Inflation and Trading*

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January 17, 2025

Abstract

We study how investors respond to inflation combining a customized survey experiment with trading data at a time of historically high inflation. Investors' beliefs about the stock return-inflation relation are very heterogeneous in the cross section and on average too optimistic. Moreover, many investors appear unaware of inflation-hedging strategies despite being otherwise well-informed about inflation rates and asset returns. Consequently, whereas exogenous shifts in inflation expectations do not impact return expectations, information on past returns during periods of high inflation leads to negative updating about the perceived stock-return impact of inflation, which feeds into return expectations and subsequent actual trading behavior.

JEL codes: C93, D14, D83, D84, E22, E31, E44, G11, G51
Keywords: Belief Formation, Field Experiment, Inflation, Trading

*We thank our partners at a bank for their collaboration and the data necessary to conduct this research. The bank data were obtained under a non-disclosure agreement. The bank did not review the results of the paper prior to public dissemination. We are also grateful for helpful comments from Peter Andre, Ricardo De la O, Wolfram Horn, Pascal Kieren, Tarun Ramadorai, Philipp Schirmer, and Johannes Wohlfart, and from conference and seminar participants at Carnegie Mellon University, Goethe University Frankfurt, Leibniz Institute for Financial Research SAFE, Penn State, Purdue University, Stanford G53 Network, University of Notre Dame, the 1st Alpine Finance Summit, 2024 Behavioral Finance and Accounting Conference, 2024 Financial Research Association, 2024 Frankfurt-Mannheim Macro Workshop, 14th ifo Conference on Macroeconomics and Survey Data, 5th Joint BoC–ECB–NY Fed Conference, 2022 Experimental Finance Conference, 2024 German Finance Association, 5th LTI@UniTo/Bank of Italy Workshop, 2022 Research in Behavioral Finance Conference, 8th SAFE Household Finance Workshop, and 2024 Sydney Banking and Finance Forum. The experiment received IRB approval from Goethe University Frankfurt and is preregistered in the AEA RCT Registry (ID: 8940). We gratefully acknowledge financial support from efl – the Data Science Institute, Inquire Europe, and Leibniz Institute for Financial Research SAFE.

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1 Introduction

Inflation is a key risk for financial-market participants. Empirically, a negative relation exists between inflation and stock returns, which is inconsistent with the basic premise that stocks are claims on real assets and as such should be an effective hedge against inflation. Instead, money illusion, sticky cash flows, and inflation predicting tighter monetary policy or lower consumption growth can rationalize the negative relation between stock returns and inflation.[1] Despite the plethora of theories linking inflation and asset returns, in particular stocks, direct evidence on how inflation affects investor beliefs and choices is scant.

We study investors' beliefs about inflation and its asset-return impact, as well as how beliefs pass through to return expectations and ultimately actual trading behavior. To investigate the role of inflation for portfolio choice, we combine a randomized controlled trial (RCT) on customers of a large German bank with trading data, at a time of high and rising inflation. Participants receive a combination of information about inflation, asset returns during past inflationary periods, and the possible return drivers. We find investors are well-informed about past and current inflation, past asset returns, and consider inflation an important driver of returns. However, beliefs about the stock-return impact of inflation are heterogeneous and too optimistic on average. As a result, whereas exogenous shifts in inflation expectations do not impact return expectations, providing information on actual returns during past inflationary periods leads to negative updating about the perceived stock-return impact of inflation, which results in negative changes in expected returns and transmits to both hypothetical and actual trading.

We conduct the RCT with 2,800 investors in February 2022 when inflation in Germany

[1]For money illusion see, e.g., Modigliani and Cohn (1979); for sticky cash flows, e.g., Bhamra et al. (2023). Inflation predicts monetary policy in de Rubio Cruz et al. (2023) and consumption growth in, e.g., Boons et al. (2020); Campbell, Pflueger, and Viceira (2020); Fama (1981); Fang, Liu, and Roussanov (2022).

was at a 30-year high of 5.3% before surging past 11%. We first elicit beliefs about inflation and asset returns, including estimates of past returns unconditionally as well as during periods of high and rising inflation. We then randomly assign investors into three treatment groups and one control group. The control group does not receive any information. Treatments 1 and 3 contain information on inflation, with the aim of shifting inflation expectations upwards. Treatments 2 and 3 provide information on realized asset returns during past inflationary periods in Germany. Notably, during these periods stocks performed poorly, whereas commodities performed well.[2] Treatment 3 additionally conveys brief narratives about the possible impact of inflation on asset returns, which might increase the treatment effectiveness (Andre et al., 2022, Goetzmann et al., 2022, Shiller, 2017). Treatment 3 allows us to analyze the interaction between exogenous shifts in the beliefs about future inflation and about the return impact of inflation. Post-treatment, we elicit inflation and return expectations, subjective beliefs (mental models) on the stock return-inflation relation and hypothetical investment choices. Crucially, we also observe actual trading decisions in bank data.

We have three main sets of results. First, investors exhibit large heterogeneity in their prior beliefs about the asset-return impact of inflation, in particular on stocks. Most estimates of stock returns during past inflationary periods are too positive, and many investors are unaware of international diversification and investing in commodities as possible inflation-hedging strategies. The vast heterogeneity in and overoptimism about the perceived stock-return impact of inflation stands in contrast to largely accurate estimates of unconditional past returns and perceptions of past and current inflation.

We also study implications and drivers of the heterogeneous perceived return-inflation nexus. The perceived return impact of inflation predicts 12-month return expectations,

[2]We follow Neville et al. (2021) in defining inflationary periods. They find similar return patterns to ours during inflationary periods in the US, UK, and Japan.

contributing to disagreement about return expectations (Giglio et al., 2021). Regarding perceived drivers, investors agree with multiple theories about the return-inflation relation, notably that inflation predicts economic uncertainty and that firms' real assets protect against money erosion. Investors, on average, agree the least with the theory that inflation increases firms' nominal cash flows, consistent with money illusion (Cohen, Polk, and Vuolteenaho, 2005). Variation in support for that theory is the strongest predictor of return beliefs.

Second, the treatment information shifts return expectations through beliefs about the return impact of inflation. Information on low German stock returns during past inflationary periods in Germany in particular reduces 12-month expectations of German stock returns by one percentage point on average, thereby dampening belief dispersion. Information on past returns is more effective at shifting expectations when it is paired with explanations and for those with optimistic prior return beliefs. The information also strengthens the subjective belief that inflation predicts economic uncertainty, corroborating the inflation-real economy link as a salient mental model for investors. We also find plausible treatment effects on expectations about returns of other assets, such as gold with high realized returns.

Inflation information shifts inflation expectations by around 0.5 percentage points on average. Yet, the information does not impact return expectations. Digging deeper, we first show an insignificant interaction effect of the inflation treatment with prior beliefs about the return impact of inflation. Second, among investors who learn about inflation and its return impact, those who increase their inflation expectations do not differ in their return expectations from those who do not. The results indicate that once households are concerned about inflation—most investors in our sample expect elevated inflation—the precise inflation forecast is less relevant (Andrade, Gautier, and Mengus, 2023; Pfäuti, 2024).

Third, learning about past asset returns during inflationary periods has real effects both

in survey data and in actual trading data from our partner bank. In the survey, learning about past returns impacts hypothetical allocations in an investment task. In the trading data, treatment information about the negative stock return-inflation relation reduces actual stock purchases, alleviating possible concerns about experimenter demand effects (Haaland, Roth, and Wohlfart, 2023). The passthrough from return expectations to trading decisions is sizable: return expectations for the German stock market that are exogenously lower by one percentage point—roughly the baseline treatment effect—reduce net purchases of German equities on average by around 20% of the average net purchases in the control group for the 2–4 months following the experimental intervention. Our results suggest investors respond strongly to information about the return impact of inflation.

Our German setting is unique, but it has potential shortcomings. It allows us to pair a customized survey experiment with trading data, during a historic increase in inflation. However, Germans are notoriously concerned about inflation (Braggion et al., 2024). One might hence expect that our sample of investors is well-informed about the return effects of inflation; yet, we show they are on average too optimistic. For example, only few investors estimate a negative stock return-inflation relation. Moreover, Weber et al. (2023) find that Germans respond to inflation information in a way similar to households in the US and other European countries. We can therefore likely generalize our results on how investors think about and respond to inflation to other settings.

Related literature We contribute to three strands of the literature. First, we add to research on how investors respond to inflation. For some asset classes, such as bonds, the negative effect of inflation on realized returns is rather ubiquitous (e.g., Neville et al., 2021); for others, such as real estate, investors strongly believe in their inflation-hedging properties (e.g., Malmendier and Wellsjo, 2024; Schnorpfeil, Weber, and Hackethal, 2023). Equities

are more complicated. An extensive literature documents a negative stock return-inflation relation. Theories behind the negative relation include sticky cash flows (e.g., Bhamra et al., 2023; Gorodnichenko and Weber, 2016), money illusion (e.g., Cohen, Polk, and Vuolteenaho, 2005; Modigliani and Cohn, 1979), and inflation negatively predicting economic growth (e.g., Boons et al., 2020; Campbell, Pflueger, and Viceira, 2020; Cieslak and Pflueger, 2023; Knox and Timmer, 2024). Moreover, Chaudhary and Marrow (2023) discuss the separate effects of inflation expectations and realized inflation on equity returns. The literature largely focuses on aggregate data. Braggion, von Meyerinck, and Schaub (2023) is a recent exception, showing that investors purchase fewer stocks when facing higher local inflation during the hyperinflation in Germany in the 1920s. We differ from the literature by directly studying investor beliefs about inflation and how these beliefs causally feed into trading decisions. For example, we illustrate the importance of beliefs about the return impact of inflation relative to the level of inflation expectations and we shed light on investors' subjective mental models linking inflation and stock returns. One implication of our results from a household-finance perspective is that many otherwise well-informed investors appear unaware of inflation-hedging strategies like international diversification.

Second, we connect to a recent and growing literature in macroeconomics on the formation of households' subjective beliefs and how they shape economic decisions. Most research in this area studies the effects of inflation expectations on consumption, with mixed results (see D'Acunto, Malmendier, and Weber (2023), D'Acunto and Weber (2024), and Jiang et al. (2024) for reviews of this work). The literature also explores how inflation expectations shape borrowing decisions (Botsch and Malmendier, 2023; Schnorpfeil, Weber, and Hackethal, 2023) and more broadly households' attitudes toward and understanding of inflation (Shiller, 1997; Stantcheva, 2024). Studies on the implications of inflation expectations

for investments are more limited. Armantier et al. (2015) present survey evidence suggesting that investors with higher inflation expectations abstain from fixed-rate savings products. Leombroni et al. (2020) link high inflation expectations in the 1970s to a portfolio shift from equity toward housing. We contribute to this literature combining exogenous shifts in beliefs about inflation with trading data at a time of historically high inflation.

Third, a growing literature studies subjective expectations about asset pricing (see Adam and Nagel (2023) for a review). A subset of the work relies on information-provision experiments to test theories of expectation formation (Beutel and Weber, 2023; Laudenbach et al., 2024), and points towards the role of subjective mental models to explain beliefs and choices (e.g., Andre et al., 2023; Meeuwis et al., 2022).[3] We add to the literature by studying directly the formation and effects of expectations about asset prices in the context of inflation. Our results show investors have heterogeneous beliefs about the return impact of inflation. These beliefs causally feed into return expectations and actual trading, and reflect subjective mental models of how inflation impacts asset returns.

2 Experimental design and data

In this section, we discuss the survey design and characteristics of our sample. Section 2.1 introduces the survey, with a focus on the experimental intervention, whereas Section 2.2 describes the bank data as well as the sample composition and characteristics.

[3] Haaland et al. (2024) review the work on mental models across different fields of economics.

2.1 Experiment

We field the survey experiment on more than 2,800 bank customers in February 2022. The survey comprises three sections: a pre-treatment section on recent trading motives and beliefs about inflation and asset returns; the experimental phase in which we provide a mix of information about inflation and asset returns; and a post-treatment stage on economic beliefs, hypothetical choices, and respondent characteristics. Online Appendix B contains the survey questions, translated from German to English.

Pre-treatment section The survey begins with questions about recent trading motives and inflation beliefs. We ask about motives for trading using an open-ended and a multiple-choice question to avoid leading investors to choose inflation as a motive. We do so to gauge the extent to which inflation matters for investors. Respondents provide estimates of past, current, and expected inflation as measures of awareness of and concerns about inflation. Specifically, we elicit expected inflation as the midpoint between respondents' beliefs for the maximum and minimum possible inflation realization over the next 12 months, following Coibion et al. (2024) and Guiso, Jappelli, and Pistaferri (2002).

Respondents then estimate past returns of the following assets: overall German stock market and German energy stocks, US and Japanese stock market, German government bonds, commodities, gold, and German residential real estate. The asset choice reflects our interest in investors' beliefs about the impact of local/German inflation on the local stock market as a measure of the perceived stock-return impact of inflation; international stocks, which tend to be less affected by inflation in Germany; energy and commodities as components of inflation and as determinants of supply-driven inflation; and gold and real estate as commonly perceived inflation hedges. We ask about average annual nominal returns since 1950. This starting year allows for a long time series without covering WWII and the

1948 currency reform in Germany, which led to a massive loss in value of German securities.

After estimating unconditional past returns, we ask respondents to estimate nominal annualized returns during past inflationary periods since 1950.[4] We define inflationary periods as episodes of inflation in Germany accelerating and peaking above 4%, following Neville et al. (2021). Five inflationary periods exist in Germany during our sample period, in 1951, 1965–66, 1969–73, 1978–81, and 1989–91. These periods are similar to the inflationary period during which we fielded the survey, so they should be of relevance to respondents.[5] Our definition implies we likely focus on returns during periods of positive inflation surprises. Respondents provide estimates for inflationary periods right next to their unconditional estimates; they can hence base their estimates during inflationary periods on their unconditional estimates. This comparison is important because we take the difference between the two estimates for each asset as a measure of the perceived return impact of inflation.

Treatment section The information treatments constitute the core of the survey. Our objective is to generate exogenous variation in inflation expectations and beliefs about the asset-return impact of inflation. We randomly divide participants into four equally-sized groups, three treatment groups and one control group. By comparing respondents in the treatment and control groups, we can identify the effects of our information provision.

Respondents in treatment groups 1 and 3 receive in text form and graphically the information that current inflation is at a 30-year high.[6] This information should likely increase their inflation expectations, because perceived inflation is a strong predictor of expected inflation (Weber et al., 2022). The treatments also mention that senior German monetary policymakers discuss the possibility of a further rise in inflation and list multiple reasons for

[4]Respondents could skip this question given its perceived difficulty; 5% of the sample did.

[5]We define inflationary periods in the survey and mention that five such periods occurred since 1950 but we purposefully do not mention the years to keep respondents from thinking about any given episode.

[6]We show the treatment graph in Panel A of Appendix Figure A1.

the price increases, because Andre et al. (2022) show people who recall more inflation drivers forecast higher inflation. We provide this information, instead of other information such as inflation forecasts by professionals, because of the widespread belief by central banks and professional forecasters at the time that inflation would decrease in the following months.

Respondents in treatment groups 2 and 3 learn about actual asset returns during past inflationary periods in Germany since 1950. The returns we show resemble the pre-treatment elicitation, but we only provide information on nominal, annualized returns for the German (1%), US (7%), and Japanese stock markets (11%); German energy stocks (6%) and government bonds (2%); and gold (15%). The actual returns hence illustrate the negative impact of local inflation on local stock markets, and that local stocks also do poorly in relative terms, because returns of energy and international stocks as well as gold are sizable on average.[7]

We present actual asset returns graphically, and contrast them with respondents' pre-treatment estimates. Respondents initially see their past-return estimates in a bar chart. They then click on a button to display the actual past returns one-by-one next to their respective prior.[8] For each asset, we also display one sentence above the graphic contrasting the actual return and respondents' prior estimates.

Respondents in treatment group 3 additionally read short explanations of past asset returns. We explain international stocks perform better than German stocks on average because they are less affected by German inflation, thereby stressing the negative stock return-inflation relation and the possibility for international diversification to hedge against

[7]Our approach follows and our estimates are comparable to Neville et al. (2021) for investors in the US, UK, and Japan. We calculate annualized nominal returns during inflationary periods in Germany. Inflationary periods begin at the latest date with inflation below 2% and end when inflation peaks, if it is above 4%. We use CPI data from Global Financial Data and the German Statistical Office. Total German-market returns come from Stehle and Schmidt (2015) and capture the German benchmark index DAX. We convert local currency returns for the US (S&P 500) and Japanese (TOPIX) stock markets into Deutsche Mark and euro returns, respectively. We retrieve gold returns from Global Financial Data.

[8]We show a hypothetical example screen of the graphical illustration in Panel B of Appendix Figure A1.

local inflation. Moreover, we argue that energy stocks and gold tend to do well because commodity-price increases often drive inflation and gold is commonly perceived as an inflation hedge. We aim to give more context to the returns we present, so results might be more convincing, increasing treatment effectiveness (Andre et al., 2022; Shiller, 2017).

Providing the full set of information to treatment group 3 enables us to study interaction effects, but means we add two pieces of information at once. Specifically, the design choice allows us to study possible effects of shifting both beliefs about inflation and about its asset-return impact at the same time. Moreover, by only showing actual past returns to treatment group 2, we can isolate effects of return-information provision. However, adding two sets of information at once makes it harder to pinpoint the drivers behind treatment effects. We address this concern in Section 4 below by documenting that (i) treatment-1 information on inflation does not affect return beliefs and (ii) larger shifts in inflation expectations do not exert stronger effects on return expectations within treatment group 3.

Post-treatment section Following the information intervention, a series of questions aims to measure instantaneous treatment effects. We elicit 12-month and five-year inflation expectations. This time we ask for point estimates to mitigate survey fatigue and demand effects when asking the same question twice (Coibion, Gorodnichenko, and Weber, 2022).[9] Respondents provide 12-month return expectations and engage in a hypothetical €10,000 portfolio-choice task involving the financial assets that are part of the treatment stage plus a savings account, similar to Coibion et al. (2024). Moreover, to assess whether the treatments feed into trading through other channels, we elicit further macro- and personal-level economic expectations, on a five-point scale ranging from "much worse" to "much better."

We next ask about the subjective drivers of the stock return-inflation relation. Re-

[9] De Quidt, Haushofer, and Roth (2018) show that demand effects tend to be small in settings like ours in which the survey is administered online.

spondents assess on a seven-point scale ranging from "fully disagree" to "fully agree" their agreement with theories commonly discussed in the academic literature, for example, that inflation proxies for economic uncertainty. We pose this question post-treatment so we can assess how mental models correlate with return beliefs for the control group as well as how treatment-induced changes in return beliefs might alter mental models.

We also elicit respondents' risk tolerance, financial literacy, received financial advice, as well as estimates of wealth and debt because we might not observe all relevant balance-sheet items in the bank data if investors have accounts with multiple banks. We also ask about gold holdings and recent purchases because we cannot observe physical holdings. The questions come at the end of the survey to avoid priming subjects. We finish the survey by asking respondents how interesting they found the survey and they can leave comments.

2.2 Data

Survey administration We collaborate with a large German bank to administer the survey experiment on the customers of their brokerage arm. The bank offers the full range of banking services and many customers use it as their main bank. We focus on brokerage clients because they are more likely to be self-directed. Indeed, only 21% of survey participants state they rely on an advisor from the bank when making trading decisions, and 63% say they do not discuss trading decisions with anyone. Self-directed trading is important to have a largely unfiltered transmission of beliefs into choices.

In February 2022, the partnering bank sent a short email to 42,000 brokerage customers, inviting them to participate in a survey on inflation run by Goethe University Frankfurt. The bank sent a reminder email two weeks after the initial invitation, and the survey was in the field for a total of three weeks. Overall, 2,843 bank customers completed the survey

for a response rate of 6.8%, which is above the response rate for other surveys the bank runs. The median response time was 18 minutes and survey participants received a €10 online-shopping voucher for survey completion.

Inflation in Germany was high and rising in February 2022. Appendix Figure A2 shows inflation increased from 2% in 2021 to a 30-year high of 5.3% during the survey period, and rose above 11% in the fall of 2022 before starting to come down again. Inflation might have been of particular interest to investors during and in the months following the survey period. Moreover, the figure shows a strongly negative relation between inflation and the DAX, the major German stock-market index, over the same period.

Sample filters We take two filtering steps to enhance data quality. First, we omit survey participants who finish the survey in less than seven or more than 90 minutes, corresponding to around 2% of the sample. Second, we trim observations of past, current, and future inflation estimates at the 1% tails as well as prior or posterior return estimates below -10% or above 20%. Results are robust to varying cutoffs for filtering estimates and to excluding respondents who anywhere in the survey provided an extreme response. The resulting sample size is 2,792 based on the survey-time restriction, and around 2–3% lower in estimations involving asset returns or inflation.

We observe actual trading data for 1,994 brokerage customers. The drop in sample size occurs because we focus on respondents with at least one trade in the pre-treatment period, which spans 1.5 years for most respondents. The filter aims to eliminate deserted brokerage accounts and inactive traders. We also report results for the overall sample, which are very similar to our baseline results.

Sample characteristics Table 1 presents summary statistics for our sample. Basic demographics are in the top panel, which we benchmark against the most recent wave of the

Bundesbank Panel on Household Finances (PHF), from 2017. The PHF is a representative survey of German households' finances and part of the ECB's Household Finance and Consumption Survey. Our respondents are predominantly male, with only 14% of the sample being female. 6% of the sample have a joint account with a spouse. The educational attainment of the sample is relatively high: two-thirds have a university degree, compared to 29% in the PHF, and 19% of them have a business-related degree. 72% of the sample is employed (54% in the PHF). Household net wealth in our sample is €276,000, which is also relatively high (€207,000 in the PHF).

The middle panel of Table 1 reports statistics on respondents' perceptions and expectations in the context of inflation. The average perceived rate of inflation is 5%, close to actual inflation of 4.9% or 5.3%, depending on the survey date. More than 80% of estimates are between 4% and 7%. Perceptions of the past-12-month trajectory of inflation are also accurate on average, with an estimated increase of 3.1 percentage points (actual increase: 3.5 percentage points). Accurate perceptions during times of high inflation are consistent with recent evidence that households and firms acquire information about inflation in inflationary periods (Cavallo, Cruces, and Perez-Truglia, 2017; Weber et al., 2023), in line with theories of rational inattention (Maćkowiak et al., 2023). Respondents also expect inflation to remain high, with a mean one-year forecast of 4.6%. Another possible reason for accurate perceptions might be a large perceived financial impact of inflation: 26% see inflation as the number-one financial-market risk over the next 12 months, and 75% see it as a top-three risk.[10] Moreover, 42% mention inflation as a recent trading motive. Overall, respondents on average are relatively well-educated and wealthy, have accurate perceptions about inflation, and view inflation to have important implications for their financial portfolio.

[10]The other financial-market risks we elicit include a recession, interest-rate increases, COVID-19, climate change, and political uncertainty. Respondents can choose up to three risks out of the list of five.

Bank data The bottom panel of Table 1 relies on data on month-end security holdings and each security transaction. The average portfolio value in our sample is €140,000, comprised of 14 positions on average. Respondents hold 84% of their portfolio in stocks on average, and 37% of it is in German securities. The mean number of monthly trades is three, slightly above other investor datasets in the existing literature (Laudenbach et al., 2024). Monthly net buys amount to €628 on average.

Integrity of randomization Appendix Table A1 reports balancing tests between control and treatment groups. No notable differences between the different groups exist on a wide range of demographics, inflation beliefs, and trading characteristics. To address small imbalances across treatment arms, we show stability of results when including a set of control variables in our empirical analysis (Chopra, Roth, and Wohlfart, 2024).

3 Prior beliefs about inflation and asset returns

Beliefs about the return impact of inflation Figure 1 documents pre-treatment estimates of average annual returns of the German stock-market index, DAX. Panel A shows estimates of unconditional nominal returns. The average is 7.2%, slightly below actual historical returns.[11] Dispersion in estimates is small: nearly 80% of respondents provide estimates between 5% and 10%. In untabulated results, we find estimates are also reasonable for other assets. The results indicate high awareness of average past asset returns.

Panel B of Figure 1 contrasts estimates of unconditional past returns of the German stock market with those during inflationary periods, that is, times of high and rising infla-

[11] We ask about average returns since 1950. Actual returns of the German stock market have been 9%, relatively high because of a strong performance during the 1950s (Stehle and Schmidt, 2015). For example, Laudenbach et al. (2024) calculate a historical return of the DAX, the major German stock market index, of 8.5%. In any case, we are primarily concerned about returns during inflationary periods.

tion. We subtract unconditional return estimates from inflationary-period return estimates, so positive numbers indicate higher perceived nominal returns during inflationary periods. Investors exhibit large disagreement about the stock return-inflation relation. Specifically, 49% estimate lower nominal returns during inflationary periods, whereas 39% provide higher estimates. On average, investors overestimate nominal returns during inflationary periods despite the large disagreement: the average estimate is 6.7%, whereas we calculate a return of only 1%. The large perception gap between the actual and perceived returns might translate into a strong response to the past-return treatment.

Does uncertainty in beliefs explain the disagreement about the historical stock-return impact of inflation?[12] Indeed, experience with past inflationary periods is limited for most investors in our sample, and the actual index DAX only dates back to 1988. However, four reasons suggest a limited role for uncertainty. First, in light of the limited history of the DAX, we ask about past returns of the German stock market, similar to the DAX, for which investors estimate largely plausible unconditional returns. Second, investors report they are only slightly more uncertain about their inflationary-period estimates than their unconditional ones (3.3 vs. 2.9 on average, elicited on a 1–7 scale). Third, in untabulated results we find the distribution of beliefs about the return impact of inflation does not vary by uncertainty. Fourth, Table 1 shows many investors mention inflation as a recent trading motive, consistent with them placing at least some confidence in their beliefs.

Figure 2 displays the perceived return impact of inflation on other assets. Again, investors exhibit pronounced heterogeneity in beliefs for energy stocks, government bonds, international stocks, gold, and residential real estate. The heterogeneity implies many investors do not view energy or international stocks as better hedges against inflation in Germany than

[12] We thank Ricardo De la O for suggesting this possibility and the subsequent tests.

holding the German market index. In the case of international stocks, investors might hence lack knowledge about the benefits of international diversification or believe in a large global component in inflation rates across countries (though Japan is a country with a recent history of very low inflation). Estimates of the return impact of inflation are more positive for gold and real estate, consistent with conventional wisdom (see, e.g., Malmendier and Wellsjo, 2024). Nonetheless, respondents' estimates suggest limited existing knowledge about international diversification and exposure to commodities as inflation-hedging strategies.

We explore the association between the perceived stock return-inflation relation and beliefs about returns of other assets. Appendix Figure A3 displays the distribution of estimates of the return impact of inflation by whether investors perceive returns of German stocks to be higher or lower during inflationary periods. Beliefs about the impact of inflation on returns of German stocks and other assets strongly correlate. This finding suggests investors who correctly perceive a negative stock return-inflation relation do not hold more accurate beliefs about other assets; instead, investors appear to view inflation as being good or bad for asset returns, with limited discrimination across assets. Gold and real estate are exceptions in that many investors who perceive a negative impact of inflation on German stock returns view these assets' inflationary-period returns more positively.

Passthrough to return expectations To what extent do return expectations reflect beliefs about the return impact of inflation? Figure 3 shows a binned scatterplot of the relation between return expectations of the German stock market over the following 12 months and the perceived historical stock-return impact of inflation. We partial out a standard set of controls we describe in Section 4, following the covariate-adjustment approach of Cattaneo et al. (2024). A one-percentage-point higher perceived past return impact of inflation is associated with a 0.13-percentage-point increase in the 12-month return expectation. That is,

investors in our sample who think stock returns were higher during past inflationary periods expect higher returns, suggesting inflation as a driver of heterogeneous return expectations.

A smaller than one-for-one passthrough from the perceived historical return impact of inflation to expected returns is plausible. First, we study the perceived return impact of inflation instead of the expected or perceived realized return during inflationary periods. That is, we subtract the unconditional return estimate from the return estimate during inflationary periods, effectively controlling for unconditional return estimates that abstract from the role of inflation. Focusing on the perceived return during past inflationary periods instead yields a stronger passthrough to return expectations, of 0.23. Second, investors likely do not base their return expectations exclusively on realized returns. Third, the historical relation between inflation and asset returns might seem only partially useful to investors to assess the relation at the time of the survey, possibly due to different perceived drivers of inflation, such as supply- versus demand-side factors, and a different monetary-policy environment since the founding of the European Central Bank. Fourth, measurement error in beliefs about past returns might result in an attenuation bias. Fifth, investors might believe that asset prices have already partially adjusted to the surge in inflation.

Mental models behind return impact of inflation We explore investors' reasoning—their mental models—behind the effects of inflation on stock returns.[13] We list theories on the stock return-inflation relation and ask survey respondents to which degree they agree with these theories. Specifically, we state (i) dividends go up with inflation (e.g., Modigliani and Cohn, 1979), (ii) real assets protect against money erosion (e.g., Fang, Liu, and Roussanov, 2022), (iii) nominal debt erodes in real terms with inflation (e.g., Doepke and Schneider, 2006), (iv) inflation precedes economic uncertainty (e.g., Cieslak and Pflueger, 2023), and

[13]Differences in the beliefs about the return impact of inflation could also arise for other reasons, such as different heuristics or experiences (e.g., Barberis et al., 2015).

(v) prices are sticky (e.g., Bhamra et al., 2023). We randomize the order of the list of theories. Responses range from "completely disagree" to "completely agree" on a seven-point scale.

Figure 4 plots agreement to the theories on the stock return-inflation relation.[14] Large heterogeneity in agreement exists for all theories. Investors agree, however, most often with the reasoning that inflation precedes economic uncertainty (65% of answers are between five and seven). Prominence of this mental model is consistent with its importance in the asset-pricing literature and with evidence that many households associate higher inflation with a poorer economic outlook (e.g., Kamdar, 2018). Agreement is also common (63%) for the basic intuition that inflation poses little threat to owners of stocks, which derive their value from real assets. Investors agree the least with the idea that dividends increase with inflation (24%), possibly reflecting money illusion in the form of expected constant nominal cash-flow growth. The results are consistent with recent evidence that investors interpret the same information based on different subjective models (Beutel and Weber (2023); Laudenbach et al. (2024); Meeuwis et al. (2022); see Haaland et al. (2024) for a recent review).

To what extent do investors' subjective models explain their heterogeneous estimates of how inflation shapes stock returns? Figure 5 links the perceived historical stock return-inflation relation to agreement with each theory describing the relation. Specifically, we plot respondents' pre-treatment estimates of the stock-return impact of inflation on the vertical axis against their degree of support for each theory on the stock return-inflation relation on the horizontal axis. We find that variation in agreement with "dividends go up with inflation" is the strongest predictor of return beliefs. Appendix Table A2 corroborates this finding, showing results of regressions of return beliefs on all mental models jointly as well as on controls. In terms of magnitudes, a one-standard-deviation increase in the agreement

[14] Responses here and in Figure 5 are only for the control group as we pose the question post-treatment. As treatment assignment is random, the responses should still be representative of our overall sample.

with the "dividends-up" theory corresponds to a 0.52-percentage-point more positive perceived stock-return impact of inflation. Similarly, in regressions of 12-month expectations of German stock returns on the different theories, only the dividends-up theory is a significant predictor. This finding suggests the extent to which investors perceive nominal cash flows to be constant—which constitutes a form of money illusion if investors scale these constant nominal cash flows with higher nominal discount rates—constitutes a key driver of beliefs about the stock return-inflation relation. More generally, the result is consistent with the literature that documents subjective beliefs about fundamentals like cash flows are key determinants of return expectations (e.g., De la O and Myers, 2021).

4 Treatment effects on return expectations

Next, we analyze effects of randomized information provision about the current inflation environment and past asset returns during inflationary periods. To characterize treatment effects, we estimate variants of the following baseline equation:

$$\hat{y}_i = \alpha + \sum_{k=1}^{3} \beta_k I(x_i = x^k) + \theta \boldsymbol{X}_i + \epsilon_i, \tag{1}$$

where $\hat{y}_i$ is the 12-month return forecast of respondent i measured post-treatment. To reduce the impact of outliers, we exclude forecasts lower than -10% or higher than 20%. This step eliminates between 0.5% and 2% of estimates depending on the asset class.[15] $I(x_i = x^k)$ indicates that respondent i receives signal k. The omitted category is the control group, which implies we can interpret coefficients $\{\beta_k\}_{j=1}^{3}$ as being relative to the control group.

[15] When keeping extreme return expectations instead, estimates are qualitatively similar but less precisely estimated. An alternative to excluding extreme observations is a Hubert-robust estimation (e.g., Coibion, Gorodnichenko, and Weber, 2022), which yields comparable results.

We randomize treatment assignment, so controls improve the precision of the estimates but do not have a substantive effect on the point estimates of interest. $\boldsymbol{X}_i$ denotes the set of controls, which include a quadratic polynomial in respondents' age, financial-risk tolerance measured on a 1–4 ordinal scale, perceived past and current inflation (1% tails of estimates trimmed), perceived past nominal returns of the asset studied as the dependent variable,[16] and fixed effects for gross wealth and debt.[17] We also include a set of dummy variables for gender, marital status, university education, business degree, financial literacy, receiving financial advice, and whether survey participation is after the bank sent a reminder email.

4.1 Beliefs about return impact of inflation

Panel A of Table 2 reports treatment effects on 12-month return expectations based on estimating Equation 1. The effect of the inflation treatment (T1) is insignificant.[18] Treatment information about past returns (T2 and T3), however, significantly shifts return expectations in the expected direction. In particular, investors who learn about 1% average nominal stock returns in Germany during inflationary periods reduce their expected return of the German stock market by 0.7 percentage points for T2 (return information only) and by one percentage point for T3 (return information as well as explanations). Treatment effects on expectations are also large for Japanese stocks and gold for which realized returns during inflationary periods in Germany were high (11% and 15%, respectively). Effects of T3 tend to exceed those of T2, suggesting that explanations of returns can increase treatment effects.

Treatment effects on expected US stock returns are insignificant. This result could reflect

[16] When the dependent variable is not about asset returns, we do not control for perceived past returns.

[17] We ask respondents to estimate their gross wealth and outstanding debt based on pre-set brackets, such as €100,000–250,000. 25% of respondents prefer to not disclose their level of wealth, and 15% provide no answer to the debt elicitation. We lump non-responses into a separate bracket.

[18] We take a closer look at the role of inflation beliefs in Section 4.2 below.

that investors are aware of the fact that inflationary pressures in the US are similar to the situation in Germany at the time of the survey experiment, in February 2022, in contrast to the inflation situation in Japan—which might mute the international-diversification argument for US stocks. However, on average, realized US returns during past inflationary periods in Germany differ little from perceived returns (7% versus 5.9%). As a consequence, and as we show below, treatment effects should be concentrated among the subset of investors with a significant perception gap for US returns, and the insignificant unconditional average treatment effects largely reflect accurate average prior perceptions.

Why do the treatments affect return expectations despite inflation likely being at least partially priced in? Our findings are consistent with recent evidence documenting a neglect of equilibrium pricing: investors update return expectations in response to stale information (Andre, Schirmer, and Wohlfart, 2023). When we turn to trading choices below, an additional mechanism behind the treatments can be a positive perceived inflation risk premium.

So far, we focus on average treatment effects, yet learning from the treatments might be stronger for respondents whose prior return beliefs deviate more from actual returns. Moreover, we might find zero average treatment effects in settings in which priors are symmetrically distributed around the signals even if everyone updated towards the provided signal. Therefore, we now focus on the degree of updating as a function of the news contained in the signal. To do so, we define the perception gap as the realized return during past inflationary periods in Germany minus the respondent's pre-treatment estimate of that return. We then run regression specifications of the following form:

$$\hat{y}_i = \sum_{k=1}^{3} \beta_k I(x_i = x^k) \ (x^{ret} - \hat{x}^{ret}_{i,prior}) + \mu_k I(x_i = x^k) + \delta_k (x^{ret} - \hat{x}^{ret}_{i,prior}) + \theta \boldsymbol{X}_i + \epsilon_i, \quad (2)$$

where $(x^{ret} - \hat{x}^{ret}_{i,prior})$ denotes the perception gap. The coefficient of interest is still β_k, which captures the extent of updating of prior return beliefs. μ_k measures treatment effects that are independent of priors. δ_k captures posterior expectations across respondents with different priors that are independent of the treatment; for example, low perceived prior stock returns likely feed into low posteriors.[19] The set of controls, $\boldsymbol{X}_i$, is the same as before.

Panel B of Table 2 shows results from estimating Equation 2. For returns of the German stock market, estimated coefficients are 0.13 (T2) and 0.17 (T3) on the interaction term. That is, investors in T3 with a one-percentage-point higher prior estimate of stock returns during past inflationary periods relative to actual returns forecast 0.17-percentage-point lower 12-month returns. Coefficients on the interaction terms are also roughly comparable for German energy stocks as well as for the US and Japanese stock market. The treatment effect on return expectations is hence larger for respondents with a more positive perceived prior stock return-inflation relation. However, respondents only partially adjust their expectations to the past returns we show, consistent with the less than one-to-one passthrough from beliefs about the stock-return impact of inflation to expectations we document above (Figure 3). Yet, the literature on belief formation in macroeconomics commonly reports learning rates that are comparable to ours (Haaland, Roth, and Wohlfart, 2023).

We also find some treatment effects on expectations that are independent of respondents' perception gaps for German energy stocks, the Japanese stock market, German government bonds, and gold. Most notably, T2 (T3) increases expected gold returns by 1.7 (2.5) percentage points. This finding might reflect that realized gold returns far exceed most investors' prior, so they exhibit a level shift in their return expectations for gold.

Figure 6 graphically illustrates the rate of learning about the stock return-inflation re-

[19] See Fuster and Zafar (2023) for more details on estimation designs in survey experiments.

lation. The association between return expectations (vertical axis) and the perception gap (horizontal axis) is negative. Most investors pre-treatment perceive inflationary-period returns that are too high and a more negative perception gap corresponds to a higher prior estimate of returns. A higher prior estimate predicts higher returns going forward. The association between expectations and the perception gap is almost identical for the control group and T1, given the absence of average effects of the inflation information in T1. For respondents receiving T2 (return information) and even more so for T3 ("full" treatment), the association between priors and posteriors becomes weaker. The effect size is large: whereas respondents in the control group with the largest perception gap—that is, the most positive prior—expect 12-month returns of the German stock market of 8% on average, T3 respondents with a similar prior expect returns of less than 5%.

Mental models Table 3 documents treatment effects on respondents' subjective reasoning about the stock return-inflation relation. Information about low stock returns during past inflationary periods strengthens the belief in inflation proxying economic uncertainty. Economically, receiving information about past returns (T2 and T3) increases agreement with the inflation-as-proxy statement by 0.17 of a standard deviation. We also find a weakly positive effect on agreement with the statement that firms' ability to pass on higher costs to consumers is limited. The results corroborate the salience of inflation predicting economic uncertainty as a mental model investors rely on when prompted to reason about the perceived effects of inflation on stock returns (Knox and Timmer, 2024).

4.2 Inflation expectations

We inspect the role of exogenous shifts in inflation expectations for asset-return forecasts. In a first step, we estimate Equation 1 to gauge the extent to which information about the

current inflation environment affects inflation expectations. Appendix Table A3 reports the results. The inflation information, contained in T1 and T3, on average increases respondents' one-year inflation forecasts by around 0.5 percentage points. This effect constitutes a 10% increase relative to the average control-group estimate of 5%. The magnitude is comparable when we use forecast revisions as the dependent variable. The inflation treatment also increases long-run expectations, with the five-year forecast being around 0.3 percentage points higher than in the control group. The results suggest the inflation treatment is able to shift inflation expectations; however, baseline expectations are already high and for most respondents inflation is already a topic of concern (see Table 1).

We then shed light on the impact of shifts in inflation expectations on return forecasts. We first regress 12-month forecasts of returns of various assets on the interaction between the inflation treatment, T1, and respondents' prior beliefs about the respective asset-return impact of inflation. We isolate the return impact of inflation by subtracting estimates of unconditional returns from inflationary-period return estimates. The interaction is important because respondents' prior return beliefs are heterogeneous, so that average treatment effects can be close to zero even if T1 shifts return expectations.

Panel A of Table 4 presents the results. Coefficients on T1 are largely insignificant, which implies exogenous shifts in inflation expectations do not alter return expectations when the perceived impact of inflation on returns is zero. Coefficients on the perceived inflation impact on returns instead positively predict return expectations for all assets, so beliefs about the return impact of inflation correlate with return expectations. However, coefficients on the interaction term are insignificant and close to zero across all asset classes. That is, the treatment-induced average increase in inflation expectations does not tighten the relation between return expectations and prior beliefs about the return impact of inflation.

In Panel B of Table 4, we regress return expectations on the revision of expected inflation within the T3 subsample.[20] We aim to understand whether learning about the return impact of inflation interacts with shifts in inflation expectations—as is the case for respondents receiving T3. We find the coefficient on the forecast revision is insignificant, so respondents in treatment group 3 who raise their inflation expectations by more do not differ from other T3 respondents in their return expectations. Overall, our results suggest that, at a time of high perceived and expected inflation, small shifts in inflation forecasts play only a limited role in investors' formation of return expectations.[21] This interpretation is consistent with recent evidence that attention paid to and the consumption response to inflation vary mainly with households perceiving inflation qualitatively to be high or low rather than with the precise quantitative expectation (Andrade, Gautier, and Mengus, 2023; Pfäuti, 2024).

5 Expectations and trading

Trading data In this section, we link the information treatments, through their effects on return expectations, to respondents' trading choices. We rely on two sources of data for this analysis. First, in the survey, respondents engage in a hypothetical portfolio-choice task. They can invest a €10,000 windfall into the different assets for which we previously elicited their return expectations. Second, our bank partner provides us with respondents' trading data. We use the data to compare trading in the months before the experimental intervention to the months thereafter.

The two data sources are complementary. Data on self-reported, hypothetical trading are useful because the passthrough from belief changes to actual trading may be low (Ameriks

[20] We sacrifice econometric rigor by estimating such a model (Angrist and Pischke, 2009).

[21] Moreover, the passthrough from beliefs about the return impact of inflation to return expectations (Figure 3) does not vary by whether investors have above-/below-median inflation expectations (untabulated).

et al., 2019; Giglio et al., 2021), possibly due to trading costs, inaction due to time, cognitive or other constraints, or because other news subsequent to our information provision intervene. The stylized portfolio decision means we abstract from trading costs and other frictions that might hamper the passthrough (Beutel and Weber, 2023). Data on actual trading, instead, allow us to check whether respondents actually follow through in their trading decisions when they change their expectations. To the extent we see that investors indeed change their trading patterns following our experimental intervention, we can also rule out that survey demand effects can explain our results (Haaland, Roth, and Wohlfart, 2023). Moreover, trading data allow us to shed light on the margins of adjustment. For example, belief changes might only alter trading in familiar securities (such as German ones) rather than trigger trading in previously unknown securities (such as Japanese ones).

Hypothetical trading Table 5 reports how beliefs about the asset-return impact of inflation affect hypothetical trading. Panel A studies prior beliefs about returns. Higher perceived unconditional historical returns of each asset class positively predict hypothetical portfolio allocations into each respective asset. Higher perceived returns during inflationary periods, controlling for unconditional-return beliefs, also increase allocations, for the German and US stock market and gold. The relative passthrough is significant, in particular for German stocks: a one-percentage-point higher perceived inflationary-period return increases allocations into the German stock market by €42 on average, whereas a similar increase in perceived unconditional returns increases allocations by €67. The results suggest beliefs about unconditional returns and the return impact of inflation shape hypothetical trading.

Panel B of Table 5 shows reduced-form treatment effects, thereby turning to exogenous changes in beliefs. The inflation treatment (T1) does not affect portfolio allocations, in line with the insignificant effects on beliefs we document above. Information about past

returns (T2 and T3), however, alters allocations in the expected direction. In particular, respondents in treatment groups T2 and T3 allocate €831 and €1,288 less into the German stock market, respectively. This effect is sizable, with subjects in treatment T3 reducing exposure by more than one-third relative to the allocation of the control group. In turn, learning about past returns increases allocations into German energy stocks, the Japanese stock market, and gold. The information about past US returns does not materially affect allocations into the US stock market, again possibly because of a small average perception gap in inflationary-period returns. Moreover, effects of T3, which includes brief explanations of past returns, are again larger than those of T2.

We next study return expectations as the link between the information-provision experiment and trading. We estimate the following model:

$$a_i = \delta + \kappa \hat{y}_i + \theta \boldsymbol{X}_i + \epsilon_i, \tag{3}$$

where a_i denotes trading by respondent i. $\hat{y}_i$ is the posterior return expectation instrumented using Equation 1. However, exogenous variation in return expectations comes from an indicator of the full treatment, T3, versus the control group. The just-identified specification is less prone to weak instruments. Using the treatment as identifying variation reduces concerns about omitted variables that could lead to a spurious relation between expectations and actions. The set of controls, $\boldsymbol{X}$, is the same as in Equation 1.

Panel C of Table 5 reports the results from estimating Equation 3. The Kleibergen-Paap F-statistic is large for investments in the German and Japanese stock market, as well as in gold; the F-statistic is close to zero instead for the other assets. A treatment-induced one-percentage-point change in 12-month return expectations of the German stock market—

roughly corresponding to the baseline T3 effect on expectations—changes allocations in the German stock market by €1,189. This effect is sizable given that survey participants in the control group invest on average €3,444 of the hypothetical endowment into German stocks. We also find large effects of return expectations on Japanese stock and gold investments.[22] The results indicate a large passthrough from subjective return expectations—shaped by beliefs about the impact of inflation—into hypothetical trading decisions.

Actual trading We now turn to treatment effects on actual trading. We study effects on gross and net purchases of German equity securities in the two and four months post-treatment. During that time, inflation was elevated, at 5.3%, and rising, eventually reaching a 70-year high of above 11% (see Appendix Figure A2). Concurrently, the DAX fell from around 14,500 to just above 12,000 points. Hence, we provide information that respondents might find relevant as they confront a historic surge in inflation. We study gross and net purchases relative to the three months pre-treatment. Conditioning on pre-survey trading allows us to control for differences in trading behavior across individuals, akin to taking out fixed effects at the individual level, and enhances the power of the regressions. To mitigate the impact of influential observations, we winsorize the 1% tails of the pre-to-post-treatment difference in trading at the investor level.

Our focus is on treatment effects on trading of German equities for two reasons. First, trading of German equities is a natural outcome given our interest in the perceived sensitivity of stock returns to inflation, and discussing past inflationary periods in Germany in the treatment. Second, frictions impeding the passthrough from changes in beliefs to actual trading should be smallest for German securities. Consistent with that, German securities feature prominently in the average investor's portfolio (see Table 1) and the correlation

[22] Appendix Table A4 shows estimation results when instrumenting the posterior return expectation using indicators for all treatments instead of T3 only. Results are robust.

between pre-treatment beliefs about the asset-return impact of inflation and hypothetical trading is strongest for Germans stocks (see Table 5). German equities that we study include both stocks held directly and indirectly through active and passive funds.

Table 6 shows the results. Panel A reveals negative reduced-form effects of T3 on gross and net purchases of German equities. In the four months following the experimental intervention, T3 reduces the number of gross purchases by 0.09 and net purchases by 0.07 per month on average, which constitutes a roughly 20% decrease relative to the control group. The T3 effect also amounts to a drop by €376 (gross buys) and €170 (net buys). The euro-amount effects are large economically as well—around 25% relative to buying in the control group—but the net-buys effect is statistically insignificant. Effects of T2 are insignificant, corroborating that adding explanations for returns bolsters the treatment effectiveness.

Panel B adds results from IV regressions based on Equation 3. The Kleibergen-Paap F-statistic is 29.7. We find a positive effect of treatment-induced changes in expectations about returns of the German stock market on purchases of German equities. Over the four months post-treatment, a one-percentage-point lower expectation decreases gross purchases by 0.07 and net purchases by 0.06 per month. The drop in euro is €287 and €56, respectively. The effects of a one-percentage-point expectation change are economically significant—they constitute 15–20% of purchases in the control group; yet the net-buy euro-amount effects are statistically insignificant.[23] Nonetheless, the trading results suggest investors respond strongly to information about the stock-return impact of inflation. The passthrough from beliefs to trading operates primarily through adjustments in gross purchases, similar to existing studies (e.g., Calvet, Campbell, and Sodini, 2009). Moreover, the weaker net-buy

[23] Appendix Table A5 shows estimation results when instrumenting the posterior return expectation using indicators for all treatments instead of T3 only. Results are slightly weaker but comparable.

effect might reflect that some investors reduce their trading of German equities altogether.[24]

Stocks held directly drive the treatment effect on actual trading. Panel A of Appendix Table A6 shows effects of T3 on purchases of directly held German stocks are close in magnitude to effects on directly and indirectly held stocks. In Panel B, we study trading of all German securities, including bonds. Consistent with the emphasis on low German stock returns in the treatment, the coefficient on T3 is close to the baseline effect on equities trading. Moreover, the amount of trading in German securities in the control group barely exceeds trading of German equities, highlighting investors mostly trade equities.

Appendix Table A7 illustrates the robustness of the treatment effects on actual trading. In Panel A, we add the standard set of controls (see Equation 1). Treatment effects are similar. In Panel B, we shorten the pre-treatment window to two months. Treatment effects strengthen. In Panel C, we forgo the restriction of at least one trade in the 1.5 years pre-treatment. Treatment effects are weaker when including inactive investors, consistent with the passthrough from beliefs requiring some trading.

Other expectations Do the information treatments affect other beliefs, which in turn might impact trading choices? To assess the role of other beliefs, we elicit post-treatment a set of expectations about personal and aggregate economic conditions. Specifically, we ask about respondents' 12-month expectations about their own salary and the performance of their portfolio, as well as expectations for aggregate unemployment and growth qualitatively, with responses ranging from "much worse" to "much better." A number of possible mechanisms linking the treatments to trading via these expectations exist. For example, investors who are more confident that they are hedged against inflation post-treatment might expect to

[24]We find treatment effects are limited to German equities; that is, for example, treated investors do not diversify more internationally. The concentration of effects to German securities is consistent with the assertion that, whereas the frictionless hypothetical setting allows investors to branch out into various financial products, in reality effects are limited to securities that can be traded at low financial and nonfinancial costs.

become wealthier, which could affect trading under decreasing relative risk aversion (e.g., Calvet and Sodini, 2014). A shift in inflation expectations might lower growth forecasts if respondents take a supply-side view of the economy (e.g., Coibion et al., 2023). Yet, we do not find an exogenous shift in inflation expectations feeds into asset-return expectations.

Table 7 presents the results. Effects of T1 are insignificant throughout. Information about past returns (T2 and T3) have largely insignificant effects on other expectations as well. An exception is a small positive effect on the portfolio forecast, though this effect should work against our finding of less net securities buying. We also find a small negative T3 effect on the forecast for economic growth. This finding is consistent with the treatment effect on subjective mental models (Appendix Table 3): learning about low stock returns during inflation strengthens the belief in inflation predicting economic uncertainty. Overall, the results suggest the treatment indeed affects trading through return expectations, reflecting shifts in beliefs about the stock return-inflation relation.

Investments into gold Appendix Table A8 documents the link between beliefs about the return impact of inflation on gold and actual investments into gold based on survey questions. We find a positive association between the perceived gold-return impact of inflation and both gold holdings as well as purchases over the last 12 months. The perceived past return impact of inflation has more predictive power for investments than perceived unconditional past returns. In terms of magnitude, a one-percentage-point higher perceived return impact is associated with a 0.6-percentage-point (4.3%) higher probability of having purchased gold recently. The results suggest investors perceive gold as a hedge against inflation.

6 Conclusion

We study investors' return beliefs and trading choices in the context of inflation, leveraging a survey experiment paired with trading data at a time of high and rising inflation. In an inflationary regime, investor behavior appears inelastic to the precise level of inflation expectations. Instead, investors exhibit vast heterogeneity in beliefs about the asset-return impact of inflation and are too optimistic about its effect on stock returns on average. We generate exogenous shifts in the return beliefs, which pass through to return expectations and hypothetical and actual trading. Exploring investors' subjective models behind the stock return-inflation relation, we find support in particular for the belief that inflation predicts economic conditions and for money illusion of Modigliani and Cohn's variety.

Our results are potentially relevant for research in household finance, on macro expectations, and in asset pricing. From a household-finance perspective, we find investors are well-informed and concerned about inflation, yet seem largely unaware of how to protect against it. Hence, they respond strongly to information we provide on stock returns during past inflationary periods. Disseminating hedging strategies—such as on the benefits of international diversification to reduce exposure to local inflation—through information campaigns or robo-advise might be useful (D'Acunto and Rossi, 2023). From a macro-expectations perspective, we extend a literature that largely focuses on the link between expectations and consumption by exploring the role of beliefs about inflation for trading decisions. For asset pricing, our paper represents an initial step to shed light on which subjective models guide investor behavior concerning inflation. Observational data alone fall short because similar outcomes could be explained by multiple theories. Future research should delve deeper into investors' mental models using open-ended survey questions tailored towards exploring the origins of subjective theories on the stock return-inflation relation (Haaland et al., 2024).

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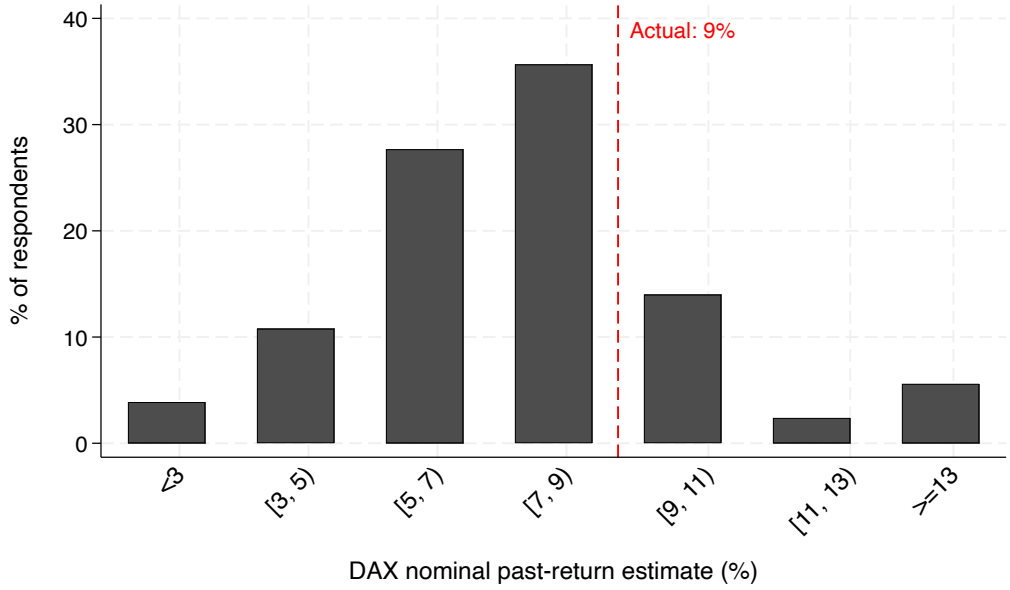
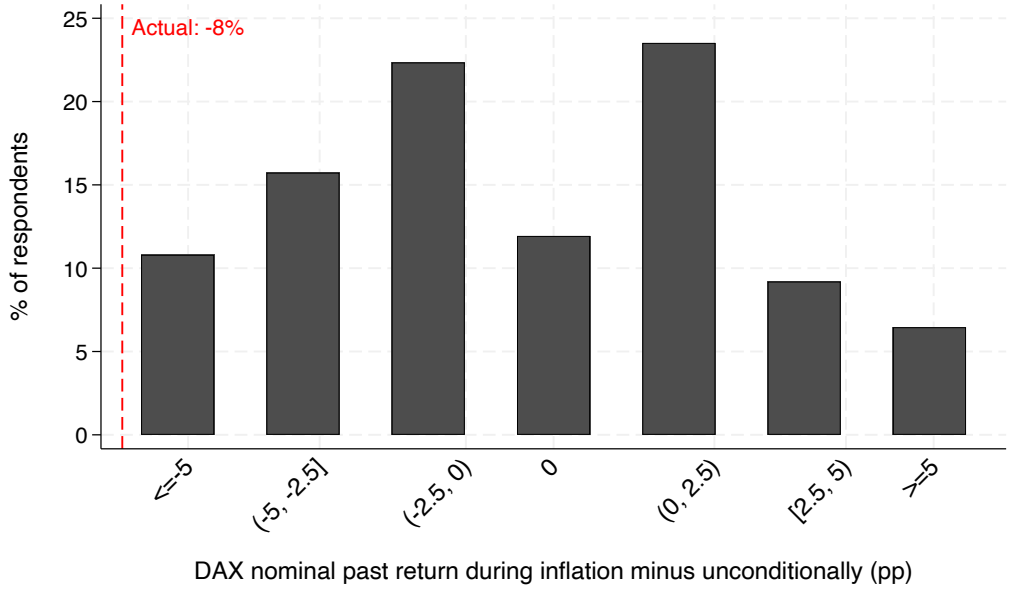
Figures and Tables

Figure 1: Prior nominal-return estimates of German stock market

Panel A. Perceived unconditional historical returns

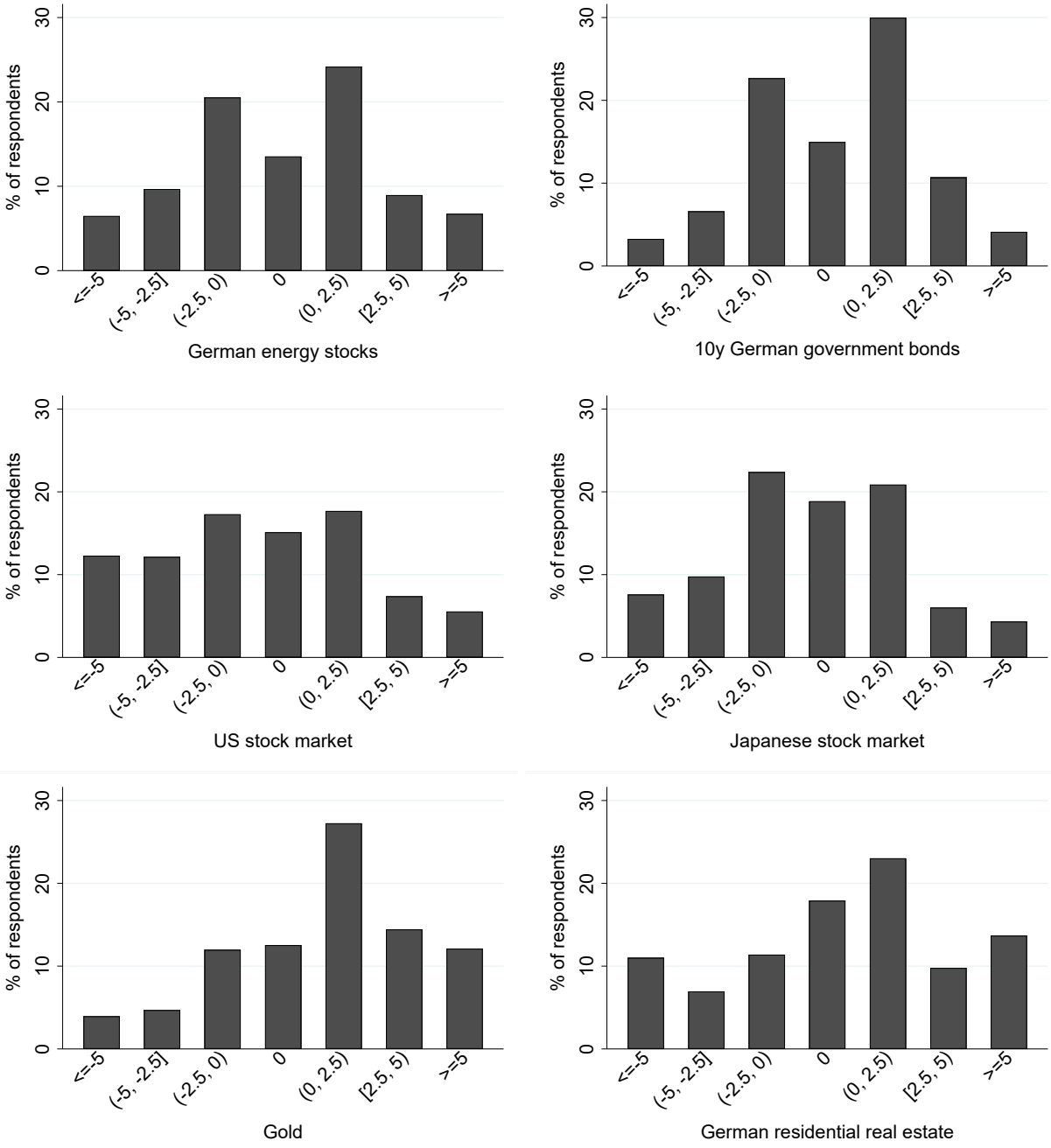


Panel B. Perceived historical return impact of inflation



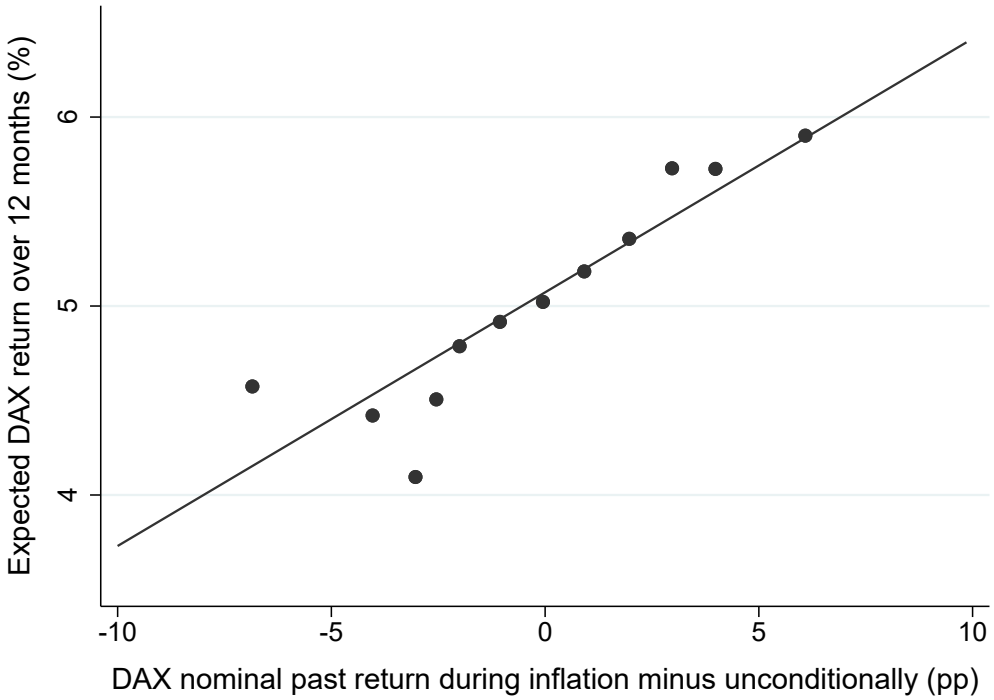
Notes: The figures show the distribution of prior estimates of annual nominal returns of the German stock market since 1950. Panel A plots unconditional return estimates. Panel B subtracts unconditional return estimates from inflationary-period return estimates, so positive numbers indicate higher perceived returns during inflationary periods. We define inflationary periods as episodes of inflation in Germany accelerating and peaking at above 4%. Vertical lines show actual returns.

Figure 2: Prior estimates of asset-return impact of inflation



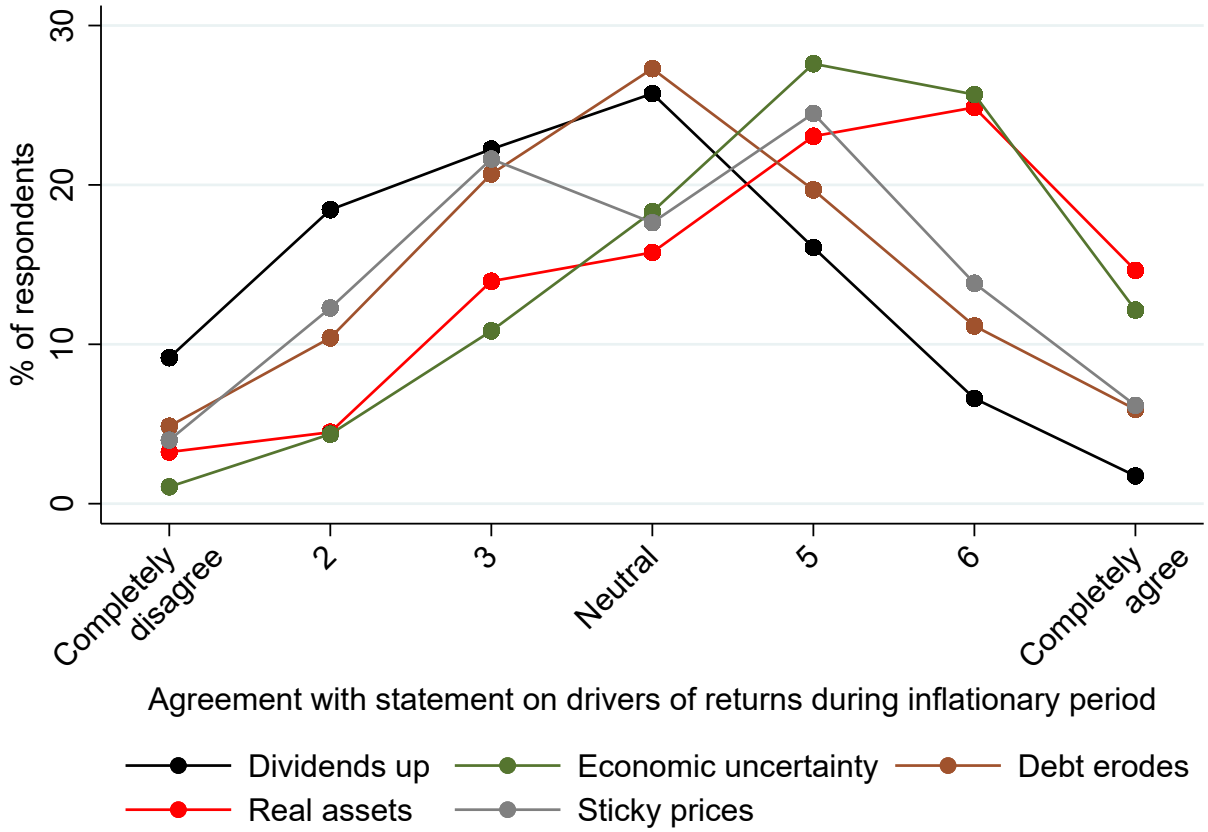
Notes: The figures report the distribution of pre-treatment estimates of the historical asset-return impact of inflation. We subtract unconditional return estimates from inflationary-period return estimates, so positive numbers indicate higher perceived returns during inflationary periods. We define inflationary periods as episodes of inflation in Germany accelerating and peaking at above 4%. Return estimates are from the perspective of a German investor. We elicit return estimates of German energy stocks, German government bonds with a 10-year remaining maturity, the US stock market, the Japanese stock market, gold, and residential real estate in Germany.

Figure 3: Prior passthrough of return impact of inflation on expectations



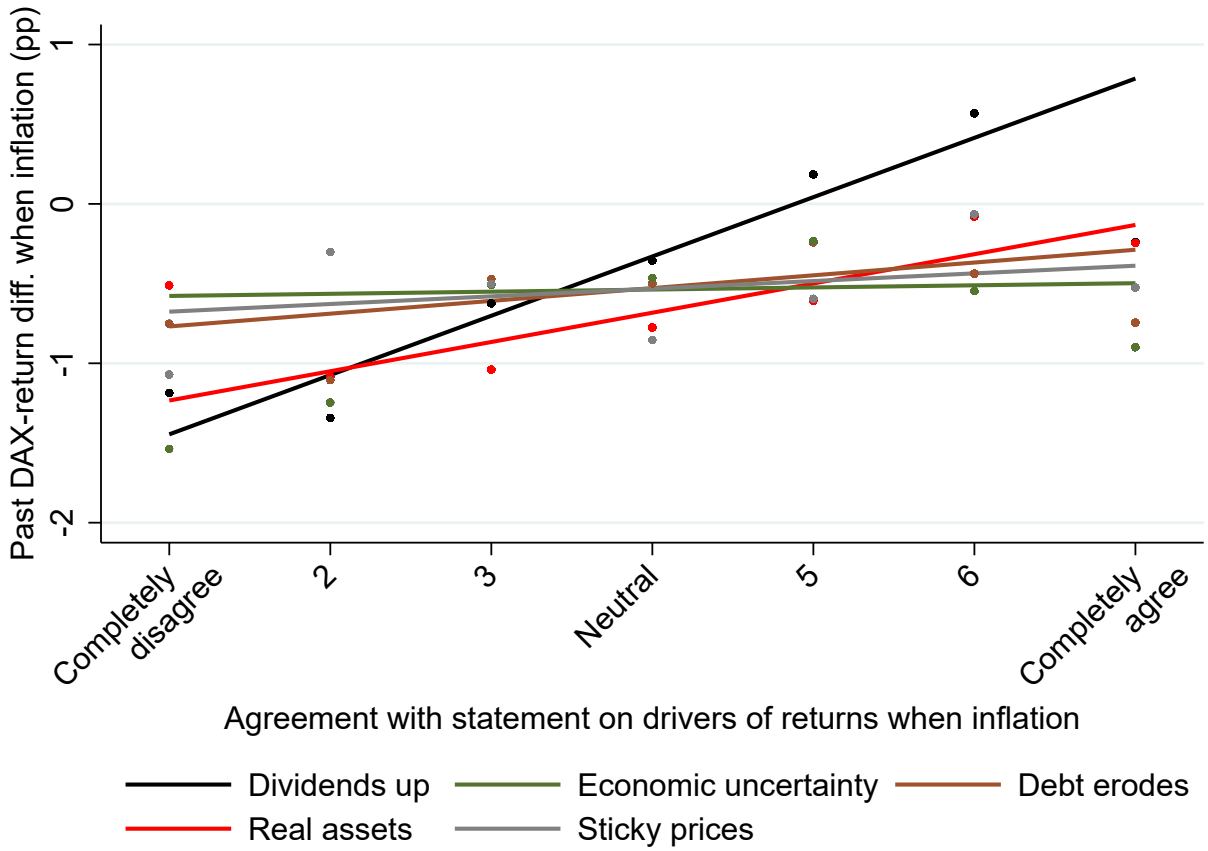
Notes: The figure shows respondents' 12-month return expectations of the German stock market (vertical axis) relative to their perceived German-stock-return impact of inflationary periods in Germany since 1950 (horizontal axis). We calculate the return impact of inflation by subtracting respondents' pre-treatment estimates of unconditional returns from inflationary-period return estimates. Positive numbers hence imply a positive perceived nominal return impact of inflationary periods. We partial out a standard set of controls we describe in Section 4 as well as unconditional return estimates, following the covariate-adjustment approach by Cattaneo et al. (2024).

Figure 4: Distribution of mental models behind return impact of inflation



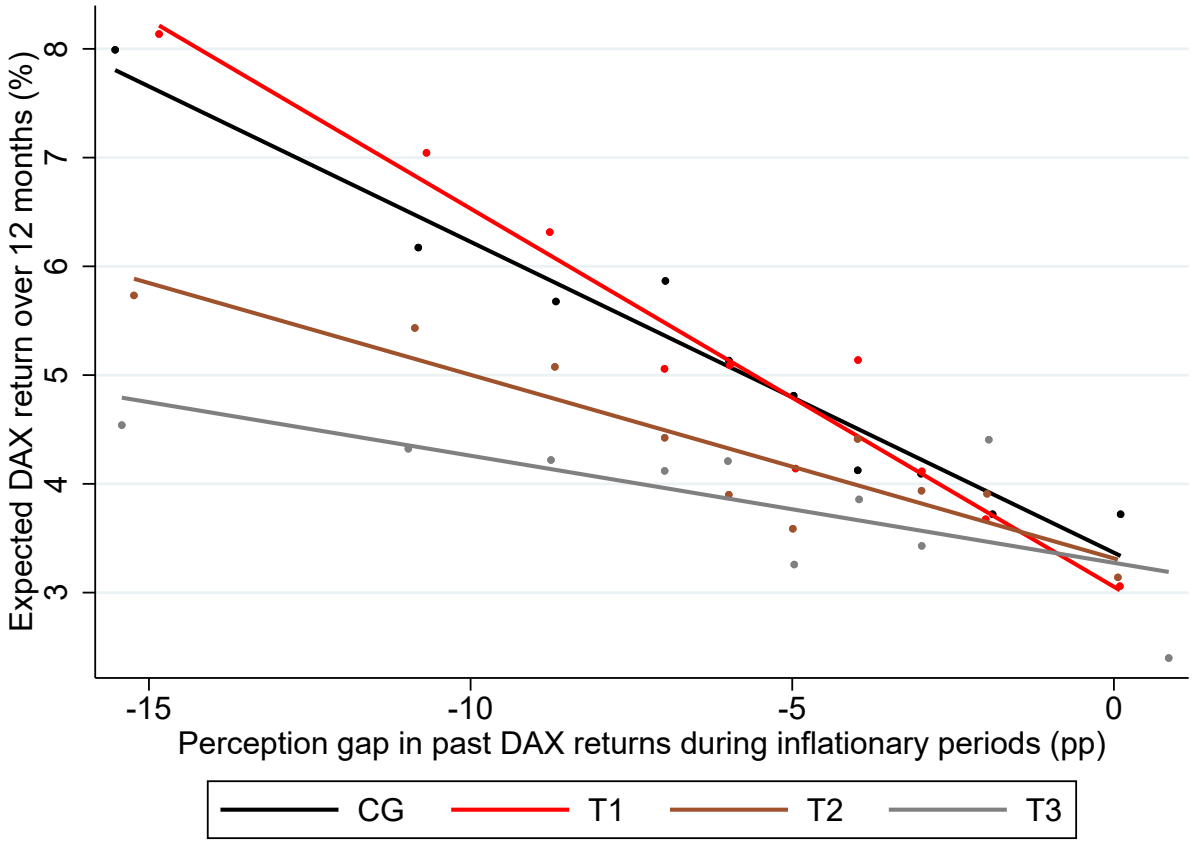
Notes: The figure documents the distribution of agreement with theories describing the stock return-inflation relation. We measure agreement on a 1–7 scale, ranging from "completely disagree" over "neutral" to "completely agree." We ask about the following theories: *dividends up* describes that dividends go up with inflation; *economic uncertainty* means inflation precedes economic uncertainty; *debt erodes* in real terms with inflation; *real assets* protect against money erosion; and *sticky prices* mean firms cannot pass on higher costs. Responses come from the control group and inflation treatment only to avoid mental models being affected by the past-returns treatments.

Figure 5: Mental models and beliefs about return impact of inflation



Notes: The figure illustrates the relation between the perceived German-stock-return impact of inflationary periods since 1950 (vertical axis) and agreement with theories describing the stock return-inflation relation (horizontal axis). We calculate the stock-return impact of inflation by subtracting respondents' pre-treatment estimates of unconditional returns from inflationary-period return estimates. Positive numbers hence imply a positive perceived nominal return impact of inflationary periods. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. We measure agreement with theories on a 1–7 scale, ranging from "completely disagree" over "neutral" to "completely agree." We ask about the following theories: *dividends up* describes that dividends go up with inflation; *economic uncertainty* means inflation precedes economic uncertainty; *debt erodes* in real terms with inflation; *real assets* protect against money erosion; and *sticky prices* mean firms cannot pass on higher costs. We limit the sample to the control group and inflation treatment to mitigate possible effects of the past-returns information.

Figure 6: Treatment effects on return expectations by perception gaps



Notes: The figure highlights the effects of treatment-induced learning about the historical stock return-inflation relation. 12-month return expectations of the German stock market are on the vertical axis. The difference between realized annual returns of the German stock market in nominal terms during inflationary periods since 1950 and respondents' corresponding pre-treatment estimates of returns is on the horizontal axis. A more negative perception gap hence implies a higher pre-treatment inflationary-period return estimate. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. We plot the relation between expectations and the perception gap for each treatment arm. *CG* is the control group that receives no information; *T1* learns about the inflation environment; *T2* gets past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns.

Table 1: Descriptive statistics

Data sources:	PHF	Bank sample				
Statistics:	Mean	Mean	SD	P25	P50	P75
Demographics						
Female (0/1)	0.50	0.14	0.34	0.00	0.00	0.00
Joint account (0/1)		0.06	0.24	0.00	0.00	0.00
Age (years)	52.97	50.35	14.54	39.00	51.00	61.00
University completed (0/1)	0.29	0.66	0.47	0.00	1.00	1.00
Business at university (0/1)		0.19	0.40	0.00	0.00	0.00
Employed (0/1)	0.54	0.72	0.45	0.00	1.00	1.00
Gross wealth (€ k)	238.13	345.09	302.76	87.50	375.00	750.00
Debt (€ k)	31.15	69.00	139.65	0.00	0.00	75.00
Perceptions and expectations						
Inflation rate today (%)		4.99	1.62	4.00	5.00	5.00
Inflation rate today relative to 1yr ago (%)		3.12	1.97	2.00	3.00	4.00
Inflation rate in 12 months (%)		4.57	1.92	3.50	4.50	5.25
Inflation as recent trading motive (0/1)		0.42	0.49	0.00	0.00	1.00
Inflation top financial-market risk (0/1)		0.26	0.44	0.00	0.00	1.00
Portfolio at bank						
Portfolio value (€ k)		139.61	265.61	7.38	35.96	130.74
Portfolio positions (no.)		14.21	15.15	4.08	10.25	17.92
Equity share (%)		0.84	0.22	0.76	0.94	1.00
Share of German securities (%)		0.37	0.32	0.10	0.27	0.62
Monthly trades (no.)		2.98	4.04	0.33	1.27	3.83
Monthly net buys (€)		628.01	5142.94	0.00	189.99	1061.07

Notes: This table presents summary statistics for respondents' characteristics (survey and bank data), perceptions and expectations (survey data), and portfolios (bank data). We present the variables' mean, standard deviation (SD), 25th percentile (P25), median (P50), and 75th percentile (P75). We compare our respondents to a representative German sample from the 2017 wave of the Bundesbank's Panel on Household Finances. Perceptions and expectations are from the pre-treatment section of the survey. We trim the 1% tails of perceived past and current as well as expected inflation. Portfolio data cover averages over the 12 months preceding the survey. We winsorize unbounded portfolio variables at the 99th percentile. The baseline number of observations is 2,792 for survey data and 1,994 for bank data.

Table 2: Treatment effects on 12-month return expectations

Dependent variable:	DAX	DE energy	S&P 500	Nikkei 225	Bunds 10y	Gold
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Baseline						
T1: inflation	0.092	0.243	0.051	−0.163	−0.087	−0.026
	(0.181)	(0.189)	(0.203)	(0.166)	(0.103)	(0.170)
T2: past returns	−0.684***	0.505***	−0.035	1.066***	0.123	1.909***
	(0.184)	(0.189)	(0.205)	(0.200)	(0.102)	(0.214)
T3: 1+2+reason	−1.049***	0.429**	−0.114	1.490***	0.164	2.354***
	(0.185)	(0.180)	(0.205)	(0.194)	(0.109)	(0.219)
Observations	2,568	2,572	2,499	2,578	2,644	2,525
R-squared	0.14	0.10	0.16	0.18	0.16	0.22
Panel B. Perception gaps						
Perception gap	−0.191***	−0.271***	−0.206***	−0.184***	−0.101***	−0.171***
	(0.040)	(0.038)	(0.044)	(0.049)	(0.033)	(0.036)
T1: inflation	−0.222	0.345*	0.061	−0.123	−0.031	0.891*
	(0.304)	(0.193)	(0.197)	(0.401)	(0.113)	(0.515)
T2: past returns	0.006	0.547***	0.112	0.571	0.169	1.679***
	(0.310)	(0.193)	(0.202)	(0.450)	(0.110)	(0.530)
T3: 1+2+reason	−0.196	0.395**	0.054	0.846*	0.315***	2.479***
	(0.317)	(0.178)	(0.205)	(0.459)	(0.115)	(0.586)
T1 x perception gap	−0.037	−0.039	−0.075	−0.004	0.044	−0.107**
	(0.052)	(0.057)	(0.054)	(0.056)	(0.048)	(0.048)
T2 x perception gap	0.131**	0.215***	0.109**	0.103	0.020	0.029
	(0.051)	(0.051)	(0.055)	(0.065)	(0.045)	(0.053)
T3 x perception gap	0.172***	0.145***	0.155***	0.129**	0.070	−0.017
	(0.054)	(0.050)	(0.053)	(0.066)	(0.052)	(0.058)
Observations	2,445	2,412	2,332	2,407	2,479	2,329
R-squared	0.17	0.14	0.19	0.19	0.17	0.24
Controls	Y	Y	Y	Y	Y	Y
Avg. Y control group	5.0	4.6	5.9	4.1	1.4	4.0

Notes: This table reports regression estimates of 12-month asset-return expectations in each treatment arm relative to the control group. Returns are from the perspective of a German investor and for the German stock market, German energy stocks, the US and Japanese stock market, 10-year German government bonds, and gold. *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. In Panel B, we define the *perception gap* as the difference between realized annual returns of the German stock market in nominal terms during inflationary periods since 1950 and respondents' corresponding pre-treatment estimates of returns. *Observations* vary because we filter out return estimates outside the -10–20% bounds. The list of *controls* is in Section 4. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Treatment effects on mental models behind return impact of inflation

Dependent variable:	Dividends up	Real assets	Debt erodes	Econ. proxy	Sticky prices
	(1)	(2)	(3)	(4)	(5)
T2 or T3	0.048	−0.012	0.014	0.172***	0.070*
	(0.039)	(0.038)	(0.039)	(0.039)	(0.039)
Controls	Y	Y	Y	Y	Y
Avg. Y control group	3.6	4.9	4.1	5.2	4.2
Observations	2,690	2,690	2,690	2,690	2,690
R-squared	0.03	0.07	0.04	0.02	0.02

Notes: This table shows subjective mental models of respondents in a pooled treatment group learning about past returns (T2 and T3) relative to those who do not (control group and T1). We test for mental models by asking for agreement with theories on the stock return-inflation relation. The theories are as follows: *dividends up* describes that dividends go up with inflation; *real assets* protect against money erosion; *debt erodes* in real terms with inflation; *econ. proxy* means inflation precedes economic uncertainty; and *sticky prices* imply firms cannot easily pass on higher input costs. Response options are on a 1–7 ordinal scale, ranging from "completely disagree" over "neutral" to "completely agree." We standardize the outcome variables. The list of *controls* is in Section 4. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Inflation beliefs and 12-month return expectations

Dependent variable:	DAX	DE energy	S&P 500	Nikkei 225	Bunds 10y	Gold
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Perceived return impact of inflation						
T1: inflation	−0.023	0.339*	0.212	−0.094	−0.106	−0.108
	(0.185)	(0.190)	(0.204)	(0.168)	(0.113)	(0.183)
Return Δ when inflation	0.210***	0.284***	0.174***	0.154***	0.068*	0.171***
	(0.045)	(0.045)	(0.052)	(0.047)	(0.041)	(0.046)
T1 x return Δ	−0.025	−0.029	0.101	0.070	0.002	0.073
	(0.061)	(0.071)	(0.077)	(0.073)	(0.065)	(0.071)
Observations	1,402	1,387	1,343	1,389	1,424	1,340
R-squared	0.19	0.20	0.24	0.22	0.21	0.24
Panel B. Revision of inflation forecast						
Inflation-forecast revision	−0.038	−0.073	0.013	0.004	0.057	−0.011
	(0.090)	(0.086)	(0.095)	(0.109)	(0.060)	(0.131)
Observations	538	542	530	544	557	529
R-squared	0.15	0.13	0.15	0.18	0.13	0.15
Controls	Y	Y	Y	Y	Y	Y
Avg. Y control group	5.0	4.7	6.0	4.1	1.4	4.2

Notes: This table reports regression estimates of 12-month return expectations of various assets. Returns are from the perspective of an investor in Germany and for the German stock market, German energy stocks, the US and Japanese stock market, German government bonds with a 10-year remaining maturity, and gold. In Panel A, we restrict the sample to the control group and respondents in the first treatment group (T1). *T1* receives information about the inflation environment. *Return Δ when inflation* is the perceived asset-return impact of inflationary periods since 1950, which we calculate by subtracting respondents' pre-treatment estimates of unconditional returns from inflationary-period return estimates for each asset. Positive numbers hence imply a positive perceived nominal return impact of inflationary periods. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. In Panel B, we restrict the sample to respondents in the third treatment group (T3). *T3* receives the information of T1 as well as past inflationary-period asset returns with the reasoning behind the returns. *Inflation-forecast revision* is the change in the one-year inflation forecast post- relative to pre-treatment. *Observations* vary because we filter out return estimates outside the -10–20% bounds. The list of *controls* is in Section 4. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Beliefs about returns during inflation and hypothetical trading

Dependent variable:	DAX	DE energy	S&P 500	Nikkei 225	Bunds 10y	Gold
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Prior beliefs						
Return Δ when inflation	41.7***	−1.5	26.7**	7.7	0.6	36.8***
	(13.1)	(8.6)	(12.9)	(7.1)	(6.1)	(10.8)
Historical return	66.7***	31.2***	92.4***	20.8***	18.6**	65.3***
	(16.0)	(7.3)	(12.9)	(6.1)	(7.5)	(11.2)
Observations	2,471	2,429	2,359	2,427	2,484	2,345
R-squared	0.11	0.05	0.16	0.09	0.04	0.09
Panel B. Reduced form						
T1: inflation	−73.6	42.8	−50.5	−58.4	−25.8	−3.7
	(120.5)	(61.8)	(121.0)	(41.3)	(41.2)	(83.5)
T2: past returns	−830.6***	155.3**	−231.1*	383.4***	30.7	397.3***
	(123.7)	(63.7)	(124.8)	(55.9)	(40.3)	(94.9)
T3: 1+2+reason	−1288.1***	372.0***	−125.8	522.3***	21.2	456.8***
	(120.8)	(65.8)	(123.0)	(57.8)	(40.1)	(91.1)
Observations	2,597	2,594	2,529	2,599	2,648	2,549
R-squared	0.11	0.06	0.16	0.09	0.04	0.09
Panel C. Instrumental variable						
12m return expectation	1189.3***	933.4**	795.6	360.8***	104.4	187.2***
	(212.5)	(409.7)	(1255.1)	(56.1)	(281.1)	(36.0)
Observations	1,315	1,320	1,283	1,321	1,350	1,296
1st stage F-stat	34.75	5.01	0.48	56.35	1.71	113.35
Controls	Y	Y	Y	Y	Y	Y
Avg. Y control group	3,444.3	771.8	2,963.2	488.0	264.9	1,024.4

Notes: This table reports estimates from regressions of asset allocation based on a hypothetical €10,000 endowment. Assets in question are cash (not shown), the German stock market, German energy stocks, the US and Japanese stock market, 10-year German government bonds, and gold. In Panel A, *return Δ when inflation* is the perceived historical impact of inflationary periods on returns of the respective asset. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. *Historical return* is the perceived historical unconditional return of the respective asset. In Panel B, *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. In Panel C, we instrument *12m return expectation* of each asset using the T3 indicator. *Observations* vary because we filter out return estimates outside the -10–20% bounds. The list of *controls* is in Section 4. We additionally control for the treatment indicator in Panel A. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Beliefs about returns during inflation and actual trading

DV:	Number German equities				German equities in EUR			
Trades:	Gross buys		Net buys		Gross buys		Net buys	
Post-treat:	2m	4m	2m	4m	2m	4m	2m	4m
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Reduced form								
T1	−0.05	−0.04	−0.03	−0.01	−24.55	−89.58	37.19	46.06
	(0.05)	(0.04)	(0.05)	(0.04)	(292.96)	(201.89)	(275.04)	(211.29)
T2	−0.02	−0.01	0.00	0.01	−261.13	−209.77	−103.66	−150.14
	(0.05)	(0.04)	(0.05)	(0.04)	(296.61)	(212.80)	(272.08)	(210.64)
T3	−0.15***	−0.09**	−0.13***	−0.07*	−693.94***	−388.77*	−229.40	−91.79
	(0.05)	(0.04)	(0.05)	(0.04)	(265.69)	(203.70)	(251.07)	(200.70)
N	1,994	1,994	1,994	1,994	1,994	1,994	1,994	1,994
Panel B. Instrumental variable								
12m DAX	0.12***	0.07**	0.11**	0.06*	536.22**	287.46*	165.20	55.92
	(0.04)	(0.03)	(0.04)	(0.03)	(234.14)	(169.85)	(204.38)	(162.34)
N	1,001	1,001	1,001	1,001	1,001	1,001	1,001	1,001
F-stat	29.71	29.71	29.71	29.71	29.71	29.71	29.71	29.71
Y	0.55	0.49	0.34	0.31	1,823.67	1,415.51	550.27	428.34

Notes: This table reports estimates from regressions of actual trading of German equity securities. We study purchases in terms of number of securities (Columns 1–4) and their euro amount (Columns 5–8). Purchases are gross (Columns 1–2 and 5–6) and net (Columns 3–4 and 7–8). We take investor-month averages in the two and four months post-treatment relative to the three months pre-treatment. In Panel A, *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. In Panel B, *12m DAX* is the 12-month return expectation of the German stock market, which we instrument using the T3 indicator. *N* describes the number of observations, which is lower in Panel B because we filter out return expectations outside the -10–20% bounds. *Y* is the post-treatment average of the dependent variable in the control group. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Treatment effects on other expectations

DV:	Own salary		Own portfolio		Unemployment		Economic growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
T1	0.003	−0.004	−0.034	−0.067	−0.049	−0.064	0.006	−0.018
	(0.040)	(0.040)	(0.047)	(0.045)	(0.045)	(0.045)	(0.051)	(0.050)
T2	−0.014	−0.003	0.118**	0.078*	0.020	−0.028	0.056	0.018
	(0.042)	(0.041)	(0.048)	(0.046)	(0.049)	(0.049)	(0.054)	(0.053)
T3	0.004	0.018	0.039	−0.009	−0.042	−0.077	−0.081	−0.128**
	(0.041)	(0.040)	(0.048)	(0.047)	(0.048)	(0.049)	(0.053)	(0.053)
Controls	N	Y	N	Y	N	Y	N	Y
Avg. Y	3.3	3.3	3.5	3.5	2.9	2.9	3.1	3.1
N	2,792	2,690	2,792	2,690	2,792	2,690	2,792	2,690
R2	0.00	0.09	0.00	0.10	0.00	0.05	0.00	0.07

Notes: This table reports 12-month expectations of personal (Columns 1–4) and aggregate (Columns 5–8) economic conditions in the treatment groups relative to the control group. We measure expectations on a 1–5 scale, ranging from "much worse" to "much better." *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. The list of *controls* is in Section 4. The number of observations, *N*, is lower where we add controls because these include perceptions of inflation, trimmed at the 1st and 99th percentile. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix:

Inflation and Trading

Philip Schnorpfeil, Michael Weber, and Andreas Hackethal

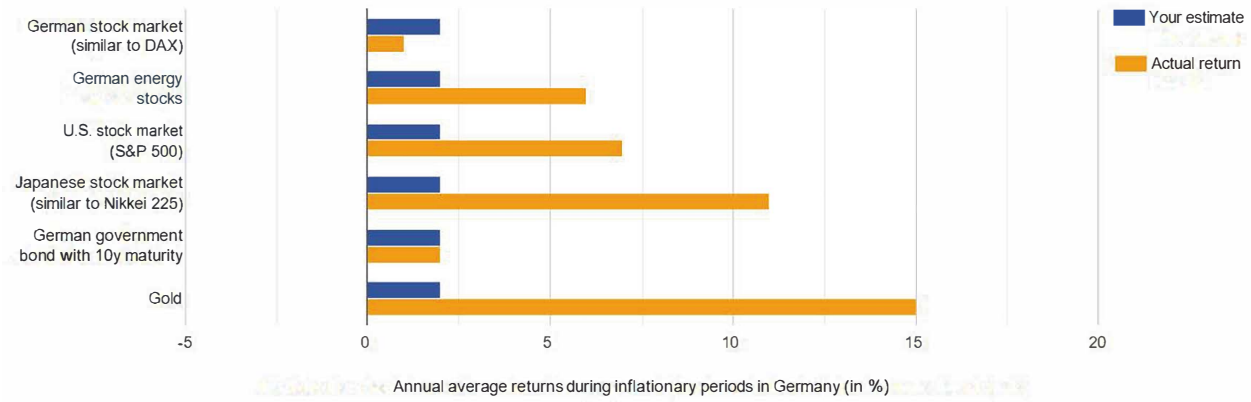
Not for Publication

A Appendix figures and tables

Figure A1: Screenshots of figures as part of information treatments

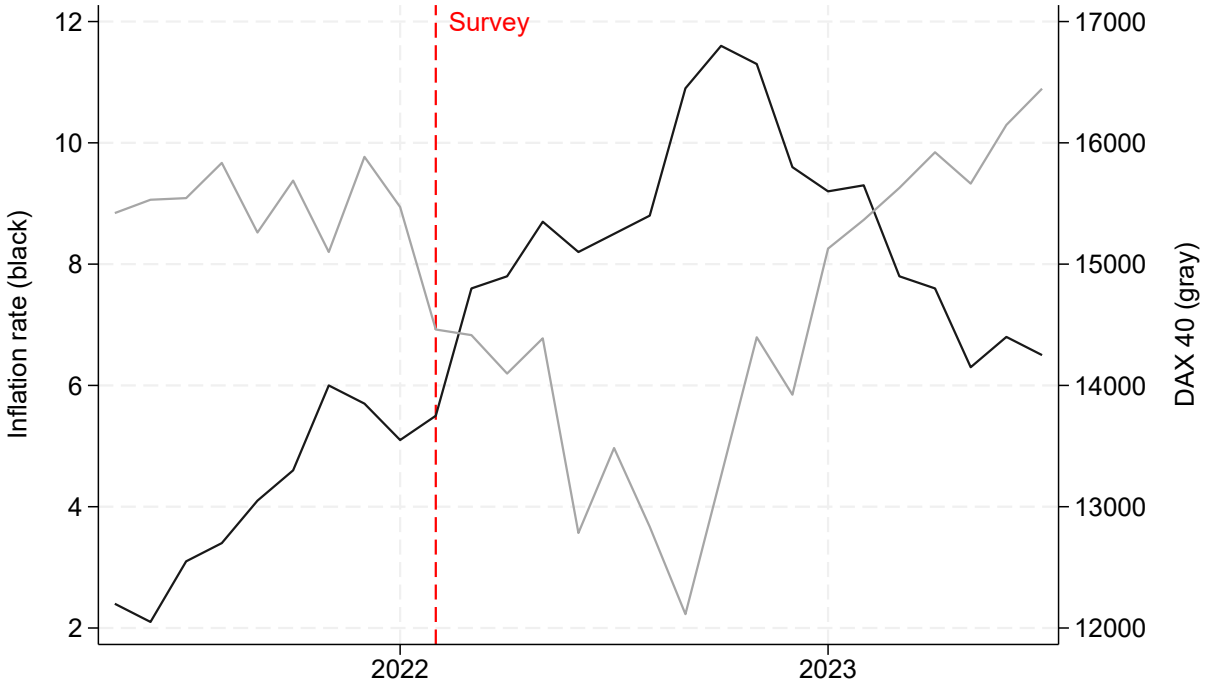
Panel A. Time series of inflation rate in Germany

Panel B. Actual vs. estimated returns during past inflationary periods



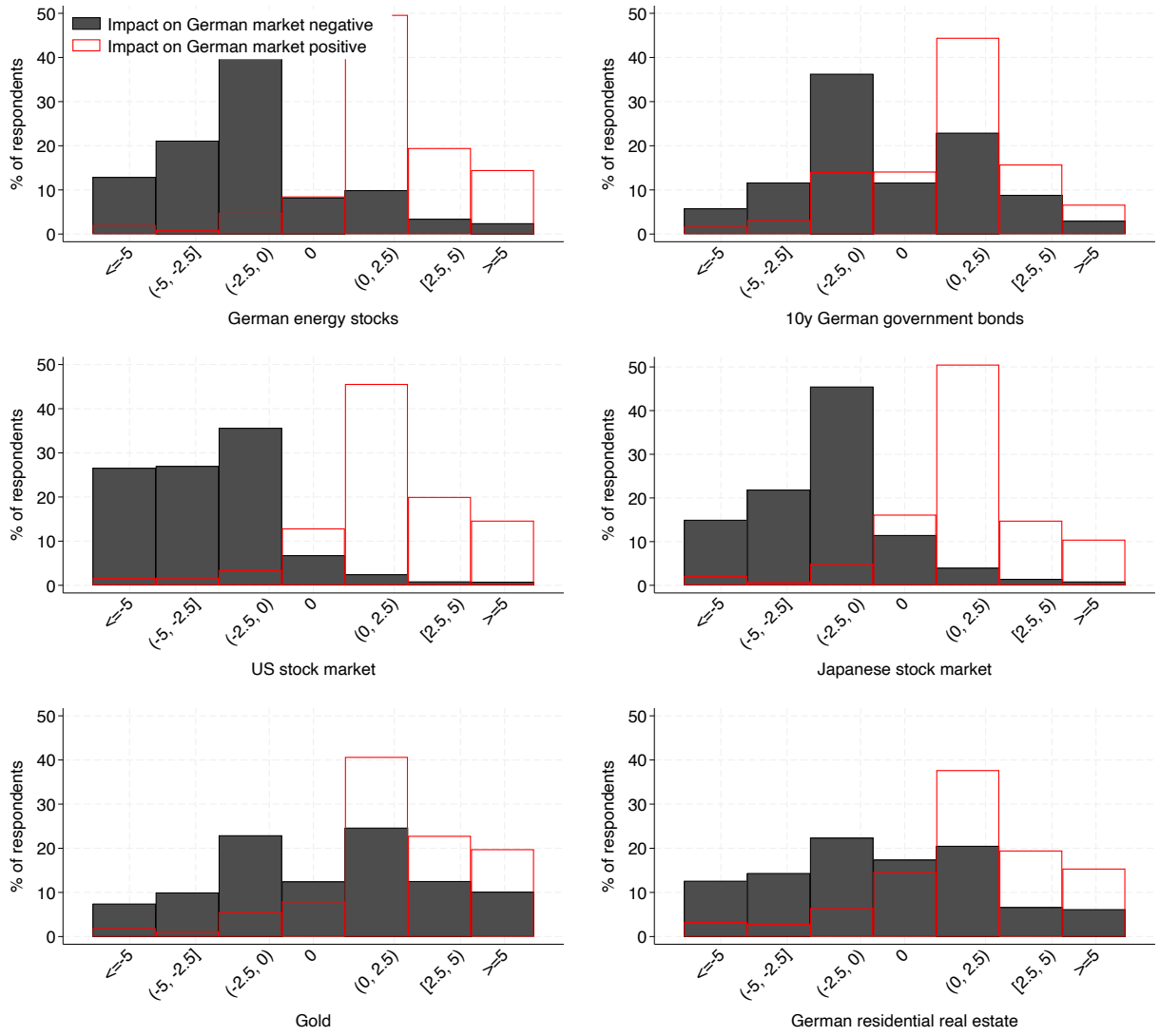
Notes: The figures present screenshots of the illustrations that are part of the treatments. We translate all text from German to English. In Panel A, we show a time series of inflation in Germany, as part of treatments 1 and 3. In Panel B, we present an example screenshot of the dynamic figures on past asset returns during inflationary periods in Germany. Respondents in treatment groups 2 and 3 see the screen. The screen contrasts respondents' estimates of past average annual nominal returns (blue bars) with actual past returns (orange bars). The screen initially shows respondents' pre-treatment estimates. We then instruct respondents to repeatedly click on a button to show asset-by-asset actual returns graphically as well as display a sentence above the figure comparing each pre-treatment estimate with the respective actual return.

Figure A2: Inflation and stock returns around survey participation



Notes: This figure plots the trajectory of inflation in Germany and the DAX 40, the major German stock market index, before and after the survey period. The rate of inflation is on the left vertical axis, and is based on the harmonized consumer price index. Data come from Deutsche Bundesbank. Values of the DAX 40 are on the right vertical axis. Data come from Global Financial Data.

Figure A3: Perceived return impact of inflation by beliefs about German stocks



Notes: The figures report the distribution of pre-treatment estimates of the historical asset-return impact of inflation. We subtract unconditional return estimates from inflationary-period return estimates, so positive numbers indicate higher perceived returns during inflationary periods. Gray bars show the distribution of estimates for investors who perceive lower returns of German stocks during inflationary periods; transparent bars display the distribution for investors who perceive inflationary-period returns of German stocks to be higher. We define inflationary periods as episodes of inflation in Germany accelerating and peaking at above 4%. Return estimates are from the perspective of a German investor. We elicit return estimates of German energy stocks, German government bonds with a 10-year remaining maturity, the US stock market, the Japanese stock market, gold, and residential real estate in Germany.

Table A1: Balancedness across treatment arms

	CG	T1	p-val (1)=(2)	T2	p-val (1)=(4)	p-val (2)=(4)	T3	p-val (1)=(7)	p-val (2)=(7)	p-val (4)=(7)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Demographics										
Female (0/1)	0.15	0.15	0.96	0.11	0.04**	0.04**	0.12	0.07*	0.07*	0.81
Couple (0/1)	0.06	0.07	0.54	0.07	0.63	0.93	0.06	0.85	0.71	0.79
Age (years)	50.04	49.36	0.36	51.47	0.06*	0.01***	50.94	0.24	0.05*	0.52
University (0/1)	0.67	0.64	0.24	0.66	0.63	0.55	0.67	0.90	0.34	0.74
Business at uni (0/1)	0.22	0.19	0.21	0.18	0.09*	0.59	0.17	0.01**	0.17	0.43
Employed (0/1)	0.75	0.69	0.02**	0.71	0.13	0.54	0.72	0.25	0.31	0.71
Gross wealth (€ k)	348.53	337.49	0.53	340.22	0.66	0.89	355.09	0.73	0.35	0.46
Debt (€ k)	81.49	69.07	0.12	62.05	0.02**	0.38	58.98	0.01***	0.19	0.70
Inflation beliefs										
Inflation rate today (%)	5.03	4.91	0.13	5.01	0.81	0.26	5.02	0.91	0.17	0.90
Inflation change 1yr (%)	3.15	3.03	0.21	3.20	0.64	0.10	3.10	0.61	0.51	0.37
Inflation in 12m (%)	4.60	4.47	0.17	4.56	0.73	0.36	4.66	0.54	0.06*	0.38
Inflation trading (0/1)	0.46	0.41	0.09*	0.41	0.11	0.98	0.41	0.16	0.83	0.85
Inflation top risk (0/1)	0.22	0.27	0.06*	0.29	0.01***	0.42	0.27	0.07*	0.97	0.46
Portfolio at bank										
Portfolio value (€ k)	127.06	128.48	0.92	138.59	0.44	0.51	117.98	0.53	0.48	0.18
Portfolio positions (no.)	12.44	12.30	0.87	13.31	0.31	0.25	11.91	0.52	0.64	0.11
Equity share (%)	0.83	0.84	0.55	0.85	0.11	0.30	0.84	0.54	0.96	0.34
Share DE securities (%)	0.40	0.41	0.65	0.42	0.34	0.60	0.40	0.87	0.80	0.47
Monthly trades (no.)	2.08	2.29	0.29	2.21	0.53	0.73	2.10	0.92	0.38	0.62
Monthly net buys (€)	602.12	473.24	0.14	749.78	0.14	0.01***	650.72	0.62	0.08*	0.39

Notes: This table shows means for respondent characteristics in each treatment arm (Columns 1, 2, 4, and 7). We provide a check of balance of means across all arms in Columns 3, 5, 6, 8, 9, and 10. Inflation beliefs are from the pre-treatment section of the survey. We trim the 1% tails of perceived past, current, and expected inflation. Portfolio data cover averages over the 12 months preceding the survey. We winsorize unbounded portfolio variables at the 99th percentile. The baseline number of observations is 2,792.

Table A2: Mental models behind perceived return impact of inflation

Dependent variable:	DAX return Δ when inflation		DAX 12m return expectation	
	(1)	(2)	(3)	(4)
Dividends grow w/ inflation	0.516***	0.522***	0.153**	0.147**
	(0.077)	(0.076)	(0.071)	(0.069)
Real assets protect	0.143*	0.165**	0.103	0.068
	(0.079)	(0.079)	(0.073)	(0.070)
Nominal debt erodes	0.039	0.007	−0.031	−0.029
	(0.078)	(0.076)	(0.076)	(0.072)
Economic uncertainty	0.014	−0.030	−0.144**	−0.062
	(0.075)	(0.072)	(0.072)	(0.067)
Sticky prices	−0.001	0.028	−0.082	−0.081
	(0.076)	(0.074)	(0.072)	(0.068)
Controls	N	Y	N	Y
Avg. Y	-0.6	-0.6	4.7	4.6
Observations	2,555	2,472	2,747	2,568
R-squared	0.03	0.10	0.00	0.14

Notes: This table reports estimates of regressions of beliefs about the German stock market. Columns 1–2 consider the perceived historical impact of inflationary periods on returns of the German stock market. Positive numbers imply a positive perceived nominal return impact of inflation. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. Columns 3–4 refer to the 12-month return expectation of the German stock market. The key explanatory variables capture agreement with theories on the stock return-inflation relation. Response options are on a 1–7 ordinal scale, ranging from "completely disagree" over "neutral" to "completely agree." We standardize the explanatory variables. The list of *controls* is in Section 4. We add treatment indicators as controls because the past-return information affect respondents' mental models. *Observations* vary because we filter out return estimates outside the -10–20% bounds, and observations are lower where we add controls because these include perceptions of inflation, trimmed at the 1st and 99th percentile. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Treatment effects on inflation expectations

Dependent variable:	1yr forecast		Revision 1yr forecast		5yr forecast	
	(1)	(2)	(3)	(4)	(5)	(6)
T1: inflation	0.395***	0.488***	0.532***	0.540***	0.294***	0.344***
	(0.101)	(0.089)	(0.094)	(0.092)	(0.096)	(0.087)
T2: past returns	−0.189*	−0.093	−0.198**	−0.176**	−0.140	−0.067
	(0.105)	(0.087)	(0.088)	(0.086)	(0.101)	(0.091)
T3: 1+2+reason	0.417***	0.475***	0.331***	0.410***	0.202**	0.296***
	(0.109)	(0.093)	(0.101)	(0.098)	(0.097)	(0.090)
Controls	N	Y	N	Y	N	Y
Avg. Y control group	5.0	5.0	0.4	0.3	3.7	3.7
Observations	2,747	2,660	2,704	2,631	2,751	2,663
R-squared	0.02	0.27	0.02	0.09	0.01	0.18

Notes: This table reports inflation expectations in each treatment arm relative to the control group. The one-year forecast is in Columns 1–2, the pre- to post-treatment change in the one-year forecast is in Columns 3–4, and the five-year forecast is in Columns 5–6. *T1* receives inflation information; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. The list of *controls* is in Section 4. *Observations* vary because we trim 1% tails of inflation forecasts, and observations are lower where we add controls because these include perceptions of inflation, trimmed at the 1st and 99th percentile. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Changes in return expectations and hypothetical trading

Dependent variable:	DAX	DE energy	S&P 500	Nikkei 225	Bunds 10y	Gold
	(1)	(2)	(3)	(4)	(5)	(6)
12m return expectation	1095.3***	508.7***	602.7	355.8***	244.3	192.7***
	(155.1)	(187.8)	(773.8)	(41.3)	(185.7)	(29.0)
Controls	Y	Y	Y	Y	Y	Y
Avg. Y control group	3,444.3	771.8	2,963.2	488.0	264.9	1,024.4
Observations	2,566	2,569	2,498	2,575	2,641	2,522
1st stage F-stat	19.35	2.91	0.32	33.18	1.73	63.03

Notes: This table reports estimates from regressions of asset allocation based on a hypothetical €10,000 endowment. Assets in question are the German stock market, German energy stocks, the US and Japanese stock market, 10-year German government bonds, and gold. We instrument *12m return expectation* of each asset using indicators for all treatments as part of Equation 1. The list of *controls* is in Section 4. *Observations* vary because we filter out return estimates outside the -10–20% bounds. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Changes in return expectations and actual trading

DV:	Number German equities				German equities in EUR			
Trades:	Gross buys		Net buys		Gross buys		Net buys	
Post-treat:	2m	4m	2m	4m	2m	4m	2m	4m
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
12m DAX	0.09**	0.05*	0.09**	0.04	523.52**	254.00*	180.27	87.94
	(0.04)	(0.03)	(0.04)	(0.03)	(203.62)	(151.52)	(180.31)	(145.43)
Y	0.55	0.49	0.34	0.31	1,823.67	1,415.51	550.27	428.34
N	1,962	1,962	1,962	1,962	1,962	1,962	1,962	1,962
F-stat	12.78	12.78	12.78	12.78	12.78	12.78	12.78	12.78

Notes: This table reports estimates from regressions of actual trading of German equity securities. We study purchases in terms of number of securities (Columns 1–4) and their euro amount (Columns 5–8). Purchases are gross (Columns 1–2 and 5–6) and net (Columns 3–4 and 7–8). We take investor-month averages in the two and four months post-treatment relative to the three months pre-treatment. *12m DAX* is the 12-month return expectation of the German stock market, which we instrument using indicators for all treatments as part of Equation 1. Y is the post-treatment average of the dependent variable in the control group. N describes the number of observations. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Treatment effects on trading of German stocks and all securities

DV:	Number of German securities traded				Euro amount of German securities traded			
Trades:	Gross buys		Net buys		Gross buys		Net buys	
Post:	2m	4m	2m	4m	2m	4m	2m	4m
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Directly held German stocks								
T1	−0.03	−0.03	−0.01	−0.01	−66.62	−116.74	42.78	42.99
	(0.05)	(0.03)	(0.05)	(0.03)	(283.07)	(193.33)	(265.85)	(196.85)
T2	−0.02	−0.02	−0.02	−0.01	−338.34	−236.20	−182.95	−213.88
	(0.05)	(0.04)	(0.05)	(0.04)	(276.64)	(199.74)	(258.43)	(199.50)
T3	−0.12***	−0.07*	−0.11**	−0.06*	−705.75***	−348.53*	−162.24	−56.15
	(0.05)	(0.04)	(0.04)	(0.03)	(253.02)	(191.32)	(241.26)	(189.04)
Y	0.40	0.34	0.23	0.19	1,692.77	1,364.23	511.62	444.04
N	1,994	1,994	1,994	1,994	1,994	1,994	1,994	1,994
Panel B. All German securities								
T1	−0.05	−0.04	−0.04	−0.01	−55.63	−133.32	9.60	8.26
	(0.05)	(0.04)	(0.05)	(0.04)	(294.44)	(205.64)	(278.09)	(214.72)
T2	−0.02	−0.02	0.00	0.02	−298.48	−284.19	−141.41	−218.65
	(0.05)	(0.04)	(0.06)	(0.04)	(303.14)	(219.63)	(280.15)	(217.77)
T3	−0.16***	−0.10**	−0.13***	−0.08*	−750.23***	−471.40**	−257.72	−139.10
	(0.05)	(0.04)	(0.05)	(0.04)	(269.59)	(209.90)	(255.44)	(203.96)
Y	0.57	0.51	0.34	0.32	1,866.34	1,478.74	593.00	493.43
N	1,994	1,994	1,994	1,994	1,994	1,994	1,994	1,994

Notes: This table documents actual trading in each treatment arm relative to the control group. We study the number of buys (Columns 1–4) and their euro value (Columns 5–8). Buys are gross (Columns 1–2, 5–6) and net (Columns 3–4, 7–8). We take investor-month averages in the two and four months post-treatment relative to the three months pre-treatment. *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. In Panel A, we restrict trading to German stocks held directly. In Panel B, we study trades of all German securities. Y is the post-treatment control-group average of the dependent variable. N is the number of observations. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Robustness of treatment effects on actual trading

DV:	Number German equities				German equities in EUR			
Trades:	Gross buys		Net buys		Gross buys		Net buys	
Post:	2m	4m	2m	4m	2m	4m	2m	4m
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Adding controls								
T1	−0.06	−0.04	−0.04	−0.02	−105.76	−104.76	−25.10	36.59
	(0.05)	(0.04)	(0.06)	(0.04)	(304.30)	(206.64)	(284.05)	(214.63)
T2	−0.02	−0.01	−0.01	0.01	−317.29	−190.45	−122.80	−123.61
	(0.06)	(0.04)	(0.06)	(0.04)	(306.80)	(215.76)	(282.80)	(215.03)
T3	−0.16***	−0.10**	−0.14***	−0.08**	−733.16***	−351.40*	−213.50	−49.73
	(0.05)	(0.04)	(0.05)	(0.04)	(277.20)	(207.93)	(257.21)	(201.26)
N	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925
Panel B. Two-month pre-treatment window								
T1	−0.02	−0.02	−0.03	−0.03	30.25	−174.94	−1.47	−109.87
	(0.05)	(0.04)	(0.05)	(0.04)	(306.44)	(200.44)	(284.05)	(236.29)
T2	−0.02	−0.03	−0.03	−0.03	−393.06	−298.10	−209.60	−203.98
	(0.05)	(0.04)	(0.06)	(0.04)	(300.90)	(213.63)	(279.50)	(240.02)
T3	−0.17***	−0.12***	−0.17***	−0.11***	−887.44***	−614.70***	−475.57*	−285.95
	(0.05)	(0.04)	(0.05)	(0.04)	(282.19)	(214.79)	(269.26)	(233.19)
N	1,994	1,994	1,994	1,994	1,994	1,994	1,994	1,994
Panel C. No one-trade pre-treatment restriction								
T1	−0.04	−0.03	−0.03	−0.01	−22.40	−74.15	6.41	11.40
	(0.04)	(0.03)	(0.04)	(0.03)	(212.52)	(146.96)	(199.39)	(153.45)
T2	−0.02	−0.01	−0.01	0.01	−213.99	−189.21	−105.82	−148.27
	(0.04)	(0.03)	(0.04)	(0.03)	(212.46)	(152.45)	(194.70)	(150.77)
T3	−0.10***	−0.06**	−0.09**	−0.05*	−457.27**	−278.17*	−162.00	−92.29
	(0.04)	(0.03)	(0.04)	(0.03)	(195.87)	(148.74)	(184.20)	(146.93)
N	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792

Notes: This table documents actual trading of German equity securities in each treatment arm relative to the control group. We study the number of buys (Columns 1–4) and their euro value (Columns 5–8). Buys are gross (Columns 1–2 and 5–6) and net (Columns 3–4 and 7–8). We take investor-month averages in the two and four months post-treatment relative to the three months pre-treatment. *T1* receives information about the inflation environment; *T2* learns about past asset returns during inflationary periods; and *T3* receives the information of T1, T2, and explanations of past returns. In Panel A, we add the standard set of controls, which we describe in Section 4. In Panel B, we reduce the pre-treatment window from three to two months. In Panel C, we do not restrict the sample to respondents who have traded at least once at any point pre-treatment. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Beliefs about gold and purchases of gold

Dependent variable:	Gold in portfolio			Gold purchased last 12m		
	(1)	(2)	(3)	(4)	(5)	(6)
Return Δ when inflation	0.006*		0.006**	0.006***		0.006***
	(0.003)		(0.003)	(0.002)		(0.002)
Historical gold return		0.000	0.003		0.001	0.003
		(0.002)	(0.003)		(0.002)	(0.002)
Controls	Y	Y	Y	Y	Y	Y
Avg. Y	0.42	0.41	0.42	0.14	0.14	0.14
Observations	2,347	2,552	2,347	2,347	2,552	2,347
R-squared	0.07	0.06	0.07	0.04	0.04	0.04

Notes: This table reports estimates of regressions of self-reported holdings (Columns 1–3) and last-12-month purchases (Columns 4–6) of gold. *Return Δ when inflation* is the perceived historical impact of inflationary periods on returns of gold. Inflationary periods are episodes of inflation in Germany accelerating and peaking at above 4%. *Historical gold return* is the perceived historical unconditional return of gold. The list of *controls* is in Section 4. *Observations* vary because we filter out return estimates outside the -10–20% bounds. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B Experimental instructions

This appendix provides the survey instructions translated from German into English. We use green text in parentheses to highlight aspects of the survey design. We show non-numerical response options to the questions using a), b), c), and so forth.

B.1 Welcome screen

Dear investor,

Welcome to a survey conducted by Goethe University Frankfurt. As a thank you for completing the survey, you will receive a **€10 Amazon voucher**. At the end of the survey, you will have the opportunity to enter your email address, which will be used exclusively to send you the voucher and instructions on how to redeem it at Amazon.

The survey will take **approximately 10 minutes**. If you feel that you are not familiar with some of the survey topics, that is okay. We ask you to provide your best estimate. Since we are interested in your unfiltered opinion, please refrain from using external sources (e.g., a Google search).

The survey includes graphical representations that may **not be optimally displayed on smartphones and tablets**. Therefore, we recommend taking the survey on a computer if possible. Please do not use the "Back" button in your browser, as this may require you to restart the survey.

Please feel free to contact us via email at **umfrage@finance.uni-frankfurt.de** if you have any questions.

Start the survey by clicking on the "Continue" button.

B.2 Pre-treatment section

Q1: Have you bought and/or sold securities **in the past twelve months**?

a) Yes

b) No

[If Q1 is answered with "Yes," ask Q1.1 on the next screen and Q1.2 on the screen after that]

Q1.1: Please mention in keywords or 1–2 short sentences the main reasons for these securities transactions.

[Text field to answer the question]

Q1.2: How important were the changes listed below for your most recent securities transactions?

*Please arrange **1–3 items** from the left list to the right list (starting with the highest importance at the top). The items can be moved with the mouse. Additionally, double-clicking an item will move*

it to the other list.

[Three orderings of responses: like below; reverse; swap a) with c), but f) always at the bottom]

Changes in...

a) the inflation rate

b) the return expectations

c) the fluctuations in the capital market

d) the overall economic outlook

e) personal income or wealth

f) other aspects

Q2: For the next questions, we would like you to consider the development of the annual inflation rate more closely. What do you think is the **current** inflation rate in Germany?

Note: the rate of inflation is the percentage change in overall prices in the economy in the last 12 months, most commonly measured by the Consumer Price Index. A falling price level is commonly known as "deflation."

If you think there was deflation, please enter a negative value. You may enter up to one decimal point.

____%

Q3: What do you think, is the current inflation rate in Germany higher, lower, or barely different compared to the inflation rate 12 months ago?

a) Higher

b) Barely different

c) Lower

[If Q3 is answered with a) or c), ask the following question on the same screen, just further down]

Q3.1: How much higher [if a] / lower [if c]?

Please click and drag the slider. Your answer must be between 0.1 and 10 percentage points.

[Slider from 0.1 to 10 in steps of 0.1 percentage points]

Q4: What is the **lowest** inflation rate in Germany **in 12 months** that you can imagine?

In the case of an assumed deflation rate, please enter a negative percentage. The input of up to one decimal place is possible.

____%

[Same screen, just further down]

Q4.1: What is the **highest** inflation rate in Germany **in 12 months** that you can imagine?

In the case of an assumed deflation rate, please enter a negative percentage. The input of up to one decimal place is possible.

____%

[Q4.2 on the next screen]

Q4.2: How likely do you think it is that the inflation rate in Germany **in 12 months** will be more than (Q4 + Q4.1) / 2%?

Please click and drag the slider below.

[Slider from 0% to 100% in percentage point steps, starting position at 0%]

Q5: Please estimate the **annual average returns since 1950** for various asset classes available to an investor in Germany. Please answer this question even for asset classes in which you do not invest, and even if you are not familiar with the topic.

Note: please estimate nominal returns, i.e., returns without considering inflation. Example: an investor who invests €100 today will have €110 in one year at a nominal return of 10%.

In the case of an estimated negative return, please enter a negative value. The input of up to one decimal place is possible.

German stock market (similar to DAX) ____%

Stocks of German utility companies ____%

US stock market (S&P 500) ____%

Japanese stock market (similar to Nikkei 225) ____%

Federal bond with 10-year remaining maturity ____%

Federal bond with two-year remaining maturity ____%

Commodity index (including energy, grains, metals) ____%

Gold ____%

Private residential property ____%

Q5.1: Please estimate again the **annual average returns since 1950**. However, limit your estimates to periods when the **annual inflation rate in Germany increased and ultimately was above 4%**. There have been a total of six such periods since 1950.

Note: please estimate nominal returns again.

In the case of an estimated negative return, please enter a negative value. The input of up to one decimal place is possible.

[The screen, including entries made in Q5, is unchanged, but Q5 is replaced with Q5.1]

[Extension of the existing matrix by one column, where respondents again provide return estimates as percentages. Above column 2 now "Annual historical return in %" and above column 3 "Annual historical return during high inflation in %"]

How confident are you with your answers regarding historical returns that we just asked you about?

[Insert vertical line to separate questions from answers]

Q6: With my estimates on average annual returns since 1950 I am...

Response options: 1 ("Not confident at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Very confident")

Q6.1: With my estimates on average annual returns during periods since 1950 of **inflation rising and ultimately being above 4%** I am...

Response options: 1 ("Not confident at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Very confident")

B.3 Treatment section

[Each survey participant is randomly assigned to either a control group or one of the treatment groups 1-3]

[Control group skips section]

[Treatment 1: inflation]

On the next page, we will provide you with information about **current inflation**.

Please take a moment to **carefully read the information**.

["Next," so that treatment group 1 moves to the next screen]

The current **inflation rate in Germany is 5.3%**. Inflation is thus more than three times as high as the average of the last 10 years (see graph below), and **as high as it was last in 1992**. The president of the Deutsche Bundesbank and the German member of the ECB's Executive Board recently said that the inflation rate could indeed **continue to rise**. The **reasons for the rise in inflation are varied**: exceptional measures in fiscal and monetary policy are creating strong demand pressure; the pandemic is causing supply bottlenecks; climate change and protection are increasing energy costs; and there is wage pressure in the labor market. All these factors are driving prices up.

[Show graph here]

[Treatment 2: asset returns]

On the next page, we will provide you with information about the **annual nominal average returns since 1950** for various asset classes. The returns refer to periods when the **annual inflation rate in Germany increased and ultimately exceeded 4%**.

Please take a moment to **carefully read the information**.

["Next", so that treatment group 2 moves to the next screen]

By (repeatedly) clicking on the box below, the **annual nominal average returns since 1950** will be displayed, showing the actual performance of various asset classes during periods when

inflation in Germany increased and was ultimately over 4%.

Note: the actual nominal returns are based on current calculations by the universities of Frankfurt and Chicago, but do not constitute investment advice.

Only after you have viewed the actual returns of all asset classes can you continue with the survey.

During past inflationary periods, the return of the **German stock market** was on average 1% per year (your estimate: ____%).

During past inflationary periods, the return of **German utilities** was on average 6% per year (your estimate: ____%).

During past inflationary periods, the return of the **US stock market** was on average 7% per year (your estimate: ____%).

During past inflationary periods, the return of the **Japanese stock market** was on average 11% per year (your estimate: ____%).

During past inflationary periods, the return on **ten-year German federal bonds** was on average 2% per year (your estimate: ____%).

During past inflationary periods, the return on **gold** was on average 15% per year (your estimate: ____%).

["Show actual return," to move to the next return information (i.e., only display one of the above sentences additionally).]

[Return information in the text (see above) is supplemented by bars below (also click by click).]

["Next," centered below the graph. However, it only works once the survey participant has received all the return information.]

[Treatment 3: inflation + asset returns + explanations]

On the next page, we will provide you with information about **current inflation** and the **annual nominal average returns since 1950** for various asset classes. The returns refer to periods when the **annual inflation rate in Germany increased and ultimately exceeded 4%.**

Please take a moment to **carefully read the information**.

["Next," so that treatment group 3 moves to the next screen]

[Setup similar to treatment group 1]

[Setup similar to treatment group 2]

In summary, it can be noted:

US and Japanese stocks have achieved significantly higher returns during inflationary times in Germany compared to German stocks. This is because foreign companies are less affected by inflation here. **Therefore, international diversification promises better protection against inflation**.

Also, stocks of German energy providers and gold have achieved significantly positive returns on average. **Commodities (e.g., energy) are often drivers of inflation**, and gold is generally

seen as a safe haven during times of inflation.

[Treatment groups only]

Q7: Were you aware of the information X that we have just provided you with?

[X is "on current inflation" for T1, "on investment returns in past episodes of increased inflation" for T2, and two questions (T1 + T2) on the same screen for T3.]

Response options: 1 ("Not known at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Fully known")

[Additionally for T3 the following sentence (with a blank line in between): "The following information was known to me:" Below then the following response options, vertically listed, to which one responds on the same seven-point Likert scale: 1. "International diversification can protect against local inflation," 2. "Commodities (e.g., energy) are often drivers of inflation," 3. "Gold is considered a safe haven in times of inflation"]

B.4 Post-treatment section

Q8: Do you believe that, given the current economic situation, it is advisable to make major purchases (e.g., a refrigerator or sofa) now?

a) Yes, the timing is favorable

b) No, the timing is not favorable

[Same screen, just further down; Q8.1 should only be displayed after answering Q8]

Q8.1: Why do you believe that it is currently advisable [if a) at Question 8] / not advisable [if b) at Question 8] to make major purchases?

Multiple responses possible.

[Answer list, if a) at Question 8 was clicked]

[Randomized order, but e) always at the end]

a) Higher prices in the future
b) Currently stable economic environment
c) Currently attractive credit conditions
d) Sufficient savings available
e) Other reason

[Answer list, if b) at Question 8 was clicked]

[Randomized order, but e) always at the end]

a) Currently high prices
b) Currently unstable economic environment
c) Unattractive credit conditions
d) Insufficient savings available

e) Other reason

Q9: What do you think the inflation rate in Germany will be approximately **in 12 months**?

In case of an anticipated deflation rate, please enter a negative value. Entry of up to one decimal place is possible.

____%

[Same screen, just further down; Q9.1 should only be displayed after answering Q9]

Q9.1: How confident are you in your answer?

Response options: 1 ("Not confident at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Very confident")

Q10: Now, we would like you to provide us with your estimate of the average annual inflation rate in Germany **over the next five years**.

In case of an anticipated deflation rate, please enter a negative value. Entry of up to one decimal place is possible.

____%

Q11: Imagine you receive €10,000 to save or invest. Please indicate how you would allocate this amount among the following investment classes.

You can allocate the €10,000 by entering a value in each box. The total of your entries should amount to €10,000. If the total exceeds this, you should first reduce the amount in one field before increasing it in another.

Savings account € ____

German stock market (DAX) € ____

Stocks of German utility companies € ____

US stock market (S&P 500) € ____

Japanese stock market (Nikkei 225) € ____

Federal bond with 10-year remaining maturity € ____

Gold € ____

Total (the sum of the values should equal €10,000) € [Sum of the above values]

[The last entry in the second column should reflect the sum of the entries in this column. If this sum does not actually equal €10,000, the respondent should not be able to proceed with the survey; instead, the following information should be displayed: "Please ensure that the sum of your entries equals €10,000."]

Q12: Now, we would like you to estimate the nominal return for various asset classes in Germany **over the next 12 months**.

If you expect a negative return, please enter a negative value. Entry with a maximum of one decimal

place is possible.

German stock market (DAX) ____ %

Stocks of German utility companies ____ %

US stock market (S&P 500) ____ %

Japanese stock market (Nikkei 225) ____ %

Federal bond with ten years remaining maturity ____ %

Gold ____ %

[Same screen, just further down; display Q12.1 after filling out Q12]

Q12.1: How confident are you in your response?

Response options: 1 ("Not confident at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Very confident")

Q13: How do you rate the following events in terms of their risk to the German financial market **over the next 12 months**?

*Please place **1–3 items** from the left list into the right one (starting with the highest financial market risk at the top). Items can be moved with the mouse. Additionally, a double click on an item will move it to the other list.*

[Header above left list: "Candidates"; Header above right list: "Ranking"]

[Randomized order]

a) Inflation

b) Recession

c) Interest rate increase

d) COVID-19

e) Climate change

f) Political uncertainty

Q14: How do you expect the following economic factors to develop **over the next 12 months**?

Response options: Much worse – Slightly worse – Roughly the same – Slightly better – Much better

a) Your salary

b) Your securities portfolio

c) Unemployment rate

d) Economic growth

Q15: When you think about stock returns during inflationary periods, to what extent do you agree with the following statements?

[Randomized arrangement]

Response options: 1 ("Completely disagree") – 2 – 3 – 4 ("Neutral") – 5 – 6 – 7 ("Completely agree")

a) The company's dividend increases with inflation

b) Real assets of the company (factories, machinery, etc.) protect against inflation

c) Inflation erodes the real value of the firm's liabilities

d) Economic uncertainty as a result of inflation burdens companies

e) Companies can only pass on increased costs to customers to a limited extent

You are now close to the end of the survey. We only want to pose a few additional questions about you.

Q16: When making savings or investment decisions: which of the following statements best describes your personal attitude towards risk?

a) I take substantial risks aiming for high returns

b) I take above-average risks aiming for above-average returns

c) I take average risks aiming for average returns

d) I am not willing to take any financial risks

Q17: Suppose you have €200 in your savings account. You earn 10% interest per year, and you do not withdraw the money. What do you think your balance will be after two years?

a) €240

b) More than €240

c) Less than €240

Q18: Do you receive advice or support when making savings and investment decisions?

Multiple responses are possible.

a) Yes, through my life partner

b) Yes, through family or friends

c) Yes, through a financial advisor from this bank

d) Yes, through a financial advisor from another bank

e) Yes, through an independent financial advisor or investment club

f) No, I make savings and investment decisions alone

Q19: What is the highest level of education or degree you have completed?

a) Currently in education or studying (no training or bachelor's degree yet achieved)

b) Completed vocational-company training (apprenticeship)

c) Completed vocational-school training (vocational school, commercial college)

d) Completed training at a specialized school, technician school, professional or specialized academy, or master school

e) Completed bachelor's degree, university of applied sciences degree, engineering school

f) Completed diploma or master's degree, teacher training

g) Completed doctoral degree

h) Other professional degree

i) No educational qualification (and not currently in education/studying)

[Following question only for participants who replied with e), f), or g) to question 19]

Q20: In which field did you obtain your highest level of education or degree?

a) Economics/business

b) Computer Science

c) Law

d) Medicine or Psychology

e) Engineering

f) Other fields

Q21: How do you estimate the gross assets of your household?

Note: Gross assets include real estate, vehicles, and financial investments. Please do not subtract any outstanding loans from the assets.

a) 0 to under €2,500

b) €2,500 to under €5,000

c) €5,000 to under €10,000

d) €10,000 to under €25,000

e) €25,000 to under €50,000

f) €50,000 to under €75,000

g) €75,000 to under €100,000

h) €100,000 to under €250,000

i) €250,000 to under €500,000

j) €500,000 and more

k) I prefer not to say

Q22: How do you estimate the value of the financial assets of your household?

Note: Financial assets include, among other things, savings accounts, securities portfolios, and insurance assets.

a) 0 to under €2,500

b) €2,500 to under €5,000

c) €5,000 to under €10,000

d) €10,000 to under €25,000

e) €25,000 to under €50,000

f) €50,000 to under €75,000

g) €75,000 to under €100,000

h) €100,000 to under €250,000

i) €250,000 to under €500,000

j) €500,000 and more

k) I prefer not to say

Q23: How do you estimate the loans of your household?

Note: Besides mortgages, loans include, among other things, overdrafts, consumer loans, loans for financing a business or professional activity, for vehicles, household equipment, or education, and loans from friends and relatives.

a) 0 (no loan)

b) 1 to €25,000

c) €25,000 to under €50,000

d) €50,000 to under €100,000

e) €100,000 to under €150,000

f) €150,000 to under €200,000

g) €200,000 to under €300,000

h) €300,000 to under €500,000

i) €500,000 and more

j) I prefer not to say

Q24: Does your household own gold, such as in the form of physical gold or a fund product?

a) Yes

b) No

[If question 24 is answered with a), the following question on the next screen]

Q24.1: Has your household bought or sold gold **in the past 12 months**?

a) Yes, bought

b) Yes, bought more

c) Yes, sold

d) No

[If question 24 is answered with a), the following question on the next screen]

Q24.2: How do you estimate the total value of your household's gold holdings?

a) €1 to €1,000

b) €1,000 to under €2,000

c) €2,000 to under €5,000

d) €5,000 to under €10,000

e) €10,000 to under €20,000

f) €20,000 to under €40,000

g) €40,000 and more

h) I prefer not to say

Q25: Where did you grow up?

a) In the west of Germany

b) In the east of Germany (former GDR)

c) Outside of Germany

Q26: How interesting did you find this survey?

Response options: 1 ("Not interesting at all") – 2 – 3 – 4 – 5 – 6 – 7 ("Very interesting")

Q27: Do you have any comments regarding our survey? Please share them here (**optional**).

[Text field]

Q28: Thank you for participating in our survey!

As a thank you for your participation, you will receive a €10 Amazon voucher. To receive the voucher, you simply need to confirm that you would like to be contacted by us for the purpose of sending the voucher, and in a next step provide your email address.

a) Yes, I would like to receive the voucher

b) No, I do not want to receive the voucher

[If question 28 is answered with a), ask question 28.1]

Q28.1: Please enter your email address for the voucher dispatch:

Email address enter:

Email address confirm: