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How the provision of inflation information affects pension contributions: A field experiment

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Abstract

Ignoring the effects of inflation in retirement planning can have severe consequences for an individual's future financial well-being. Yet, many pension funds do not communicate inflation-related information, presumably for the fear of reduced contributions once the members understand how low the “real” return on saving for retirement is. As an alternative prediction, the provision of inflation information could increase pension contributions, because it reveals possible pension shortfalls. In cooperation with a major German pension fund, we conduct a field experiment, in which we vary the inflation information provided to the fund members, to explore this important issue. Among all participants, we find mostly positive but insignificant effects of the inflation information on pension contributions. Among those participants who voluntarily changed their pension contributions after the experimental intervention, the provision of inflation information significantly raises the likelihood of increasing pension contributions.

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KEYWORDS

field experiment, household savings, inflation, money illusion, pension contributions

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1 | INTRODUCTION

Ignoring the effects of inflation in retirement planning can have disastrous consequences for an individual's future financial well-being. If one receives a monthly pension payment of €1000 in 30 years and faces a constant inflation rate of 2%, the purchasing power of the individual's pension in 30 years will be only €552.07. To avoid old-age poverty it is thus crucial that in financial planning individuals recognize how inflation will deteriorate their purchasing power. To empower individuals to make an informed decision about the level of their pension contributions, it seems important to provide them with information about the impact of inflation. The recent sharp rise in inflation rates has made this issue even more relevant. Yet, pension funds often do not communicate inflation information to their members and present projected pension benefits in nominal terms only—even if retirement entry lies decades in the future and purchasing power will be much lower then. Presumably, pension funds choose such an information policy because they expect a reduction in pension contributions if they convey how low the “real” return on saving for retirement is. However, the effect could also be the opposite. In his analysis of a theoretical setting, Feldstein (1981) concludes that an increase in the inflation rate shifts private savings toward pension plans. Similarly, Clark and McDermed (1982) show that introducing inflation in their pension model leads to delayed retirement and working longer to increase pension payments. Hence, providing inflation information could also increase pension contributions because it reveals possible pension shortfalls to the individual.

Formally speaking, the overall effect is dependent on the income and the substitution effect. When the expected inflation increases, the perceived real interest rate decreases, which implies a lower return on savings and *ceteris paribus* lower future consumption. As a response, the income effect predicts a decrease in consumption and increased savings because one has to save more to achieve the same future consumption. At the same time the substitution effect predicts an increase in current consumption and less savings because future consumption becomes costlier. It is uncertain which effect will dominate and eventually determine a change in savings and consumption in response to the provided inflation information. This makes our research question particularly interesting for pension funds and policy making since fund managers should be interested in knowing how providing inflation information would affect their members' saving behavior before alerting them to potential pension deficiencies due to inflation effects.

To the best of our knowledge, there is no systematic empirical analysis on how the provision of inflation information affects pension contributions. Thus, we conduct a field experiment in cooperation with a major pension fund in Germany to shed light on this important issue. Typically, the annual pension statements the fund sends to its 41,000 members do not contain inflation-related information and the projected pension benefits are presented in nominal terms

only. In our field experiment, we extend this statement by providing an additional page with information on the expected inflation rate and its effect on the projected pension benefits. All letters restate the projected pension benefits in nominal terms, but they differ in terms of the provided inflation information. Thus, we address the questions on how providing inflation information affects pension contributions, and how individuals respond to different types of communication on inflation. In the control treatment, we do not provide any inflation information. These participants are representative for the status quo, as they may or may not be aware of inflation. For the three other treatments, we provide inflation information in different formats to the participants. In the annual effect treatment, we indicate the expected future annual inflation rate. In the overall effect treatment, we communicate the overall loss in purchasing power of €100 until the participant reaches retirement age. In the personal effect treatment, we communicate the overall loss in purchasing power of the participant's own projected pension benefits until reaching retirement age.

All letters enclose a separate response postcard to be sent back to the pension fund to receive further information on how to increase one's pension contributions. In the following months, we record the changes in the actual pension contributions. We find small positive but mostly insignificant effects of the inflation information on the likelihood to increase pension contributions. An explanation for the small effect size could be that most participants usually do not change their retirement plans and rather stick to the status quo. Furthermore, it is unclear how many participants even read the letters with the inflation information, as they were part of the fund's annual communication, which normally does not contain any new information. To reduce any effects of inertia or unreceived treatments, we also analyze the subgroup of participants who voluntarily changed their pension contributions following the intervention. Our reasoning for this procedure is that we can be sure that these participants were actively engaged with their retirement planning and inertia did not keep them from making any changes. Among this subsample, the provision of inflation information increases the likelihood to raise pension contributions by approximately 10%. Every treatment has a significantly positive effect on the probability of increasing pension contributions. However, we find no significant differences between the treatments that provide inflation information. We conclude that the fund members generally suffer from money illusion, the tendency to focus on nominal instead of real values. To some extent, this money illusion is just driven by negligence though. Just reminding the fund members of inflation has a systematic effect on their behavior. The style of the communication is less relevant. The fund members seem to understand the concept of inflation and its consequences and do not need help in assessing the monetary impact.¹

Furthermore, there is no evidence that the provision of inflation information increases the likelihood of decreasing pension contributions. These findings suggest that it should be in the interest of the pension fund to communicate projected pension benefits in real terms and point out the effects of inflation as this would increase pension contributions.

We contribute to the existing literature in several ways. First, we add to the literature on household pension savings behavior. There is ample evidence that individuals are subject to many behavioral biases and do not always behave rationally when it comes to old age provisions (e.g., Beshears et al., 2015; Choi et al., 2017; Duflo & Saez, 2002; Lusardi & Mitchell, 2011a; Thaler & Benartzi, 2004). This is why many researchers have tried to find ways

¹To put these findings into perspective, we should acknowledge that the financial literacy of the pension fund's members can be assumed to be above average as most of them are highly educated physicians. More details on this are provided in Section 3.3.

to help individuals with their decision making, mainly by motivating them to save more for retirement. There is strong evidence that automatic enrollment significantly increases the participation rate in 401(k) plans among employees (Choi et al., 2004; Madrian & Shea, 2001). Furthermore, Thaler and Benartzi (2004) successfully presented the Save More Tomorrow plan that tackles people's inertia by committing them to increase their pension contributions in the future instead of today. Once individuals engage in old-age provisions with a pension plan, the next question is whether and how the pension fund can influence the savings rate. There is evidence from several countries that providing estimates of future pension payments increases individual pension contributions (Dolls et al., 2018; Fajnzylber et al., 2009; Goda et al., 2014). Not surprisingly, over the past two decades, many countries have implemented this procedure (Debets et al., 2022). We go a step further by examining the extent to which inflation effects should play a role in pension communication. The inflation rate has a major influence on the real value of projected pension benefits. As providing information on pension benefits itself influences individual savings behavior it would be surprising if an alteration of this information by providing inflation information would have no effect. Our finding that fund members are more likely to increase their pension contributions after receiving inflation information indicates that they are not aware of this information or do not sufficiently account for it, unless it is explicitly mentioned. We therefore think it is crucial to provide this information to support better informed decision making regarding old-age provision.

Second, we contribute to the literature on households' inflation expectations and behavior in response to inflation communication. Households' inflation expectations are dispersed and upward biased relative to realized inflation and forecasts by professionals (D'Acunto et al., 2023; Weber et al., 2022). These expectations are important because they directly influence the households' consumption and savings decisions. The predominant opinion in the literature is that higher inflation expectations lead to higher current consumption but at the same time can have a negative effect on spending on durable goods (Coibion et al., 2019, 2022; D'Acunto et al., 2022). Meanwhile, there is comparatively little evidence on how inflation expectations affect households' saving behavior (D'Acunto et al., 2023). We directly contribute to this literature by providing evidence that increased awareness of inflation effects can have a positive influence on households' savings. Coibion et al. (2022) show that the form of communication can have an effect on the way households adjust their inflation expectations. In line with this, we alter the degree of detail in the inflation information that we provide. However, we do not find significant differences between different communication forms as they all have similar positive effects on pension contributions.

The importance of accurate inflation expectations requires that people take their inflation expectations into account when making decisions. The prevalence of money illusion, the tendency to ignore inflation and to focus on nominal values, has been observed on many occasions (e.g., Acker & Duck, 2013; Branger et al., 2023; Brunnermeier & Julliard, 2008; Cohen et al., 2005; Fehr & Tyran, 2001; Shafir et al., 1997). We add to this literature by providing another example of people suffering from money illusion. The fact that some fund members in our field study react to the inflation information clearly shows that they did not fully consider the impact of inflation on their retirement savings. Thus, our findings emphasize the relevance of money illusion in retirement planning and urge policy makers to take the phenomenon into account.

Lastly, our paper helps to understand how the exponential growth bias influences households' retirement savings. The inability to correctly estimate exponential growth is widespread among individuals (Foltice & Langer, 2017; Levy & Tasoff, 2016; Stango & Zinman, 2009). The influence of the exponential growth bias increases with the duration of the

investment period and is therefore particularly important in retirement planning. Field studies have shown that providing information on exponential growth can have a large positive influence on retirement savings (Goda et al., 2019, 2014; Song, 2020). At the same time, the exponential growth bias could also lead people to underestimate the negative effects of inflation on their retirement savings. We therefore test whether it makes a difference to just inform people about the annual inflation rate versus specifically pointing out the exact effects on their projected pension payments. However, we find no significant difference between these treatments. Therefore, the exponential growth bias seems not to play a major role in our setting where participants need to assess long term effects of inflation from an annual rate.

This study is organized as follows: Section 2 describes the institutional background and the design of the field experiment. Section 3 presents the results. Section 4 concludes by discussing the implications for public policy making.

2 | DESIGN OF THE FIELD EXPERIMENT

2.1 | Institutional background

Germany follows a pay-as-you-go common public pension system, where all dependent employees in the private and public sector must participate (85% of the workforce; see Börsch-Supan & Wilke, 2004, for a review). In 2018, members contributed 18.6% of their taxable income during their working lives to the system (assessment ceiling: €6500.00) and in return received majority of their income from the system after retirement. Self-employed individuals (9% of the workforce) can either participate in the public pension system (about two-thirds) or engage in private old-age provisions (about one-third). Civil servants (7% of the workforce) are exempt from the public pension system as they have their own system.

Chambered professions (e.g., physicians or lawyers) have a special status: Dependent employees in these professions can leave the public pension system but have to join a chamber-specific pension fund in this case. The fund cannot be chosen by the individual, but is chosen by the professional association. Self-employed individuals in chambered professions can also leave the public pension system and either join these funds (which is mandatory in some professional associations) or engage in private old-age provisions.

The field experiment was conducted in cooperation with a pension fund for physicians in Germany in 2018. Chamber-specific pension funds are much similar to the public pension system: these are noncommercial institutions with the main purpose of ensuring an adequate income on retirement or for the dependants in case of the insured person's death. Therefore, they are similar to the public pension system in terms of contributions (e.g., similar contribution rates) and insurance features. Further, many funds differentiate between dependent employment and self-employment to reflect their unequal obligation to join the public pension system in nonchambered professions. However, there are also important differences between chamber-specific pension funds and the public pension system: first, chamber-specific pension funds are not organized as pay-as-you-go systems but are fully funded systems with personal accounts for their members. Second, the level of the members' pension contributions can be flexible. Specifically, they can increase or decrease their contributions within certain boundaries.² Thus,

²They usually do not have flexibility with respect to the asset allocation though.

chamber-specific pension funds are the ideal environment for our study: The contributions to the fund are crucial for the members' retirement planning and members can increase or decrease their pension contributions in response to the intervention.

The fund we are cooperating with manages pension contributions of physicians in Germany and had about 41,000 members and 11 billion EUR assets under management in 2018. Table 1 presents the possible contribution classes for this fund. The fund distinguishes between employed physicians (e.g., in hospitals) and self-employed physicians (e.g., in private practice). Similar to the members of the public pension system, employed physicians contribute 18.6% of their taxable income in the lowest contribution class (i.e., €1209.00 per month based on the assessment ceiling of €6500.00). Self-employed physicians contribute 14% of their taxable income in the lowest contribution class (i.e., €1290.30 per month based on the assessment ceiling of €9216.42). Although members can easily change their contribution class at any time, most remain in their default class. For employed and self-employed physicians, the default is class 1 and 3, respectively. The self-employed physicians can therefore increase or decrease their pension contributions, while many employed physicians are unable to decrease their contributions.

2.2 | Chronology

In June 2018, all members of the fund received their regular annual pension statements that disclosed their cumulative pension contributions, projected pension benefits if contributions were to stop today (i.e., the member leaves the fund immediately), and projected pension benefits if contributions stop at statutory retirement age (i.e., the member continues to contribute to the fund until reaching retirement age). All information was presented in nominal terms and the statements did not contain any inflation-related information. Of the 41,113 members, 34,574 were selected to participate in our field experiment (called "participants" in the following). Their annual pension statement also included the additional page on inflation information (depending on the treatment group) and the postcard. The

TABLE 1 Contribution classes.

	Employed physicians	Self-employed physicians
Assessment ceiling of taxable monthly income	€6500.00	€9216.42
Min. contribution rate	18.6%	14.0%
Class 1 (min. contribution)	€1209.00 (18.6%)	€1290.30 (14.0%)
Class 2	Variable (18.6%–23.5%)	€1407.60 (15.3%)
Class 3	€1524.90 (23.5%)	€1524.90 (16.5%)
Class 4	€1876.80 (28.9%)	€1876.80 (20.4%)
Class 5	€2111.40 (32.5%)	€2111.40 (22.9%)
Class 6	€2346.00 (36.1%)	€2346.00 (25.5%)
Class 7 (max. contribution)	€2418.00 (37.2%)	€2418.00 (26.2%)
Flexible class	Variable (23.5%–37.2%)	Variable (16.5%–26.2%)

Note: This table shows monthly contributions for taxable monthly incomes exceeding the assessment ceiling.

remaining 6539 members were excluded from the field experiment because they were already retired, currently unemployed, or attracted the fund's attention in the past owing to complaints.

When the members returned the postcard they received additional information on how to increase their pension contributions. A total of 2084 (6.02%) participants used this option. This response rate is slightly higher than that of typical direct mail, which varies between 2.9% and 5.1% (Data & Marketing Association, 2018), thus indicating that many participants have understood the importance of the conveyed information.

In October 2018, the members received an additional form via mail that allowed them to change their contribution class. Although changes could be made at any time through the fund's service department, these forms are mailed every year to tackle the members' inertia (Benartzi & Thaler, 2007).

According to the fund's management, most changes in contribution classes occur at the end of the year. Therefore, we ended our field experiment administrations on December 31, 2018.

2.3 | Treatments

We employ four treatments in our field experiment. Table 2 compares the inflation-related information in the mail sent in June 2018 across treatments (translations of the letters are provided in Appendix D). The inflation-related letters are framed as a request to increase one's pension contributions. All letters include an information box giving reasons for such an increase. In three of the four treatments, this information box included information on inflation. In the control group, inflation is not mentioned and other reasons are given for an increase, which are also included in all other treatments. To facilitate a change in the contribution class, the participants received letters containing a self-addressed prepaid postcard to receive information on how to increase their contributions.

In the control treatment (T1), the letters did not contain inflation-related information. Thus, participants may or may not be aware of inflation and their behavior represents the status quo of the pension fund's information policy. The letters in the remaining three treatments (T2–T4) differ in how inflation information is communicated. The wording in an inflation setting may have a significant influence on the elicited responses (Bruine de Bruin et al., 2012, 2017).

TABLE 2 Information letters.

	Control (T1)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)
Request to increase contributions	✓	✓	✓	✓
Reasons for an increase (except inflation)	✓	✓	✓	✓
Postcard	✓	✓	✓	✓
Annual purchasing power loss		✓	✓	✓
Overall purchasing power loss until retirement			✓	✓
Overall purchasing power loss for personal case				✓

Note: This table shows the differing information content of the information letters, by treatment.

To empower participants to judge the purchasing power of their projected pension benefits, letters in the annual effect treatment (T2) indicated the future expected annual inflation rate (1.8% p.a.).³ However, accounting for inflation in the way intended by the annual effect treatment opens the field to various behavioral biases. Research on money illusion suggests that individuals are inclined to ignore the inconspicuous annual inflation rate (Shafir et al., 1997). Research on the exponential growth bias further suggests that individuals systematically underestimate the long-term loss in purchasing power when judging it from an annual rate (Jones, 1984; Kemp, 1984; Keren, 1983; Stango & Zinman, 2009).

To mitigate these biases, the letters in the overall effect treatment (T3) communicate the overall loss in purchasing power of €100 until the participant reaches retirement age. Thus, participants are less likely to be victims of money illusion and are immune to the exponential growth bias. This information is also provided in the annual statement of the German public pension fund, which allows us to simultaneously test the effectiveness of their approach.⁴

Nevertheless, research on psychological ownership suggests that participants may not take this information fully into account, because it is not personally applicable (Shu & Peck, 2011). To address this potential issue, letters in the personal effect treatment (T4) communicate the overall loss in purchasing power of one's projected pension benefits until reaching retirement age.

A randomized block approach is used to assign participants to treatments in groups of four with similar age, gender, nationality, and cumulative pension contributions. Within these groups, the four participants are randomly allocated to the four treatments. Therefore, the composition in the treatments is very similar. Nevertheless, we control for a broad set of variables in the analyses to eliminate competing explanations for our findings. Demographic controls include age, gender, and nationality. Administrative controls include the years of fund membership and dummy variables for self-employment and whether the participant returned the postcard. Financial controls include the projected pension benefits if contributions cease today and at statutory retirement age and its present value, as well as the log cumulative contributions until December 2017, and in 2018. Table 3 provides mean values of the control variables among the different treatment groups and *p*-values from one-way analyses of variance (ANOVAs) that test whether the means differ between treatments. As none of the *p*-values is statistically significant, we conclude that the block randomization approach was successful.

2.4 | Hypotheses

In 2016, 2 years before the main field experiment, we conducted a survey among some of the fund's members to understand whether and how they think about inflation in the context of their retirement contributions. Insights from this survey were instrumental for the development of our hypotheses and the design of our main study. At the same time, the prestudy could have produced

³1.8% was the average inflation rate over the past 30 years in Germany at the time of the field study (Statistisches Bundesamt, 2022) and is close to the European Central Bank's inflation target of 2% (European Central Bank, 2023).

⁴A sample annual statement can be found online at the homepage of the Deutsche Rentenversicherung: https://www.deutsche-rentenversicherung.de/SharedDocs/Downloads/DE/Presse/Pressemappen/welche_info_enthaelt_meine_renteninfo.html

TABLE 3 Treatment characteristics.

	Control (T1)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	p-value
Age (in years)	47.19	47.14	47.26	47.21	0.92
Female (1 = yes)	0.46	0.46	0.46	0.46	0.80
German (1 = yes)	0.85	0.85	0.85	0.84	0.71
Membership (in years)	16.88	16.88	16.94	16.89	0.98
Self-employment (1 = yes)	0.30	0.31	0.31	0.30	0.21
Returned postcard (1 = yes)	0.06	0.06	0.06	0.06	0.72
Pension today (in €)	1106.26	1111.03	1114.65	1107.57	0.91
Expected pension at retirement (in €)	2661.98	2671.73	2663.43	2665.54	0.81
PV(expected pension at retirement) (in €)	1915.22	1922.67	1921.31	1918.49	0.91
Cumulative contributions until 2018 (in €)	150,734.67	151,351.83	152,051.61	151,075.08	0.88
Cumulative contributions in 2018 (in €)	13,196.07	13,229.68	13,193.85	13,180.99	0.91
Number of participants	8448	8436	8464	8436	

Note: This table shows mean demographics of control variables, by treatments. The rightmost column shows *p*-values of one-way ANOVAs that test whether the control variables are different among treatments.

information spillover effects. Thus, it seems important to describe this preceding survey in some more detail.⁵

We invited 9150 fund members to take part in this prestudy, of which 384 completed the survey. As part of the invitation they received information on their expected pension payments and inflation effects, similar to the subsequent main study. They received this information with the invitation letters and therefore before the survey. This means that participants who did not complete the survey still received inflation information. However, we do not know whether they opened the letters and read the information as it was not part of the usual fund mailings but a separate letter. We used the same four treatments in the survey as in the main study and refer to them as P1–P4 for our development of the hypotheses.⁶ We used a randomized block approach in the same way as in the main field study to assign participants to different treatments. Therefore, it is possible that participants who took part in both the survey and the main field study received two different treatments. This could have an influence on our results, as the information provided might not have been completely new to all participants. This is why we repeat our main analyses for a subsample in which we exclude all fund members that received the invitation to the survey. This exclusion does not have a large impact on the magnitude and the significance of the observed effects. We conclude that information spillover effects are not an issue.⁷

⁵Invitation letters to the survey, the survey questionnaire and results are shown in the appendix.

⁶In the survey we also used a fifth treatment (P5) that received information as in the personal effect treatment (P4), with the difference that there were several scenarios provided for alternative possible future inflation rates. We later dropped this treatment from our study design because it did not generate any meaningful insights.

⁷Results for the subsample excluding survey participants can be found in Table A3 in the appendix.

A survey question examined whether the participants were planning to change their pension contributions within the next 6 months. They had three options: decrease, no change, and increase. Providing the participants with inflation information (P2–P5 compared with P1) raised the probability for them to answer this question with increase by 4.93% ($p = 0.0295$). Although it is known that there is a gap between intentions and behavior (Sheeran, 2002) this finding leads us to our first hypothesis:

Hypothesis 1 (H1). *The awareness of inflation effects on pension payments increases pension contributions (T1 vs. T2–T4).*

Furthermore, we analyzed the effects of the different treatments to understand whether the communication style of the given information on inflation influences its effectiveness, as discussed in Section 2.3. We therefore conducted a probit regression with our four treatments as independent variables and the willingness to increase pension contributions as the dependent variable. The survey revealed that providing participants with information on the aggregated effect of inflation until retirement (P3) compared to only giving them the yearly inflation rate (P2) indeed augmented their willingness to increase pension contributions ($\Delta = +6.73\%$). A Wald test shows that this difference is significant at the 10% level ($\chi^2 = 2.82$, $p = 0.0929$). We therefore conclude that aggregating inflation information plays a role for the participants and state our second hypothesis:

Hypothesis 2 (H2). *Aggregating the effects of the inflation rate further increases pension contributions in comparison to a mere statement of the inflation rate (T2 vs. T3).*

A Wald test of the difference in the coefficients of P3 and P4 ($\Delta = -0.42\%$) indicates that the difference between the two treatments is not significantly different from zero ($\chi^2 = 0.01$, $p = 0.9395$). This contradicts our intuition that personalization has relevance for the participants in terms of willingness to increase pension contributions. To test whether this is a result of the small sample size of the survey and whether our intuition about personalization is correct, we hypothesize the following:

Hypothesis 3 (H3). *Personalization of inflation information has a positive influence on pension contributions in comparison to a generic overall presentation of inflation effects (T3 vs. T4).*

2.5 | Sample characteristics

Between the sample selection (June 2018) and the end of our field experiment (December 31, 2018), 781 of the 34,574 participants had changed their membership status (41 joined the fund, 642 entered retirement, 75 were on sick leave, and 23 became unable to work). These individuals were excluded from the sample, along with nine others with missing control variables, thus resulting in a final sample of 33,784 participants. Table 4 shows the demographics. In total, 21,881 participants are employed physicians, 10,323 participants are self-employed physicians, and 2689 participants have other occupations (e.g., voluntary members, temporarily unemployed, and part-time work).⁸

⁸This sums up to more than 33,784 because 1109 participants are employed and self-employed at the same time.

TABLE 4 Sample characteristics.

	Employed physicians	Self-employed physicians	Other occupation	Full sample
Age (in years)	44.41 (10.55)	54.07 (6.98)	44.86 (10.50)	47.20 (10.63)
Female (1 = yes)	0.47 (0.50)	0.38 (0.49)	0.65 (0.49)	0.46 (0.50)
German (1 = yes)	0.80 (0.40)	0.98 (0.15)	0.81 (0.39)	0.85 (0.36)
Membership (in years)	13.78 (10.51)	24.37 (8.10)	14.94 (10.34)	16.90 (10.97)
Self-employment (1 = yes)	0.05 (0.22)	1.00 (0.00)	0.00 (0.00)	0.31 (0.46)
Returned postcard (1 = yes)	0.05 (0.22)	0.08 (0.27)	0.05 (0.22)	0.06 (0.24)
Pension today (in €)	908.83 (779.32)	1,652.24 (691.86)	763.32 (624.23)	1,109.88 (823.03)
Expected pension at retirement (in €)	2633.54 (672.48)	2868.15 (687.95)	2197.73 (726.35)	2665.67 (702.35)
PV(expected pension at retirement) (in €)	1797.42 (652.75)	2308.79 (677.53)	1490.67 (586.13)	1919.42 (706.47)
Cumulative contributions until 2018 (in €)	124,071.62 (105,094.89)	224,710.35 (88,136.44)	105,128.70 (82,944.17)	151,303.72 (109,726.94)
Cumulative contributions in 2018 (in €)	12,841.91 (3727.79)	15,566.71 (4063.29)	7782.18 (4925.34)	13,200.14 (4415.43)
Number of participants	21,881	10,323	2689	33,784

Note: This table shows mean demographics of control variables, by employment status. Standard deviations are provided in parentheses.

Although the mean age of 47 years is rather high, inflation substantially affects the purchasing power of most participants' projected pension benefits until they reach statutory retirement age (65–67 years, depending on the date of birth). Notably, the groups differ significantly in some key demographics. Self-employed physicians are nearly 10 years older than employed physicians, which leads to differences in membership years and cumulative contributions. Furthermore, self-employed physicians are less likely to be foreign. We control for these variables throughout this study to rule out competing explanations for our findings.

In total, 2039 participants returned the postcard and therefore signaled interest to increase their contributions (“respondents” in the following). Table 5 shows that response rates do not depend on the inflation information provided. A Pearson's χ^2 test reveals no significant difference in the response rates between treatments ($\chi^2 = 1.33$, $p = 0.7228$). Under the

TABLE 5 Postcard.

	Control (T1)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	All
Treatment subsample size	8448	8436	8464	8436	33,784
Postcard respondents	503	522	493	519	2037
Postcard response rate	5.95%	6.19%	5.82%	6.15%	6.03%

Note: This table shows the treatment size, the number of postcard respondents and the postcard response rate, by treatment.

assumption that the conversion rate between reading a letter and responding to it is stable across treatments, this indicates that more inflation-related information in the letters did not deter people from reading the letters but that the reading rate was also stable across treatments. As there are no meaningful demographic differences between respondents in the different treatments and in the main sample, our data does not seem to be compromised by a systematic selection bias.

3 | RESULTS

3.1 | Overall effects on pension contributions

The response rate with respect to the postcards does not indicate significant differences between treatments. However, intentions may not lead to actions (Sheeran, 2002). Therefore, we examine whether the postcard results are reflected in real-world behavior.

If a participant wants to increase her pension contributions and is not in a flexible class, then an additional contract must be drawn to allow her to move to a higher class. As these contracts are nonmandatory, voluntary changes in pension contributions can be determined by examining the changes in the contract structure that include such additional contracts. We thus ensure that we not falsely identify a salary increase (decrease) that goes in line with higher (lower) pension contributions as an increase (decrease) in pension contributions, as we are not interested in the participants absolute contributions (which also depend on external factors such as income) but rather in the chosen contribution rate. The downside of this procedure is that we are sometimes unable to determine whether a contract change is an increase or decrease (e.g., when a flexible class with variable contributions is involved).

In most cases within an employment group, it is clear whether a voluntary contract change is an increase or decrease. However, it may be unclear when there is change in occupation (e.g., from employed to self-employed). For these cases, we develop two simple rules:

- (1) If a participant switches to a higher class than the default, this is an increase.
- (2) If a participant switches to a lower class than the default, this is a decrease.

Thus, we categorize all changes into four groups: increases, decreases, changes into default categories (neither increase nor decrease), and changes that cannot be classified because of flexible contracts. The distribution of increases and decreases among treatments is shown in Table 6.

TABLE 6 Contract changes.

	Control (T1)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	All
Treatment size	8448	8436	8464	8436	33,784
Contribution increases	170	195	201	159	725
Rate of contribution increases	2.01%	2.31%	2.37%	1.88%	2.15%
Contribution decreases	43	42	37	45	167
Rate of contribution decreases	0.51%	0.50%	0.44%	0.53%	0.49%

Note: This table shows the treatment size, the contribution increases or decreases and the respective rates, by treatment.

Of the 33,784 participants, 725 (2.15%) increased their pension contributions in the months following the intervention (opted to a higher class), while only 167 (0.49%) reduced their pension contributions (opted to a lower class). An increase is generally more likely than a decrease. Moreover, the higher postcard response rate (6.03%) shows that the intention to increase contributions does not yet correspond to the implementation of this plan. However, this is not surprising, as Choi et al. (2002) reveal that most people think their savings rate is too low, but only few intend to increase their savings rate and even fewer actually do so.

To test for significant differences in increases or decreases between treatments, we perform a series of probit regressions, which is a good fit for our data because increases and decreases are both binary dependent variables. We report the marginal probability changes for an increase or a decrease in Table 7.⁹ Model (1) of Table 7 shows the results of a probit regression, in which we aggregate the different treatments T2, T3, and T4 into one explanatory variable, which is equal to 1 if a participant had received any inflation-related information (T2–T4) and 0 otherwise (T1). Along with the main regression results of the treatment effects, we report statistics for several control variables. The results reveal that exposing participants to inflation information has a positive but nonsignificant impact on the likelihood of increasing pension contributions ($\Delta = +0.20\%$, $p = 0.2370$). Model (2) of Table 7 shows the marginal changes of the probability of an increase from the control treatment T1 to the different inflation treatments T2–T4, separately. The results show that only the overall effect treatment (T3) has a significant positive effect on an increase ($\Delta = +0.38\%$, $p = 0.0771$). The result 0.38 should be interpreted as a 0.38% increase in the probability of increasing pension contributions if the participant received the overall effect treatment (T3) compared with the control treatment (T1). Models (3) and (4) are similar to Models (1) and (2), but they measure the effect on a decrease in pension contributions and do not reveal any significant effects, thus indicating that providing inflation information does not motivate people to decrease their pension contributions.

As the effects are mostly positive in Models (1) and (2) and positively significant in one case, we conclude that people are not fully aware of the effects of inflation on their future pension payments and therefore rather increase their contributions to compensate for the pension gap. An explanation for the rather low statistical significance of the effect size in Models (1) and (2) could be that many participants might not have read our letters, as they were part of the fund's

⁹We also performed a multinomial probit regression that leads to comparable results but chose to display the results of the simple probit models as they are easier to interpret.

TABLE 7 Effect of inflation information on likelihood of increasing or decreasing pension contributions.

	Increase		Decrease	
	(1)	(2)	(3)	(4)
Inflation information (T2–T4)	0.20 (0.17)		–0.01 (0.09)	
Annual effect treatment (T2)		0.28 (0.21)		–0.00 (0.11)
Overall effect treatment (T3)		0.38* (0.22)		–0.06 (0.10)
Personal effect treatment (T4)		–0.05 (0.21)		0.04 (0.11)
<i>Controls</i>				
Age	0.14*** (0.04)	0.14*** (0.04)	0.04** (0.02)	0.04** (0.02)
Female	0.02 (0.17)	0.02 (0.17)	–0.03 (0.09)	–0.03 (0.09)
German	1.29*** (0.20)	1.29*** (0.20)	0.04 (0.13)	0.05 (0.13)
Membership length	0.02 (0.02)	0.02 (0.02)	–0.02 (0.01)	–0.02 (0.01)
Self-employment	1.58*** (0.21)	1.58*** (0.21)	–0.45*** (0.12)	–0.45*** (0.12)
Returned postcard	8.46*** (0.64)	8.45*** (0.64)	–0.03 (0.15)	–0.03 (0.15)
Pension today	0.98 (0.85)	0.97 (0.84)	0.36 (0.40)	0.36 (0.40)
Expected pension at retirement	3.07*** (0.81)	3.06*** (0.81)	0.90** (0.40)	0.90** (0.40)
PV(expected pension at retirement)	–4.98*** (1.26)	–4.97*** (1.26)	–1.43** (0.64)	–1.43** (0.64)
ln(cumulative savings until 2018)	–0.04 (0.05)	–0.04 (0.05)	0.06* (0.04)	0.06* (0.04)
ln(savings in 2018)	0.16 (0.12)	0.16 (0.12)	–0.01 (0.02)	–0.01 (0.02)
log-likelihood	–3130.76	–3128.54	–1028.68	–1028.22

TABLE 7 (Continued)

	Increase		Decrease	
	(1)	(2)	(3)	(4)
Observations	33,784	33,784	33,784	33,784
Pseudo R^2	10.61	10.67	2.34	2.38

Note: This table shows mean marginal effects of inflation treatment dummies (T2–T4) on the likelihood of increasing or decreasing pension contributions among all participants; the control treatment (T1) is the base category. Mean marginal effects are displayed in percent. Control variables include age, gender, nationality, years of fund membership, self-employment, whether the participant returned the postcard, projected pension benefits if contributions stop today in 1000 €, projected pension benefits if contributions stop at statutory retirement age in 1000 €, present value of the projected pension benefits if contributions stop at statutory retirement age in 1000 €, log cumulative contributions until 2018, and log cumulative contributions in 2018. Robust standard errors are provided in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

annual communication, which normally does not include any new information. Furthermore, the effort needed to enter a new contract to increase pension contributions could deter participants due to their inertia. As Madrian and Shea (2001) show in a field study, employees tend to stick to the status quo in retirement plans and hesitate to change their contributions. Additionally, Sethi-Iyengar et al. (2004) find that too many options in retirement plans negatively affect the contribution rates. This could also have an effect here because the participants have several contracts to choose from, including variable contracts in which the participant can choose any amount in a given range.

3.2 | Effects among voluntary contract changes

To exclude any effects of inertia or participants being overwhelmed by too many options, we now focus our analysis on participants who voluntarily changed their contract structure in the months after the treatment. As all of these participants changed their pension contributions, we believe that they all made an informed decision about increasing or decreasing their contribution rate or maintaining the status quo in case of an occupation change. We thus intentionally focus on the participants who provably have been concerned with their old-age provisions even though this means that the following results are not a pure randomized effect.¹⁰

Model (1) of Table 8 confirms our conjecture and shows that the provision of inflation information is a much stronger predictor of the likelihood of increasing pension contributions among voluntary contract changes than in the main sample: The provision of inflation information increases the likelihood of increasing pension contributions significantly ($\Delta = +9.92\%$, $p = 0.0007$). This effect clearly supports the hypothesis that the awareness of inflation effects on pension payments increases pension contributions (H1). Model (2) of

¹⁰Table A1 in the appendix displays summary statistics for the different treatments in this subsample. There are no significant differences in demographics between treatments so that we can rule out a selection bias. Furthermore, compared to the overall sample (see Table 3) the participants in this subsample are on average older, more likely to be self-employed and a higher fraction has returned the postcard. This is in line with our later findings in Section 3.3 that older and self-employed participants are more likely to be concerned with their retirement savings.

TABLE 8 Effect of inflation information on likelihood of increasing or decreasing pension contributions among voluntary contract changes.

	Increase		Decrease	
	(1)	(2)	(3)	(4)
Inflation information (T2–T4)	9.92*** (2.92)		−0.32 (2.00)	
Annual effect treatment (T2)		10.08*** (3.52)		−0.79 (2.39)
Overall effect treatment (T3)		11.52*** (3.57)		−1.91 (2.40)
Personal effect treatment (T4)		8.00** (3.72)		1.95 (2.64)
<i>Controls</i>				
Age	1.84*** (0.64)	1.80*** (0.64)	0.49 (0.42)	0.53 (0.42)
Female	0.79 (2.82)	0.82 (2.82)	−2.64 (1.96)	−2.63 (1.95)
German	15.02** (5.90)	14.98** (5.89)	−7.09 (4.44)	−7.00 (4.42)
Membership length	0.19 (0.45)	0.19 (0.45)	−0.26 (0.31)	−0.27 (0.31)
Self-employment	15.43*** (2.74)	15.39*** (2.74)	3.15 (1.93)	3.21* (1.92)
Returned postcard	30.36*** (2.88)	30.31*** (2.89)	−10.25*** (1.61)	−10.21*** (1.62)
Pension today	11.64 (14.56)	11.77 (14.62)	2.99 (10.00)	3.10 (10.04)
Expected pension at retirement	38.00*** (13.12)	37.41*** (13.12)	13.78 (9.12)	14.49 (9.08)
PV(expected pension at retirement)	−56.78*** (21.28)	−56.08*** (21.33)	−20.21 (14.93)	−21.05 (14.87)
ln(cumulative savings until 2018)	−3.19*** (1.11)	−3.11*** (1.11)	2.31 (1.64)	2.13 (1.51)
ln(savings in 2018)	5.84** (2.62)	5.83** (2.57)	0.80 (0.93)	0.78 (0.96)
log-likelihood	−779.37	−778.92	−441.71	−440.54

TABLE 8 (Continued)

	Increase		Decrease	
	(1)	(2)	(3)	(4)
Observations	1285	1285	1285	1285
Pseudo R^2	11.75	11.80	5.84	6.09

Note: This table shows mean marginal effects of inflation treatment dummies (T2–T4) on the likelihood of increasing or decreasing pension contributions among members who voluntarily changed their contract structure; the control treatment (T1) is the base category. Mean marginal effects are displayed in percent. Control variables include age, gender, nationality, years of fund membership, self-employment, whether the participant returned the postcard, projected pension benefits if contributions stop today in 1000 €, projected pension benefits if contributions stop at statutory retirement age in 1000 €, present value of the projected pension benefits if contributions stop at statutory retirement age in 1000 €, log cumulative contributions until 2018, and log cumulative contributions in 2018. Robust standard errors are provided in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Table 8 breaks down the main effect into the individual treatment effects. The coefficients are all positive and highly significant. The annual effect treatment (T2) and the overall effect treatment (T3) are both significant at the 1% level, with T3 having the highest effect ($\Delta = +11.52\%$, $p = 0.0013$), whereas the personal effect treatment (T4) has the lowest effect ($\Delta = +8.00\%$, $p = 0.0315$) but is still significant at the 5% level. Models (3) and (4) again reveal no significant effect of the provided inflation information on decreased pension contributions. The coefficients of the probit regressions are all close to zero and thereby stand in stark contrast to the effects on an increase.

Given that the provision of inflation information induces a shift in the base probability of increasing pension contributions indicates that participants were not sufficiently aware of the effects of inflation on their projected pension payments and thus suffer from money illusion. Therefore, they are willing to save more today to receive a higher pension in the future, which can be explained by a tendency to smooth income over time to smooth consumption (Friedman, 1957; Hall, 1978). A greater preference for a smooth consumption stream over time can be explained by a rather low elasticity of intertemporal substitution (EIS). The EIS determines how an individual adjusts one's consumption to a change in the real interest rate (Hall, 1988). Of course, our study did not affect the real interest rate in the economy, but reminding a participant who suffers from money illusion of inflation should have a negative effect on his subjective estimate of the real interest rate. If the participant reduces consumption today and makes higher savings for the future in response to a decrease in his perceived real interest rate, this speaks in favor of a low EIS. The income effect dominates the substitution effect in this case and the participant is willing to forgo consumption today to save more for the future and increase future consumption.

The coefficient of the overall effect treatment (T3) is 1.44% larger than the coefficient of the annual effect treatment (T2). However, a Wald test ($\chi^2 = 0.17$, $p = 0.6837$) reveals that the difference between the two coefficients is not significantly different from zero. We therefore find no support for our second hypothesis that aggregating the effects of the inflation rate further increases pension contributions in comparison to a mere statement of the inflation rate.

We also perform a Wald test to examine whether the personalization of inflation information (T4) has a positive influence on pension contributions in comparison to a generic overall presentation of inflation effects (T3). Again, we find no significant difference between the regression coefficients T3 and T4 ($\chi^2 = 0.88$, $p = 0.3474$). Our third hypothesis is therefore

also not supported by the regression results. So, our results indicate that providing participants with inflation information encourages them to increase their pension contributions; however, there is no evidence that the type of the communication has an influence as well. This indicates the existence of money illusion among our participants as they do not appear to consider effects of inflation and rather think in nominal terms. However, on informing them of inflation, they can understand its effects on their expected pension payments and then need no help in calculating the exact monetary ramifications. Therefore, it is enough to point out inflation to the participants so that they act on this information. It should be noted, however, that the participants were encouraged to increase their pension contributions in all four treatments, including the control treatment. We therefore measure the effect whether the provision of inflation information increases the likelihood to increase pension contributions, given the encouragement to increase contributions. We do not know whether we would have observed the same effects if we only had provided the inflation information without an encouragement to increase contributions.

3.3 | Limitations

Surprisingly, T4 does not have the largest effect size among our treatments. To understand this phenomenon, we focus on the special characteristics of our sample. Most of the participants in our sample are active physicians, who tend to have an above-average income, which is also reflected in above-average pension expectations. The average pension payment in Germany in 2018 was €906 per month (Deutsche Rentenversicherung, 2019). This is only a fraction of the average pension benefits of the members of the physician's pension fund, which amounted to €2576 in 2018 according to the fund's annual report. A higher expected pension reduces the probability of old-age poverty. We therefore assume that the higher the real purchasing power of the participants' projected pension payments, the less alarming it is for them to see this number as in T4 and the less likely they will act on this information in terms of increasing their pension contributions. The marginal effect of the present value of the expected pension at retirement in Model (1) supports this argumentation, as it is negative and statistically significant ($\Delta = -56.78\%$, $p = -0.0076$). So for €1000 more that the participants can expect in real purchasing power at retirement, the likelihood of increasing pension contributions decreases by nearly 57%. Therefore, we suspect that T4 should have a higher effect if the projected pension payments of the physicians were not that exceptionally high.

Additionally, the degree of financial literacy among our participants should be considered. Several surveys provide evidence that financial planning for retirement is positively correlated with financial literacy, which in turn is highly correlated with education (Behrman et al., 2012; Bucher-Koenen & Lusardi, 2011; Clark et al., 2017; Klapper & Panos, 2011; Lusardi & Mitchell, 2017; Van Rooij et al., 2011). The participants in our sample are, on average, highly educated, which should result in a higher degree of financial literacy among the participants than among the general population. Whether this has a positive or negative effect on our general effect size is not obvious. On the one hand, higher financial literacy leads to a higher degree of financial planning for retirement, which includes considering inflation effects. Individuals with higher levels of financial literacy were shown to have more realistic inflation expectations and longer financial planning horizons (Bruine de Bruin et al., 2010). If participants have already thought about inflation in their retirement planning, they should be less surprised by the information provided, which should reduce the effect size. On the other

hand, higher financial literacy is interlinked with a better understanding of inflation effects so that the participants can better assess the detrimental effects of inflation on their pension payments, which should increase the effect size.

As we cannot distinguish between participants who are more or less financially literate in our sample, we cannot directly determine the dominant effect. However, two other control variables correlated with financial literacy can be observed: age and self-employment. It is well

TABLE 9 Effect of inflation information on likelihood of increasing pension contributions among voluntary contract changes for different subgroups.

	Age			Self-employed	
	≤35	36–50	51–65	No	Yes
Inflation information (T2–T4)	0.33 (7.90)	9.54* (5.17)	10.94*** (3.83)	5.73 (3.96)	12.61*** (4.17)
<i>Controls</i>					
Age				2.69*** (0.82)	–2.43** (1.21)
Female	–21.77** (9.11)	1.78 (4.73)	0.46 (3.78)	–7.09* (3.81)	8.71** (4.13)
German	–5.48 (11.82)	18.13** (7.57)	11.84 (11.00)	8.14 (6.66)	26.62*** (10.09)
Membership length	1.45 (6.18)	2.02* (1.08)	0.17 (0.53)	0.33 (0.68)	–0.96 (0.69)
Self-employment	Not estimable ^a	16.70*** (4.61)	14.77*** (3.58)		
Returned postcard	44.48*** (10.88)	30.31*** (5.83)	28.21*** (3.43)	39.00*** (4.09)	21.02*** (4.11)
Pension today	–74.06 (101.03)	–25.03 (27.86)	12.46 (22.27)	–9.97 (22.77)	70.70*** (22.58)
Expected pension at retirement	86.27 (64.13)	–24.69 (16.61)	21.20** (9.71)	46.50** (18.27)	–30.29 (23.36)
PV(expected pension at retirement)	–84.43 (131.46)	48.69 (36.06)	–38.52* (23.26)	–51.18 (32.61)	–32.69 (32.05)
ln(cumulative savings until 2018)	–0.90 (1.70)	–3.88 (2.37)	–2.57 (1.77)	–3.37** (1.25)	19.51** (8.05)
ln(savings in 2018)	0.13 (2.82)	3.95 (3.43)	16.96*** (4.59)	4.29* (2.47)	13.12*** (4.58)
log-likelihood	–47.36	–274.41	–432.51	–397.12	–359.04

(Continues)

TABLE 9 (Continued)

	Age			Self-employed	
	≤35	36–50	51–65	No	Yes
Observations	101	450	734	666	619
Pseudo R^2	30.57	11.92	11.27	13.75	10.86

Note: This table shows mean marginal effects of inflation treatment dummies (T2–T4) on the likelihood of increasing pension contributions among members who voluntarily changed their contract structure for different age and employment groups; the control treatment (T1) is the base category. Mean marginal effects are displayed in percent. Control variables include age, gender, nationality, years of fund membership, self-employment, whether the participant returned the postcard, projected pension benefits if contributions stop today in 1000 €, projected pension benefits if contributions stop at statutory retirement age in 1000 €, present value of the projected pension benefits if contributions stop at statutory retirement age in 1000 €, log cumulative contributions until 2018, and log cumulative contributions in 2018. Robust standard errors are provided in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

^aThere are only 8 self-employed participants in the subgroup 35 and younger out of which none increased their pension contributions. Therefore, the coefficient is not estimable and the control variable self-employment is dropped in this subgroup.

established that financial literacy has a hump-shaped pattern over age, with the age groups 36–50 years and 51–65 years performing the best (Arrondel et al., 2013; Bucher-Koenen & Lusardi, 2011; Fornero & Monticone, 2011; Lusardi & Mitchell, 2011b). Regarding employment status, self-employed people have on average higher financial literacy (Agnew et al., 2013; Bucher-Koenen & Lusardi, 2011; Fornero & Monticone, 2011). We, therefore, have two proxies for financial literacy in age and self-employment. To measure the influence of financial literacy on our effect size, we perform our standard probit regression Model (1) for five subsamples: three age groups typically used in financial literacy literature (age ≤35, age 36–50, age 51–65), as well as self-employed and non-self-employed participants. Table 9 provides the results of these regressions.

Surprisingly, we find no effect of the inflation information on participants younger than 36 years. This is remarkable as these participants are the farthest away from their retirement, which means that inflation and correspondingly an increase in pension contributions would have the highest impact for this subgroup. On the other hand, members in this age group are more financially constrained which might explain their lack of reaction to the treatment. The treatment effects for the two older subsamples are similar to the effect in the overall sample ($\Delta = +9.92\%$, $p = 0.0007$) and both are statistically significant. As these two older subsamples should have higher financial literacy, this indicates a positive relation between financial literacy and effect size.

When we differentiate between employment status, the effect size is found to be much smaller and insignificant for nonself-employed participants ($\Delta = +5.73\%$, $p = 0.1481$) than for self-employed participants ($\Delta = +12.60\%$, $p = 0.0025$). As self-employed participants are normally more financially literate, we find again support for a positive relation between financial literacy and effect size.

We therefore conclude that the high degree of financial literacy among our participants has a positive influence on the effect size as they can better understand the effect of inflation on the purchasing power of their pension, which strengthens their urge to act on this information. Furthermore, a better understanding of inflation effects might explain the absence of significant differences between our treatments as the participants do not need explicit calculations to understand the effect of inflation on their pension payments, which makes T2

already alarming enough to elicit a reaction. Consequently, the special characteristics of our sample, that is, the high pension expectations and education should be considered when interpreting the results of our field experiment.

4 | CONCLUSION

We conduct a field experiment in cooperation with a major German pension fund to study how the provision of inflation information affects pension contributions. The annual pension statements the fund sends to its members normally do not contain any inflation information and the projected pension benefits are presented in nominal terms only. We change this by sending complementary information letters with the annual pension statements, explaining how inflation deteriorates the purchasing power of the projected pension benefits. We find that the provision of inflation information increases the likelihood to increase pension contributions voluntarily by about 10%.

We also explore methods for conveying inflation information. Anecdotal evidence suggests that if pension funds convey inflation information, they often only indicate the inconspicuous future annual inflation rate. Along with this communication style, we test whether explicitly communicating the loss in purchasing power until entering retirement in general terms and for the personal case has a different influence. No significant differences were found between our treatments; thus, we conclude that it is sufficient to broadly convey the effects of inflation to motivate the participants to increase their pension contributions. The severity of money illusion among the participants appears relatively low, as it is unnecessary to provide explicit calculations on how the inflation will affect their pension. This further underlines the importance of our findings for policy making because it would be a relatively small effort for pension funds to provide some general inflation information compared to calculating the explicit loss in purchasing power for every fund member.

We conclude that providing inflation information is an important determinant in retirement planning. Our study shows that the provision of inflation information can be beneficial to both individuals and pension funds: It empowers individuals to recognize the pension shortfall induced by the value-deteriorating effects of inflation. In turn, this increases pension contributions and the fund's assets under management. We argue that institutions should (be mandated to) provide inflation information to individuals in retirement planning. Considering the recent sharp rise in inflation rates and the corresponding dramatic effect on future pension's purchasing power, this issue has gained further importance. Additionally, our results suggest that the response to inflation information depends on the degree of financial literacy among the audience. In our highly educated sample, the effect size is weaker when people are less financially literate. Therefore, it could be necessary to be much more explicit with the general public when communicating inflation information. Hence, common standards in the communication approach remain to be developed.

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APPENDIX A: ADDITIONAL TABLES

See Table A1.

See Table A2.

See Table A3.

TABLE A1 Treatment characteristics subsample.

	Control (T1)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	p-value
Age (in years)	50.14	50.34	51.22	50.39	0.44
Female (1 = yes)	0.47	0.48	0.47	0.47	0.98
German (1 = yes)	0.93	0.93	0.96	0.95	0.50
Membership (in years)	19.93	20.65	20.67	20.57	0.74
Self-employment (1 = yes)	0.49	0.47	0.49	0.48	0.95
Returned postcard (1 = yes)	0.23	0.24	0.22	0.18	0.28
Pension today (in €)	11295.02	1338.37	1314.34	1351.50	0.80
Expected pension at retirement (in €)	2682.28	2717.49	2637.67	2741.81	0.32
PV(expected pension at retirement) (in €)	2026.69	2053.41	2018.77	2077.30	0.73
Cumulative contributions until 2018 (in €)	176,184.74	183,180.67	179,593.65	185,027.32	0.69
Cumulative contributions in 2018 (in €)	13,626.88	12,995.57	13,813.09	13,450.59	0.15
Number of participants	347	331	326	282	

Note: This table shows mean demographics of control variables, by treatments among members who voluntarily changed their contract structure. The rightmost column shows *p*-values of one-way ANOVAs that test whether the control variables are different among treatments.

TABLE A2 Effect of inflation information on survey responses.

Dependent variable	Model class	Inflation info. (T2–T5)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	Uncertain effect (T5)	Constant & Controls	Observations	(Pseudo) R ²
(1) The content of the annual pension statement is easy to understand.	OLS	0.2129 (0.1904)	0.1910 (0.2299)	0.4386** (0.2197)	0.2206 (0.2362)	-0.0552 (0.2691)	yes	384	0.0642
(2) The amount of information in the annual pension statement is <i>too low</i> .	Probit	0.0600 (0.0533)	-0.0537 (0.0641)	0.0587 (0.0697)	0.0738 (0.0767)	0.2066*** (0.0789)	yes	384	0.0423
(3) I use the fund's online portal regularly to inform myself about my pension benefits.	OLS	0.1352 (0.1605)	-0.0118 (0.1894)	0.1284 (0.2202)	0.2730 (0.2419)	0.2105 (0.2182)	yes	384	0.0382
(4) Inflation is an important factor in my retirement planning.	OLS	-0.0002 (0.2081)	-0.1576 (0.2727)	0.0225 (0.2599)	0.1715 (0.2750)	0.0177 (0.2968)	yes	384	0.0411
(5) I would appreciate inflation information in the annual pension statement.	OLS	0.3537* (0.1975)	0.1585 (0.2707)	0.3498 (0.2399)	0.4900** (0.2489)	0.4940* (0.2638)	yes	384	0.0851
	OLS						yes	384	0.0903

(Continues)

TABLE A2 (Continued)

Dependent variable	Model class	Inflation info. (T2–T5)	Annual effect (T2)	Overall effect (T3)	Personal effect (T4)	Uncertain effect (T5)	Constant & Controls	Observations	(Pseudo) R ²
(6) If expected inflation rates increase, it is sensible to save more money for retirement.	OLS	0.7361*** (0.1914)	0.5825** (0.2437)	1.0358*** (0.2234)	0.6723*** (0.2442)	0.6284** (0.2693)	yes	384	0.0714
(7) I am planning to increase my pension contributions within the next 6 months.	Probit	0.0493** (0.0226)	0.0103 (0.0259)	0.0776** (0.0386)	0.0734* (0.0427)	0.0445 (0.0370)	yes	384	0.0706
(8) I am certain that I will actually implement the answer given in the previous question.	OLS	-0.2712** (0.1349)	-0.3408* (0.1942)	-0.0906 (0.1797)	-0.3402* (0.2020)	-0.3377* (0.2024)	yes	384	0.0669
(9) I am planning to enter retirement before I will reach statutory retirement age.	OLS	0.1951 (0.2516)	0.3874 (0.3015)	-0.1262 (0.3297)	0.7327** (0.3536)	-0.1984 (0.3627)	yes	384	0.0662

Note: This table shows regression coefficients and mean marginal effects of inflation information dummies (T2–T5) on survey responses; the control treatment (T1) is the base category. The dependent variables of the OLS regressions are ordinal 7-point Likert scales. Control variables include age, gender, nationality, years of fund membership, projected pension benefits if contributions stop at statutory retirement age, log cumulative contributions until 2016, log cumulative contributions in 2016, a dummy for whether the participant was affected by the opt-out policy change in December 2015, a wave dummy, and the date of survey participation. Robust standard errors are provided in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

TABLE A3 Effect of inflation information on likelihood of increasing pension contributions excluding participants with invitation to survey.

	Full sample		Voluntary contract changes	
	(1)	(2)	(3)	(4)
Inflation information (T2–T4)	0.33 (0.20)		9.26*** (3.25)	
Annual effect treatment (T2)		0.27 (0.25)		7.04* (3.91)
Overall effect treatment (T3)		0.57** (0.26)		12.38*** (3.98)
Personal effect treatment (T4)		0.14 (0.25)		8.42** (4.11)
<i>Controls</i>				
Age	0.17*** (0.04)	0.17*** (0.04)	2.03*** (0.69)	1.95*** (0.69)
Female	−0.02 (0.20)	−0.02 (0.20)	−0.61 (3.11)	−0.53 (3.11)
German	1.34*** (0.24)	1.34*** (0.24)	12.81** (6.35)	12.52** (6.35)
Membership length	0.01 (0.03)	0.01 (0.03)	0.16 (0.51)	0.16 (0.52)
Self-employment	2.33*** (0.28)	2.33*** (0.27)	19.56*** (3.04)	19.54*** (3.04)
Returned postcard	7.62*** (0.67)	7.63*** (0.67)	28.12*** (3.30)	28.10*** (3.31)
Pension today	1.13 (0.99)	1.13 (0.99)	8.18 (16.27)	8.53 (16.42)
Expected pension at retirement	3.90*** (0.96)	3.88*** (0.96)	39.16*** (14.66)	38.13*** (14.69)
PV(expected pension at retirement)	−6.08*** (1.54)	−6.06*** (1.54)	−58.18** (24.51)	−57.10** (24.68)
ln(cumulative savings until 2018)	−0.05 (0.05)	−0.05 (0.05)	−2.99*** (1.11)	−2.87** (1.11)
ln(savings in 2018)	0.26 (0.16)	0.26 (0.16)	6.26** (2.88)	6.27** (2.77)

(Continues)

TABLE A3 (Continued)

	Full sample		Voluntary contract changes	
	(1)	(2)	(3)	(4)
log-likelihood	-2468.41	-2466.99	-621.82	-620.87
Observations	25,625	25,625	1037	1037
Pseudo R ²	11.86	11.91	12.72	12.85

Note: This table shows mean marginal effects of inflation treatment dummies (T2–T4) on the likelihood of increasing pension contributions among all members and the members who voluntarily changed their contract structure, excluding participants who received the invitation to the online survey; the control treatment (T1) is the base category. Mean marginal effects are displayed in percent. Control variables include age, gender, nationality, years of fund membership, self-employment, whether the participant returned the postcard, projected pension benefits if contributions stop today in 1000 €, projected pension benefits if contributions stop at statutory retirement age in 1000 €, present value of the projected pension benefits if contributions stop at statutory retirement age in 1000 €, log cumulative contributions until 2018, and log cumulative contributions in 2018. Robust standard errors are provided in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

APPENDIX B: PRECEDING SURVEY INVITATION LETTERS (TRANSLATED FROM GERMAN)

Base letter for control treatment (P1):

[Official letterhead of the fund and contact details of the service department]

How happy are you with our annual pension statements?

Dear Mrs. [...],

We are continuously working on guaranteeing and improving the satisfaction of our members with our services.

In June 2016, we sent you your annual pension statement. Among other things, this statement informed you about your projected pension benefits if you retire at the statutory retirement age (in the year 2036). To improve the understandability of the annual pension statements and to respond to the needs of our members, we invite you to participate in a short online survey.

The survey only takes about 2–3 min. For every response, our scientific research partner *[university name and department]* will donate €1 to the charitable organization “Médecins sans Frontières.”

[Text module for additional information in inflation treatments]

Please go to *[internet address]* to participate in the survey. Alternatively, you can participate in the survey by scanning the following QR-code with your smartphone or tablet computer:

[QR-code]

For validating the donation to “Médecins sans Frontières,” please enter the following code at the beginning of the survey: [code]

Your answers will be treated anonymously and with strict confidentiality. Thank you for your participation.

Kind regards,

[Fund name]

Text module in annual effect treatment (P2, assumptions: €1000 projected monthly pension benefits when retiring in 2036):

In the survey, we are particularly interested in the question whether you would appreciate the provision of information on the expected purchasing power of your projected pension benefits. Here is some background information:

- The general price level is increasing from year to year. In the past 25 years, the average inflation rate in Germany was about 1.8% per year (which is in line with the inflation target of the European Central Bank).
- If future inflation remains at 1.8% per year, you will need to spend 1.8% more money per year if you want to be able to afford your current living standard in the future. In other words, your projected pension benefits will lose 1.8% of purchasing power every year until you reach statutory retirement age in the year 2036.

Text module in overall effect treatment (P3, assumptions: €1000 projected monthly pension benefits when retiring in 2036):

In the survey, we are particularly interested in the question whether you would appreciate the provision of information on the expected purchasing power of your projected pension benefits. Here is some background information:

- The general price level is increasing from year to year. In the past 25 years, the average inflation rate in Germany was about 1.8% per year (which is in line with the inflation target of the European Central Bank).
- If future inflation remains at 1.8% per year, you will need to spend 1.43 times more money than today if you want to be able to afford your current living standard when you reach statutory retirement age in the

year 2036. In other words, €100.00 will only have a real purchasing power of €69.91 then (in terms of today's price level).

Text module in personal effect treatment (P4, assumptions: €1000 projected monthly pension benefits when retiring in 2036):

In the survey, we are particularly interested in the question whether you would appreciate the provision of information on the expected purchasing power of your projected pension benefits. Here is some background information:

- The general price level is increasing from year to year. In the past 25 years, the average inflation rate in Germany was about 1.8% per year (which is in line with the inflation target of the European Central Bank).
- If future inflation remains at 1.8% per year, you will need to spend 1.43 times more money than today if you want to be able to afford your current living standard when you reach statutory retirement age in the year 2036. In other words, your projected pension benefits of €1000 per month will only have a real purchasing power of €699.91 then (in terms of today's price level).

Text module in uncertain effect treatment (P5, assumptions: €1000 projected monthly pension benefits when retiring in 2036):

In the survey, we are particularly interested in the question whether you would appreciate the provision of information on the expected purchasing power of your projected pension benefits. Here is some background information:

- The general price level is increasing from year to year. In the past 25 years, the average inflation rate in Germany was about 1.8% per year (which is in line with the inflation target of the European Central Bank).
- If future inflation remains at 1.8% per year, you will need to spend 1.43 times more money than today if you want to be able to afford your current living standard when you reach statutory retirement age in the year 2036. In other words, your projected pension benefits of €1000 per month will only have a real purchasing power of €699.91 then (in terms of today's price level).
- The following table shows the real purchasing of your projected pension benefits at the time you reach statutory retirement age for various inflation rates:

Assumed inflation rate until 2036 (p.a.)	0%	1%	2%	3%	4%
Overall increase of price level (today = 1.00)	1.00	1.22	1.49	1.81	2.19
Purchasing power of your projected pension benefits (in terms of today's price level)	€1,000.00	€819.55	€672.97	€553.68	€456.39

APPENDIX C: SURVEY QUESTIONNAIRE (TRANSLATED FROM GERMAN)

Thank you for participating in our survey!

For every response, our scientific research partner [university name and department] will donate €1 to the charity organization “Médecins sans Frontières”.

Code for validating the donation (at the bottom of the letter):

Please rate the following statements about the fund’s annual pension statements:

	I don't agree at all						I agree entirely
	1	2	3	4	5	6	7
1. The content of the annual pension statement is easy to understand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. The amount of information in the annual pension statement is...	<input type="radio"/> too low <input type="radio"/> exactly right <input type="radio"/> too high						
3. I use the fund’s online platform regularly to inform myself about my pension benefits.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Inflation is an important factor in my retirement planning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I would appreciate inflation information in the annual pension statement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. If expected inflation rates increase, it is sensible to save more money for retirement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Within the next six months, I am planning to...	<input type="radio"/> decrease my pension contributions <input type="radio"/> keep my pension contributions unchanged <input type="radio"/> increase my pension contributions						
8. I am certain that I will actually implement the answer given in the previous question.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I am planning to enter retirement before I will reach statutory retirement age.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(Optional) Please tell us your opinion about the annual pension statements:

APPENDIX D: MAIN FIELD STUDY INFORMATION LETTERS (TRANSLATED FROM GERMAN)

Base letter without treatment-specific information:

[Official letterhead of the fund]

Improve your pension benefits

Dear Mrs. [...],

As a member of *[Fund name]* you have the opportunity to increase your pension contributions and thus improve your pension entitlement. There are good reasons for this:

[Text module for additional information in different treatments]

If you are interested in increasing your pension contributions, please fill out the enclosed reply card and return it to us.

Your *[Fund name]*

[Fund name]

Text module in control treatment (T1):

- Compensation of a possible “pension gap”
- An attractive interest rate and reliable capital management
- Low management fees, no commissions
- Tax deductibility of contributions (within the maximum amounts)
- Improved cover for occupational disability—without a health check

Text module in annual effect treatment (T2, assumptions: €1000 projected monthly pension benefits when retiring in 2038):

Inflation

The amounts calculated in the annual pension statements—similar to all other later income—cannot be compared with a current income of this amount (loss of purchasing power) due to the increase in the cost of living and the associated depreciation of money in its purchasing power. Often, this loss of purchasing power

is not sufficiently considered when planning retirement provisions. Over the past 30 years, the cost of living in Germany has risen by an average of 1.8% per year. If this development continues until the start of your regular retirement pension in the year 2038, your previously acquired pension entitlement will lose 1.8% of purchasing power each year. You can compensate for a possible “pension gap” by increasing your pension contributions.

Furthermore, an increase in pension contributions has the following advantages:

- An attractive interest rate and reliable capital management
- Low management fees, no commissions
- Tax deductibility of contributions (within the maximum amounts)
- Improved cover for occupational disability—without a health check

Text module in overall effect treatment (T3, assumptions: €1000 projected monthly pension benefits when retiring in 2038):

Inflation

The amounts calculated in the annual pension statements—similar to all other later income—cannot be compared with a current income of this amount (loss of purchasing power) due to the increase in the cost of living and the associated depreciation of money in its purchasing power. Often, this loss of purchasing power is not sufficiently considered when planning retirement provisions. Over the past 30 years, the cost of living in Germany has risen by an average of 1.8% per year. If this development continues until the start of your regular retirement pension in the year 2038, €100 will only have a purchasing power of €69.91 (measured at the current price level). You can compensate for a possible “pension gap” by increasing your pension contributions.

Furthermore, an increase in pension contributions has the following advantages:

- An attractive interest rate and reliable capital management
- Low management fees, no commissions
- Tax deductibility of contributions (within the maximum amounts)
- Improved cover for occupational disability—without a health check

Text module in personal effect treatment (T4, assumptions: €1000 projected monthly pension benefits when retiring in 2038):

Inflation

The amounts calculated in the annual pension statements—similar to all other later income—cannot be compared with a current income of this amount (loss of purchasing power) due to the increase in the cost of living and the associated depreciation of

money in its purchasing power. Often, this loss of purchasing power is not sufficiently considered when planning retirement provisions. Over the past 30 years, the cost of living in Germany has risen by an average of 1.8% per year. If this development continues until the start of your regular retirement pension in the year 2038, your projected pension payments of €1000 from the basic pension plan, for example, will only have a purchasing power of €699.91 (measured at the current price level). You can compensate for a possible “pension gap” by increasing your pension contributions.

Furthermore, an increase in pension contributions has the following advantages:

- An attractive interest rate and reliable capital management
- Low management fees, no commissions
- Tax deductibility of contributions (within the maximum amounts)
- Improved cover for occupational disability—without a health check