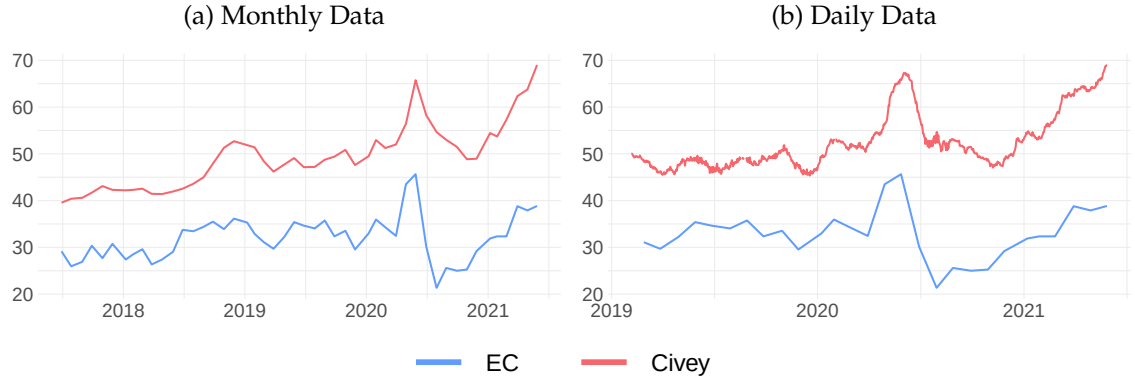
By comparison with the past 12 months, how do you expect that consumer prices will develop over the next 12 months? They will (PP) increase more rapidly; (P) increase at the same rate; (E) increase at a slower rate; (M) stay about the same; (MM) fall; (N) don't know.

The qualitative survey answers are typically summarized by the so-called expectations balance defined as $PP + 1/2P - MM - 1/2M$, see e.g. Arioli et al. (2017). The statistical procedures applied by Civey to obtain representative responses in this survey are exactly the same as in our own survey. Moreover, the composition and the size of the sample is very similar.[8] Thus, we assess the external validity of our results by comparing the expectations balance using Civey's data to the one using the data from the European Commission.

[7] The online survey can be accessed via `https://widget.civey.com/4433`. Arioli et al. (2017) provide a comprehensive analysis of the inflation expectations data provided by the Business and Consumer Survey of the European Commission.

[8] In fact, from January 2019 to May 2021 55% of the nearly 100000 participants in the short-term expectation survey also participated in our survey.

Figure 1 The Expectations Balances in Germany



Notes: Data provided by the Business and Consumer Survey of the European Commission and Civey. Figure 1a shows the expectations balances observed at the publication date of the monthly EC survey. Daily expectations balance from the Civey survey is shown in Figure 1b.

While the expectations balance is always higher in the Civey survey, the two monthly time series have been highly correlated since 2017, compare Figure 1a. Figure 1b shows that this is also true for daily expectations data from January 2019 onward. This strongly suggests that the reliability of expectations data from Civey surveys is very high. There might be a constant upward bias in the level of the expectations data. However, this bias should not affect the comparison of survey responses before and after the pandemic and is, therefore, not critical for the main results of our paper.

2.3 A Survey-Based Credibility Indicator

Surveys on household inflation expectations are often not designed to assess the credibility of a central bank's inflation target. To the best of our knowledge, our survey is the first one yet to use the exact wording of the ECB's definition of price stability and therefore allows to measure the credibility of the inflation target directly. That being said, Civey launched the following survey question in January 2019.[9]

[9]The actual survey question is stated in German and applies to the official translation used by the ECB and the Bundesbank, i.e. *unter aber nahe bei 2% in der mittleren Frist*, see `https://widget.civey.com/4417`. While the ECB's target is defined for the average euro area inflation, our survey follows e.g. the European Commission and refers to the inflation rate perceived by the consumer. However, given the weight of Germany in the euro area, the difference between euro area and German inflation is typically small. In fact, since the inflation rate for Germany is often below euro area inflation, the proportion of *A*-respondents might be even higher and, thus, the credibility indicator even lower in a survey that would explicitly refer to euro area inflation.

In what range do you think the annual inflation rate will be over the medium term? It will be ...

(A) ... clearly above 2%

(B) ... slightly above 2%

(C) ... below, but close to, 2%

(D) ... clearly below 2%

(N) Do not know

The answers C and, to a much lesser degree, B are compatible with a credible inflation target. Therefore, we propose to summarize the degree of credibility by the indicator variable $CI = C + \frac{1}{2}B$. Note that $CI = 1$ ($CI = 0$) indicates full (zero) credibility of the inflation target. Similar to the expectations balances that are widely used to evaluate qualitative inflation expectations data (see e.g. Arioli et al. (2017)), the weighting scheme of the credibility indicator is ad hoc and debatable. We also experimented with alternative indicators, partly with negative weights on answers A, D, and/or N. It is worth emphasizing that our main results do not depend on that choice.[10]

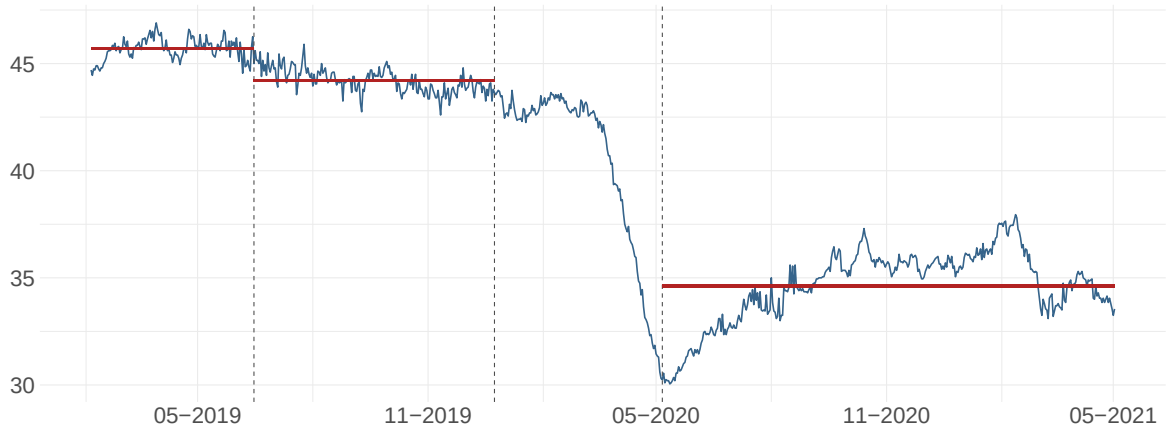
2.4 The Time-Varying Credibility of the ECB's Inflation Target

The data obtained for the credibility indicator CI are shown in Figure 2. Apparently, CI slightly decreases throughout 2019, collapses in March 2020 and stabilizes on a new but lower level in the second half of 2020. This first impression can be supported by the results of multiple endogenous break point tests, see Table 1. According to these tests, the mean of the credibility indicator CI fluctuated around 45.69 in the first half of 2019 and slightly decreased to 44.22 until the end of 2019. The reduction in credibility is much more distinct in the first half of 2020 when the pandemic started and CI reached its minimum of 30.05. Since May 2020, the indicator has stabilized around 34.62 - which is well below the credibility levels observed before the pandemic.

Longer-term inflation expectations are de-anchored, if they react to short-term inflation expectations and actual inflation rates, see e.g. Strohsal et al. (2016). In Germany, the behavior of short-term inflation expectations (see Figure 1b) and actual inflation confirms that the decline of the credibility indicator in 2019 reflects a de-anchoring of inflation expectations.

[10] For brevity, the results for alternative credibility indicators are not presented here but are available on request.

Figure 2 The Credibility Indicator



Notes: The Figure shows the daily development of the credibility indicator $CI = C + \frac{1}{2}B$ obtained for the ECB's inflation target. The vertical lines refer to the credibility regimes identified by multiple endogenous break tests. The horizontal lines show the corresponding mean value of the indicator. For more information, see Table 1.

The survey data provides further insights into the nature of the observed credibility decline. Table 1 presents the mean proportions of the five answer categories. Compared with the situation in 2019, the survey responses obtained for the most recent regime, deteriorated across all answer categories: while the proportions of all low-credibility categories (D, N and, to the largest extent, A) have increased since 2019, both credibility-categories (C, B) have decreased. Interestingly, the credibility regimes identified by the break point tests do not only differ in the mean of the credibility indicator. Compared with the first regime, the credibility indicator decreased in the second half of 2019 because both low-credibility categories, A and D, increased to a very similar extent. With the outbreak of the pandemic, however, the further decline of the indicator is mainly due to an increase in category A. Therefore, even though the German economy was in a deep recession and inflation rates have been clearly below 2% for several years, the credibility indicator has declined mainly because more people expected inflation to be *clearly above 2% over the medium term*.

This puzzling behavior of inflation expectations of German citizens confirms recent evidence obtained for the United States. Dietrich et al. (2020) for instance show that the pandemic increased U.S. consumers' inflation expectations in March 2020. In a similar vein, Binder (2020) finds that greater concern about the pandemic is associated with higher in-

flation expectations. In view of recent contributions on the formation of macroeconomic expectations, the following section further investigates the role of personal characteristics for the crisis' impact on inflation expectations.

Table 1 Survey Results

Credibility Regime	A $>> 2\%$	B $> 2\%$	C $< 2\%$	D $<< 2\%$	N	CI
05.02.2019 – 14.06.2019	16.46	34.40	28.49	7.05	13.60	45.69
15.06.2019 – 23.12.2019	17.62	32.94	27.75	8.56	13.14	44.22
24.12.2019 – 05.05.2020	20.19	31.16	24.92	9.57	14.15	40.50
06.05.2020 – 02.05.2021	26.38	29.10	20.07	8.33	16.12	34.62

Notes: The Table shows the mean values of the various survey responses in the credibility regimes identified by the global testing procedure for multiple endogenous breaks introduced by Bai and Perron (1998). The procedure allows for heterogeneous error distributions and applies HAC standard errors. We trim 15% of the observations at the boundaries of each regime. The sample period starts in February 2019 when the minimum number of 5000 answers were collected. A: Clearly above 2%, B: Above, but close to, 2%, C: Below, but close to, 2%, D: Clearly below 2%, N: Don't know, $CI = C + 0.5B$: Credibility Indicator

3 Inflation Expectations and the Pandemic: The Role of Personal Characteristics

The analysis of the previous section suggests that the proportion of A answers, i.e. people expecting inflation to be *clearly above 2% over the medium term*, is the main driver of the decline in the credibility indicator observed during the pandemic, compare Figure 3a. In line with Table 2, the regime dependence of the proportion of A answers can be confirmed by the following regression:

$$A_t = \sum_{i=1}^{4} \alpha_i D_i + u_t \tag{1}$$

where A_t is the proportion of A answers at day t ($t = 1, \ldots 815$). D_i equals one if t belongs to regime i ($i = 1, \ldots 4$) and equals zero otherwise. In line with U.S. evidence, the results presented in Table 2 show that the proportion of A answers and, thus, inflation expectations of German consumers have been significantly higher since the outbreak of the pandemic. In particular, the hypothesis $\alpha_2 = \alpha_4$, i.e. that the pandemic-related increase in inflation expectations is only a transitory phenomenon, is clearly rejected by the data.

Table 2 Inflation expectations and the pandemic: The role of personal characteristics

Dependent variable	D_1	D_2	D_3	D_4	F-statistic: regimes	t-statistic: pandemic
(1) A	16.46 (0.08)	17.62 (0.13)	20.10 (0.92)	26.38 (0.44)	172.25***	-18.91***
(2) $A^F - A^M$	2.71 (0.18)	4.36 (0.25)	4.88 (0.26)	4.06 (0.28)	20.20***	0.81
(3) $A^O - A^Y$	1.72 (0.66)	-2.04 (0.37)	-2.35 (0.39)	-4.89 (0.92)	13.90***	2.89***
(4) $A^{\text{secEdu}} - A^{\text{highEdu}}$	2.98 (0.50)	3.36 (0.28)	3.29 (0.33)	2.43 (0.54)	0.86	1.51
(5) $A^{\text{lowPP}} - A^{\text{highPP}}$	5.07 (0.42)	6.48 (0.41)	5.72 (0.38)	6.7 (0.38)	3.38**	-0.39
(6) $A^{\text{AfD}} - A^{\text{CDU}}$	22.57 (0.66)	26.01 (0.32)	24.91 (0.48)	33.15 (0.50)	74.97***	-12.11***
(7) $A^{\text{Linke}} - A^{\text{CDU}}$	6.24 (0.41)	7.36 (0.63)	4.1 (0.84)	7.04 (0.68)	3.64**	0.35

Notes: The table shows the estimation results of equations (1)-(7). The dependent variables are the proportion of A answers (inflation *clearly above 2% over the medium term*) and the A-gaps defined to investigate the role of personal characteristics like gender, age, education, purchasing power, and the respondents' political attitude. The four credibility regimes are taken from Table 1. Estimates for the regime-dependent means of the A-variables are shown in the columns below D_1, D_2, D_3, D_4, together with HAC-standard errors. The F-statistics (*regimes*) refer to the null-hypothesis that the mean of the corresponding dependent variable is constant. The t-statistics (*pandemic*) test whether the mean of the dependent variable is the same in regimes 2 and 4, i.e. before and after regime 3 when the pandemic has started. '***' '**' and '*' indicate significance at the 1, 5, or 10% level respectively.

It is well-documented that females tend to have higher inflation expectations than males, see e.g. Jonung (1981), Bryan and Venkatu (2001a) and D'Acunto et al. (2020). Figure 3b plots the A proportions of females (A^F) and males (A^M) suggesting that this gender gap in inflation expectations is also present in our data. Estimating the equation

$$A_t^F - A_t^M = \sum_{i=1}^{4} \beta_i D_i + u_t \tag{2}$$

confirms that females have higher inflation expectations ($\beta_i > 0$) over the whole sample period, see row 2 of Table 2. The gender gap reaches its maximum at the beginning of the pandemic ($\widehat{\beta}_3 = 4.88$), when the number of infections was growing exponentially, vaccines had not been discovered yet and economic uncertainty was exceptionally high. According

to our results, however, this widening of the gender gap is only transitory. Specifically, the gender gap before and after the initial pandemic regime is of equal size ($\beta_2 = \beta_4$).

A very interesting topic concerns the influence of inflation experience and, thereby, of age on the formation of inflation expectations. Here, the available evidence is mixed. Using data from the Michigan Consumer Survey, Malmendier and Nagel (2016) and Dräger and Lamla (2018) find that differences in experienced mean inflation generate differences in inflation expectations between younger and older cohorts, where only the latter experienced the high inflation period of the 1970s. By contrast, Bryan and Venkatu (2001b) find that U.S. consumers are likely to have higher inflation expectations if they are younger. Meyler and Reiche (2021) provide similar results for consumers' inflation expectations in the euro area. Our data differentiates between five age groups, where the youngest group contains respondents between 18 and 29 years old and the oldest group consists of those 65 and above. Only the old age cohort may have experienced inflation rates that were well above 2% in Germany. In order to investigate the impact of the pandemic on the role of age for inflation expectations, we calculate the A proportions for the oldest (A_t^O) and the youngest (A_t^Y) age group and re-run the test equation for the age gap:

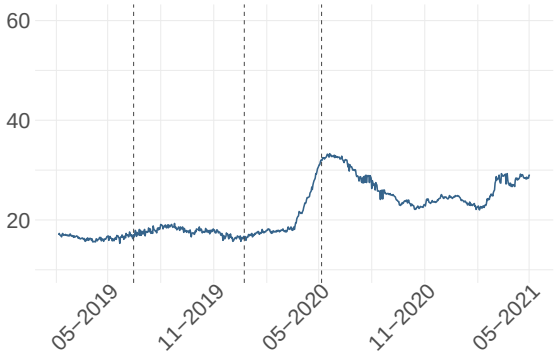
$$A_t^O - A_t^Y = \sum_{i=1}^{4} \gamma_i D_i + u_t \tag{3}$$

The results in Table 2 (row 3) show that the mean of the age gap is time-varying. With the exception of the first regime, the younger respondents tend to have higher inflation expectations than the older ones. The age-related difference in inflation expectations seems to be particularly pronounced in the most recent period. Note, however, that the share of young people in the raw data may be too small to guarantee representative results, compare Table 3. In fact, looking at the complete picture, the A proportions of all age groups show no clear pattern, see Figure 4 in the Appendix.[11]

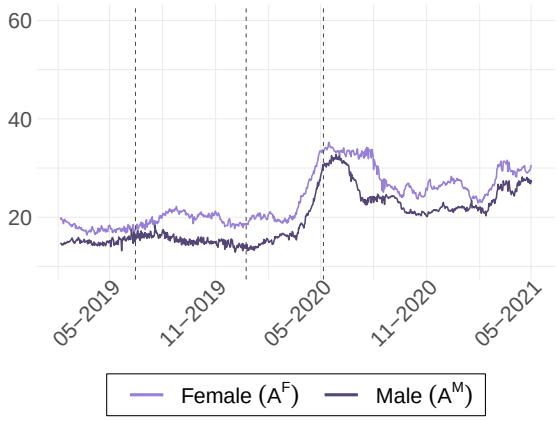
[11] For brevity, the estimation results obtained for all age groups are not presented but are available on request.

Figure 3 The proportion of A answers and the role of personal characteristics

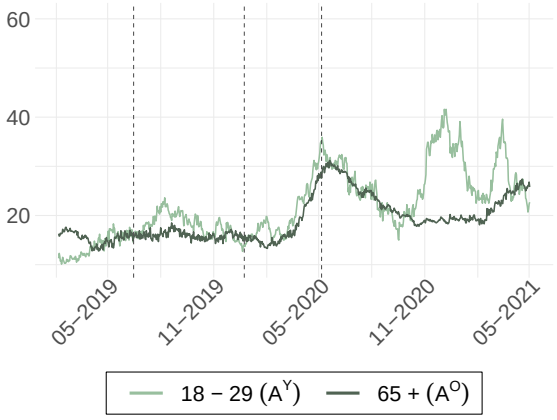
(a) A responses



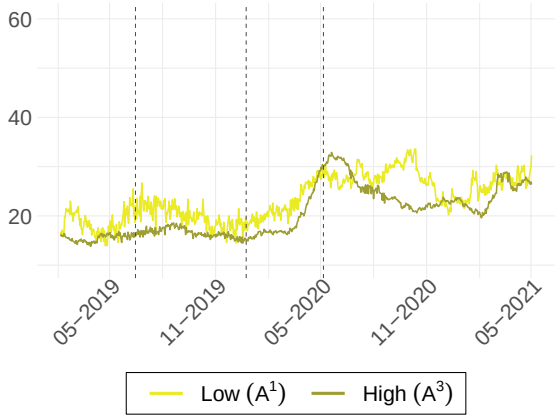
(b) A responses by gender



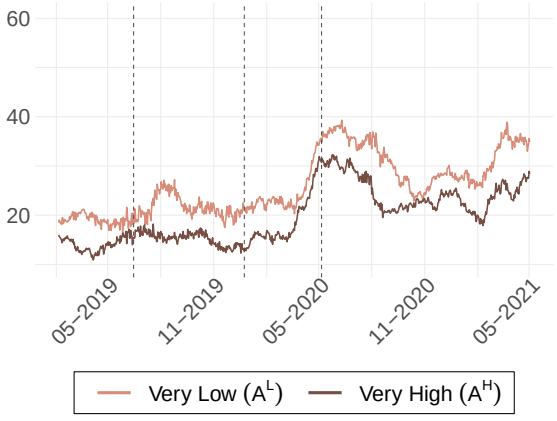
(c) A responses by age



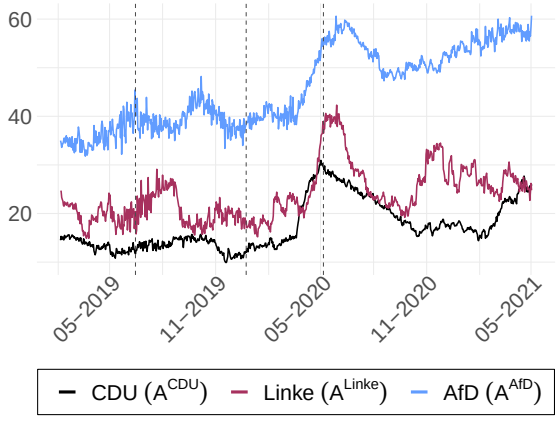
(d) A responses by education (school)



(e) A responses by purchasing power



(f) A responses by party preference



Notes: The figures show the proportion (in %) of A answers (inflation *clearly above 2% over the medium term*) for the whole sample (a) and for sub-groups with certain personal characteristics. The vertical lines refer to the credibility regimes estimated in Table 1. For further explanation see equations (1)-(7).

The next personal characteristics to be addressed are income and education. Both variables are seen as proxies for financial literacy and the awareness of the central bank's inflation target. The literature typically finds that both, higher education and higher income are associated with lower inflation expectations, see e.g. Bryan and Venkatu (2001a), Blanchflower and MacCoille (2009), Bruine de Bruin et al. (2010) and Meyler and Reiche (2021). In our data set, there are three different categories regarding the education level ranging from secondary school to high school. Concerning the level of income, the postal code is used to sort respondents into five categories ranging from very low to very high regional purchasing power. In the following, we consider the gaps between the A proportions of low and high education ($A^{\text{lowEdu}} - A^{\text{highEdu}}$) and very low and very high purchasing power ($A^{\text{lowPP}} - A^{\text{highPP}}$), respectively:

$$A^{\text{lowEdu}} - A^{\text{highEdu}} = \sum_{i=1}^{4} \delta_i D_i + u_t \tag{4}$$

$$A^{\text{lowPP}} - A^{\text{highPP}} = \sum_{i=1}^{4} \tilde{\delta}_i D_i + \tilde{u}_t \tag{5}$$

In line with the literature, our results show that inflation expectations are higher for respondents with lower education and lower purchasing power. According to the test results, the education gap is rather stable over time. In particular, the impact of the education level on inflation expectations did not change in the course of the pandemic ($\delta_2 = \delta_4$). For income, the significant time-variability of the proportion of A answers seems to be driven by the responses given during the first regime, i.e. during the first half of 2019. Similar to the results obtained for education, however, there is no evidence that the pandemic had an impact on the effect of income on inflation expectations.

Inflation expectations may also depend on political attitudes. Recently, Gillitzer et al. (2021) showed that U.S. and Australian consumers expect significantly lower inflation when the political party they support holds executive office. In our sample period, the executive office in Germany is held by chancellor Merkel who represents the largest political party, the Christian Democrats (CDU). Her government is challenged from two sides of the political spectrum. From the left-wing, there is the pro-european *Linke* and from the right-wing, there is the anti-european *AfD*. Therefore, we construct the proportions of A answers depending on the political attitude, i.e. A^{AfD}, A^{CDU}, and A^{Linke}, to analyze the deviations from

the governing party CDU.[12] Specifically, we estimate:

$$A^{\text{Linke}} - A^{\text{CDU}} = \sum_{i=1}^{4} \rho_i^L D_i + u_t \quad (6)$$

$$A^{\text{AfD}} - A^{\text{CDU}} = \sum_{i=1}^{4} \rho_i^R D_i + u_t \quad (7)$$

Table 2 (rows 6 and 7) confirms the findings obtained for the U.S. and Australia: in all periods and for both opposition parties, the proportion of A answers is significantly higher than those observed for the government party. This effect is of moderate size and rather stable over time for the left-wing party. For the right-wing party AfD, however, the anti-european and also anti-ECB attitude apparently translates into exceptionally high inflation expectations. Remarkably, the pandemic has significantly reinforced the conviction of AfD-supporters that inflation rates will be *clearly above 2% over the medium term*.

4 Concluding Remarks

The current paper employs a novel data set taken from an online-survey of German citizens to investigate the behavior of longer-term inflation expectations and the credibility of the ECB's inflation target. Our results show that credibility has significantly declined during 2019 and, particularly, since spring 2020 in response to the massive fiscal and monetary policy interventions stirred by the pandemic. Remarkably, in spite of the deep recession and even though inflation rates in Germany have been clearly *below* 2% for several years, the survey shows that credibility of the ECB's inflation target has declined mainly because more people expect inflation rates to be *clearly above 2% over the medium term*. This puzzling behavior of inflation expectations during a recession is also observed for the U.S., see e.g. Dietrich et al. (2020).

It is well-established in the literature that the level of inflation expectations depends on personal characteristics like gender, age, education, income, and political party preference. Our data set allows to re-investigate and confirm these findings for German citizens during

[12] We do not consider the remaining, more moderate, parties like the social democrats (SPD), the liberals (FDP), and the Greens (Grüne) because these are - to a varying degree - coalition partners of the CDU, at least at the federal state level.

the pandemic. For example, we confirm that females have higher inflation expectations than males and that consumers expect significantly lower inflation when the political party they support holds executive office (Gillitzer et al., 2021). In Germany, the latter effect is particularly pronounced for supporters of the anit-european, right-wing party AfD. We further contribute to the literature by investigating whether the effects of personal characteristics are amplified or mitigated by the pandemic. Our results show that the pandemic has mainly transitory effects on the inflation expectations of females relative to those of males. By contrast, the gap between the inflation expectations of AfD-supporters and those of supporters of the government party has been widened persistently by the pandemic.

Following Coibion et al. (2020), a lack of credibility of the inflation target could be particularly problematic in times of unconventional monetary policies that are thought to operate primarily through the inflation expectations of households and firms. In fact, there has been an increased interest in the analysis of household expectations and several new, though standard probabilistic online surveys, like the Fed's Survey of Consumer Expectations (SCE) or the ECB's Household Finance and Consumption Survey (HFCS), have been launched. Our results suggest that the more flexible online surveys based on non-probabilistic sampling could be an additional tool for monetary policy analysis that might help to evaluate and improve the communication of the central bank with the public.

References

Andrade, P., Gautier, E., and Mengus, E. (2020). What Matters in Households' Inflation Expectations? Working Paper 770, Banque de France.

Arioli, R., Bates, C., Dieden, H., Duca, I., Friz, R., Gayer, C., Kenny, G., Meyler, A., and Pavlova, I. (2017). EU Consumers' Quantitative Inflation Perceptions and Expectations: An Evaluation. Occasional Paper 186, European Central Bank.

Armantier, O., Nelson, S., Topa, G., Van der Klaauw, W., and Zafar, B. (2016). The Price Is Right: Updating Inflation Expectations in a Randomized Price Information Experiment. *The Review of Economics and Statistics*, 98(3):503–523.

Bai, J. and Perron, P. (1998). Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica*, 66(1):47–78.

Bauer, M. D. (2015). Inflation Expectations and the News. *International Journal of Central Banking*, 11(2):1–40.

Binder, C. (2020). Coronavirus Fears and Macroeconomic Expectations. *The Review of Economics and Statistics*, 102(4):721–730.

Blanchflower, D. G. and MacCoille, C. (2009). The Formation of Inflation Expectations: An Empirical Analysis for the UK. Working Paper 15388, National Bureau of Economic Research.

Bruine de Bruin, W., van der Klaauw, W., Downs, J. S., Fischhoff, B., Topa, G., and Armantier, O. (2010). Expectations of Inflation: The Role of Demographic Variables, Expectation Formation, and Financial Literacy. *Journal of Consumer Affairs*, 44(2):381–402.

Bryan, M. F. and Venkatu, G. (2001a). The Curiously Different Inflation Perspectives of Men and Women. Economic commentary, Federal Reserve Bank of Cleveland. 11.01.2001.

Bryan, M. F. and Venkatu, G. (2001b). The Demographics of Inflation Opinion Surveys. Economic commentary, Federal Reserve Bank of Cleveland. 10.15.2001.

Cavallo, A. (2020). Inflation with Covid Consumption Baskets. Working Paper 27352, National Bureau of Economic Research.

Christelis, D., Georgarakos, D., Jappelli, T., and Van Rooij, M. (2020). Trust in the Central Bank and Inflation Expectation. *International Journal of Central Banking*, 16(6):1–37.

Civey (2020). Die Statistische Methodik von Civey. White paper, Civey GmbH. `https://civey.com/whitepaper/`, last accessed on 05.04.2021.

Coibion, O., Gorodnichenko, Y., Kumar, S., and Pedemonte, M. (2020). Inflation Expectations as a Policy Tool? *Journal of International Economics*, 124:103297.

Coibion, O., Gorodnichenko, Y., and Weber, M. (2019). Monetary Policy Communications and their Effects on Household Inflation Expectations. Working Paper 25482, NBER.

D'Acunto, F., Malmendier, U., and Weber, M. (2020). Gender Roles and the Gender Expectations Gap. Working Paper 26837, National Bureau of Economic Research.

Dietrich, A. M., Kuester, K., Müller, G. J., and Schoenle, R. S. (2020). News and Uncertainty about COVID-19: Survey Evidence and Short-Run Economic Impact. Working Paper 20-12, Federal Reserve Bank of Cleveland.

Dräger, L. and Lamla, M. J. (2018). Is the Anchoring of Consumers' Inflation Expectations Shaped by Inflation Experience? CESifo Working Papers 7042, CESifo.

Ehrmann, M., Soudan, M., and Stracca, L. (2013). Explaining European Union Citizens' Trust in the European Central Bank in Normal and Crisis Times. *The Scandinavian Journal of Economics*, 115(3):781–807.

Gillitzer, C., Prasad, N., and Robinson, T. (2021). Political Attitudes and Inflation Expectations: Evidence and Implications. *Journal of Money, Credit and Banking*, 53(4):605–634.

Gürkaynak, R. S., Sack, B., and Swanson, E. (2005). The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models. *The American Economic Review*, 95(1):425–436.

Hachula, M. and Nautz, D. (2018). The Dynamic Impact of Macroeconomic News on Long-Term Inflation Expectations. *Economics Letters*, 165:39–43.

Jonung, L. (1981). Perceived and Expected Rates of Inflation in Sweden. *The American Economic Review*, 71(5):961–968.

Malmendier, U. and Nagel, S. (2016). Learning from Inflation Experiences. *The Quarterly Journal of Economics*, 131(1):53–87.

Meyler, A. and Reiche, L. (2021). Making Sense of Consumers' Inflation Perceptions and Expectations – The Role of (Un)certainty. Economic Bulletin 2/2021, European Central Bank.

Nautz, D., Pagenhardt, L., and Strohsal, T. (2017). The (De-)anchoring of Inflation Expectations: New Evidence from the Euro Area. *The North American Journal of Economics and Finance*, 40:103 – 115.

Strohsal, T., Melnick, R., and Nautz, D. (2016). The time-varying Degree of Inflation Expectations Anchoring. *Journal of Macroeconomics*, 48:62–71.

Appendix

Table 3 Survey Respondent Characteristics

Demographic variable		Number	Share
Gender	Male	71605	73.41%
	Female	25932	26.59%
Age	18 – 29	2569	2.63%
	30 – 39	5877	6.03%
	40 – 49	10548	10.81%
	50 – 64	34453	35.32%
	65 +	44090	45.20%
Education	NA	5168	5.30%
	Secondary	8909	9.13%
	Middle	23273	23.86%
	High	60187	61.71%
Purchasing Power	Very low	19234	19.72%
	Low	15767	16.17%
	Medium	16679	17.10%
	High	19613	20.11%
	Very high	26244	26.91%
Party Preference	CDU / CSU	17654	18.10%
	SPD	8945	9.17%
	Gruene	15579	15.97%
	Linke	7500	7.69%
	FDP	8777	9.00%
	AfD	30183	30.95%
	Other	5816	0.84%
	Don't vote	3083	3.16%

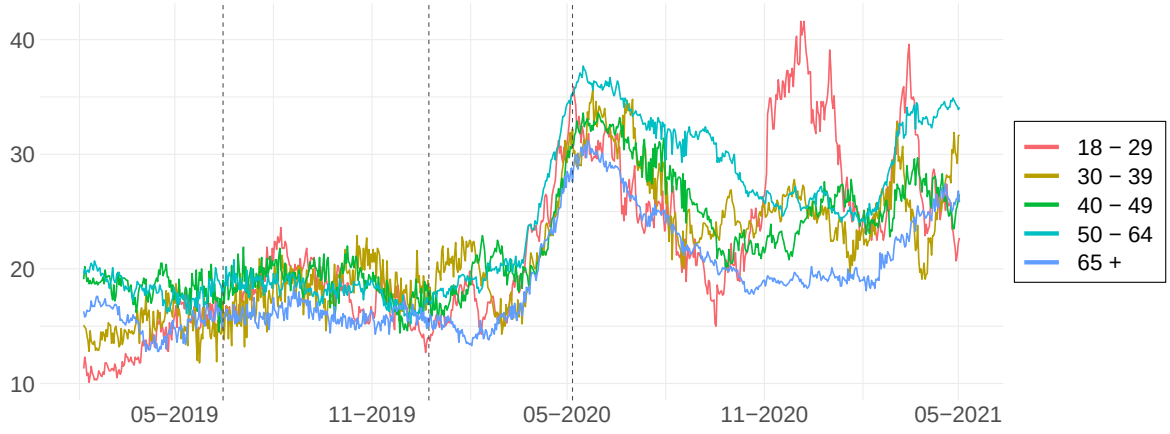
Notes: The table shows the composition of the unweighted and unadjusted data collected from Jan 2019 until 2 May 2021. Purchasing power is proxied via the respondents' postcode. The total number of observations is 97537.

Table 4 Survey Results based on Raw Data

Credibility Regime	A $>> 2\%$	B $> 2\%$	C $< 2\%$	D $<< 2\%$	N	CI
05.02.2019 – 14.06.2019	22.12	34.87	26.46	7.07	9.48	43.90
15.06.2019 – 23.12.2019	22.36	31.15	27.12	10.52	8.86	42.69
24.12.2019 – 05.05.2020	28.44	28.71	21.86	9.85	11.14	36.22
06.05.2020 – 02.05.2021	32.32	27.62	18.73	9.11	12.22	32.54

Notes: The table shows that the survey results based on the raw data are similar to the weighted, representative results presented in Table 1. For sake of comparison, we used the same credibility regimes for the raw and the adjusted data. A: Clearly above 2%, B: Above, but close to, 2%, C: Below, but close to, 2%, D: Clearly below 2%, N: Don't know, $CI = C + 0.5B$: Credibility Indicator.

Figure 4 A responses across all age groups



Notes: The figure shows the proportion (in %) of A answers (inflation *clearly above 2% over the medium term*) for all age groups. The vertical lines refer to the credibility regimes in Table 1.