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Subjective-Return Uncertainty and Household Portfolio Choice: A Two-Moment Information Experiment*

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Abstract

This paper examines how the two moments of an investor's beliefs about an asset's return, the expected return and the uncertainty around it, shape the investor's portfolio. We surveyed 22,000 respondents in Japan, the United States, Germany, and China and randomly showed each respondent information about the domestic stock index or Bitcoin. We estimate the relation between beliefs and portfolios twice: by ordinary least squares (OLS) on elicited beliefs, and by two-stage least squares (2SLS) with the randomized information as instruments. The two methods give different answers. In the OLS estimates, respondents who expect higher returns tend to hold more of an asset. Once beliefs are instrumented, the positive relation between expected returns and holdings disappears, whereas the negative coefficient on subjective-return uncertainty keeps its sign and becomes several times larger. Belief updating also changes how much respondents intend to hold rather than whether they hold at all, and it works through subjective uncertainty rather than the expected return: among U.S. and German respondents, higher instrumented uncertainty lowers the intended share of domestic equities.

JEL Classification: D12; D14; D84; E21; G11; G41

Keywords: cross-country analysis; crypto-asset holding; digital assets;
household finance; investment behavior; subjective uncertainty

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1 Introduction

In portfolio theory, both moments of an investor’s beliefs about a risky asset enter the desired position: the expected return raises it, and the variance of returns lowers it. Separating the two effects in data is difficult. Investors who expect high returns usually also perceive low uncertainty, and the portfolios that investors already hold shape both beliefs. The correlation between beliefs and holdings in observational data therefore cannot tell us how either moment affects portfolio choice. The question is especially pressing for crypto assets, whose realized returns are far more volatile than those of equities (Liu and Tsyvinski, 2021) and whose holdings differ sharply across countries. Yet most household-level evidence on crypto adoption is observational. The main experimental contribution is Weber et al. (2026), who show that information about recent historical crypto returns shifts U.S. households’ expected returns and raises their desired crypto holdings and subsequent purchases. Their experiment therefore identifies an expected-return channel. It does not, however, separately generate exogenous variation in the expected return and in the uncertainty around it, which is the distinction central to our design.

This paper examines the two moments separately, using an original survey fielded in Japan, the United States, Germany, and China and a randomized intervention that informs respondents about the level or the dispersion of historical returns on the domestic stock index or Bitcoin. Throughout the paper, a respondent’s beliefs about an asset are the respondent’s subjective probability distribution of the asset’s one-year-ahead return. We elicit this distribution rather than a single number, and we summarize it by two moments: the mean is the respondent’s expected return, which we also call the first moment, and the standard deviation is the respondent’s subjective-return uncertainty, the second moment. Each respondent reports the distribution twice for each asset, before and after the intervention, so we observe a prior mean and prior uncertainty as well as a posterior mean and posterior uncertainty. The posterior moments are the beliefs whose effect on portfolio choice we estimate; the prior moments enter as controls, so that the estimates reflect not differences across respondents in the level of beliefs but the belief revision that follows the intervention.

We tackle three questions. First, *do correlational and experimental estimates of the relation between beliefs and portfolios agree?* For every respondent we observe both the elicited posterior beliefs and the randomized treatment that moved them, so we can estimate the same equation twice: by ordinary least squares (OLS) on the elicited beliefs, and by two-stage least squares (2SLS) that uses the randomized treatments as instruments for those beliefs. We then compare the two sets of estimates moment by moment. Second, *on which margin* does belief updating operate? We distinguish the extensive margin, whether a respondent holds the asset, from the intensive margin, what share of the portfolio the respondent allocates to the asset.¹ Because respondents report the portfolio they want to hold one year ahead, we can trace the

¹The intended share is defined for every respondent and equals zero for those who want none of the asset; it is not an allocation

effect of an exogenous belief revision on each margin separately. Third, *which moment of beliefs* carries the response? We separate the expected return from the subjective-return uncertainty within a single two-moment framework. Throughout, we estimate every equation for domestic stocks and for crypto assets, and for a four-country pooled sample as well as a pooled sample of the United States and Germany. We pool these two countries for two reasons. First, the rules governing crypto assets were clearer there than in Japan and China. Under the survey-period rules described in Section 2, crypto assets could be traded legally under relatively favorable tax rules for long-held positions: preferential long-term capital-gains rates in the United States and, for qualifying private disposals, exemption after one year in Germany. Japan, by contrast, taxed crypto gains as miscellaneous income at progressive rates under rules that have since been revised, and China prohibited trading. Second, U.S. and German respondents hold a smaller share of their financial assets in cash and deposits than Japanese respondents, so that a revised belief can be acted on by adjusting an existing position rather than by opening one.

We report three findings. The first is that OLS on elicited beliefs and instrumental variables based on the randomized intervention give different answers. When the equation is estimated by OLS, the data point to the first moment. Respondents with a higher posterior mean tend to hold more, most clearly for Bitcoin, where a higher posterior mean predicts both the probability of holding crypto assets and the crypto share of the portfolio in the U.S.–Germany sample. The OLS coefficient on posterior uncertainty in the domestic-stock-share equation, by contrast, is far smaller in magnitude than its instrumented counterpart. Under 2SLS, the pattern reverses. In the pooled samples, the positive coefficient on the posterior mean disappears: it is insignificant in fifteen of the sixteen pooled specifications, whereas the coefficient on posterior uncertainty in the stock-share equation keeps its negative sign. The two estimators thus disagree not only about magnitudes but about which moment of beliefs is related to portfolio choice at all. The strong OLS relation between expected returns and holdings therefore describes which respondents hold more of an asset; it does not identify the causal effect of a change in beliefs on holdings.

Our second finding is that belief updating operates on the intensive margin, how much respondents intend to hold, rather than on the extensive margin, whether they hold the asset at all. In the U.S.–Germany pooled sample, instrumented posterior uncertainty lowers the intended domestic-stock share: an increase of 0.1 log points in the subjective standard deviation of stock returns (approximately a 10 percent increase) lowers the intended share by roughly 0.6 percentage points. In the pooled samples, the corresponding extensive-margin equations yield no belief coefficient that differs from zero. Participation instead behaves like a state variable. Prior participation predicts intended participation so strongly that a single information intervention does not induce entry. Information can therefore change the scale of risk-taking but not, in our pooled estimates, the decision to participate.

Our third finding is that the response works through the second moment of beliefs rather than the

conditional on holding. We call it an intensive margin only in the sense that it varies continuously. Section 2 defines both outcomes.

first. Under OLS, expected returns predict holdings strongly: a higher posterior mean for Bitcoin returns predicts both a higher probability of holding crypto assets and a larger crypto share in the U.S.–Germany sample. Neither relation remains once beliefs are instrumented. Subjective uncertainty behaves differently: its coefficient in the stock-share equation keeps its sign and becomes several times larger once posterior beliefs are instrumented. This gap is consistent with measurement error in elicited beliefs, which attenuates OLS coefficients, and with 2SLS identifying the response of respondents whose beliefs actually move. We therefore interpret the OLS correlation between expected returns and holdings as endogenous belief formation among respondents already invested in the asset, not as a channel through which information changes portfolios.

We contribute to three literatures. The first studies crypto assets in household portfolios. One part examines their risk, return, and diversification properties (Bouri et al., 2017; Liu and Tsyvinski, 2021; Pagnotta, 2022; Biais et al., 2023; Sockin and Xiong, 2023). Another studies who holds them. Survey evidence links ownership to age, gender, risk tolerance, and financial sophistication (Stix, 2021; Auer and Tercero-Lucas, 2022; Bonaparte, 2022; Hayashi and Routh, 2025). Administrative transaction and account data document trading styles and portfolio composition (Hackethal et al., 2022; Aiello et al., 2023; Kogan et al., 2024), while Divakaruni and Zimmerman (2024) exploit stimulus-check timing to identify effects on Bitcoin trading. For Japan, Fujiki (2020) reports a mixed financial-literacy profile among owners, who score higher on some literacy and financial-education measures and lower on others, together with greater experience in conventional risky assets. Fujiki (2021) finds higher average financial literacy among owners and substantial heterogeneity by conventional investment experience, and Nakazono et al. (2025) find in an earlier four-country survey, fielded in October 2024, that holders are younger, richer, and more financially sophisticated. Much of this evidence is observational, but it is not almost entirely cross-sectional: the literature includes repeated surveys, administrative transaction panels, and quasi-experimental evidence. Weber et al. (2026) provide a randomized information experiment, and Benetton and Compiani (2024) estimate a structural model of crypto demand. We do not claim that information about past returns matters for crypto investment; Weber et al. (2026) have established that. We claim that the two moments of a belief can be separated, as Coibion et al. (2024) argue they must be for consumer spending, that separating them locates the response in the second moment, and that observational and experimental estimates give different answers. Our approach of instrumenting beliefs with randomized information follows Coibion et al. (2023), who apply it to households’ durable-goods purchases.

The second literature studies financial sophistication and household portfolio choice. Cognitive ability, financial knowledge, trust, and social interaction are central determinants of participation in risky-asset markets (Hong et al., 2004; Guiso et al., 2008; Christelis et al., 2010; Grinblatt et al., 2011; van Rooij et al., 2011; Lusardi and Mitchell, 2014); financial education changes financial knowledge and downstream behavior (Kaiser et al., 2022); endogenous investment in financial knowledge helps account for wealth in-

equality (Lusardi et al., 2017); and the returns households have experienced shape how much risk they are willing to take (Malmendier and Nagel, 2011). Evidence from outside the United States qualifies the role of literacy. Participation in Japan stays low even among households with high measured literacy (Yamori and Ueyama, 2022); confidence in one’s knowledge predicts participation beyond the knowledge itself (Bucher-Koenen et al., 2025); and “don’t know” answers to literacy questions, which standard scoring discards, carry information about market engagement that changes the estimated effect of literacy at the entry margin (Nakazono et al., 2026). These studies treat beliefs about returns, when they enter at all, as background. A separate literature elicits those beliefs directly and finds that expected returns and subjective uncertainty predict portfolio shares in the cross-section, but far less strongly than portfolio theory implies (Dominitz and Manski, 2007; Hurd et al., 2011; Drerup et al., 2017; Ameriks et al., 2020; Giglio et al., 2021). We bring individual characteristics, such as education and income, from the first literature and the belief measures of the second into one empirical framework, and we show that the participation margin the first literature emphasizes is precisely the margin on which our information treatments have no detectable effect.

The third literature studies uncertainty and household decisions. Theory links uncertainty to precautionary saving and to lower exposure to risky assets (Guiso et al., 1996; Bloom, 2014), and survey evidence links subjective uncertainty to saving, spending, and borrowing (Christelis et al., 2020; Fermann et al., 2024). Showing that uncertainty itself, rather than the events that raise it, drives these responses has required experiments that move uncertainty exogenously. Coibion et al. (2024) and Georgarakos et al. (2024) show for euro-area households, and Kumar et al. (2023) for firms, that randomized information which raises uncertainty about inflation or growth lowers spending and investment, whereas information that shifts only the expected level has different effects (Coibion et al., 2022, 2023; Roth and Wohlfart, 2020). Information experiments of the same kind have traced exogenous changes in expected stock returns to hypothetical portfolio choices (Beutel and Weber, 2026) and to actual trades measured in administrative account data (Laudenbach et al., 2026), and Haaland et al. (2023) review the method. We bring the two-moment design of Coibion et al. (2024) and Georgarakos et al. (2024) to beliefs about a specific asset and examine which moment carries the portfolio response. We find that subjective uncertainty about returns, not the expected return, moves intended allocations. The effect appears in the U.S.–Germany sample, the two countries where crypto assets were traded under clearer rules than in Japan and China and where cash positions are smaller than in Japan, and we estimate it with limited precision.

The rest of the paper proceeds as follows. Section 2 describes the survey and the randomized information intervention. Section 3 presents the two-moment instrumental-variables framework. Section 4 reports the estimates for stocks and crypto assets. Section 5 interprets them, and Section 6 concludes.

2 Survey Design

Identifying how beliefs move portfolios requires three pieces of information that surveys usually confound: what a respondent already holds, what the respondent believes about future returns, and what the respondent would hold if free to rebalance. Our survey separates the three by design, in three parts. Respondents first report their current portfolio and their prior beliefs (Part 1). They then receive randomized information about historical returns and state their beliefs again (Part 2). Finally, they report the portfolio they would like to hold one year from now (Part 3). This section describes the sample and each of the three parts.²

2.1 RCT Design

INTAGE Inc., a professional survey-research firm, fielded the survey between September and October 2025 to 22,000 respondents: 10,000 in Japan and 4,000 each in the United States, Germany, and China. The individual respondent, who reports his or her own holdings, is the unit of randomization and of observation. Sampling in each country followed the population distribution by gender and age group. Age is recorded in ten-year brackets, from 10–19 years to 80 years or older (Q2 in Appendix A), and enters the analysis as a set of bracket indicators. Respondents reported demographic characteristics and asset holdings and answered questions on financial literacy and risk preferences. Throughout the paper, crypto assets denote the combined category of crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs); the questionnaire in Appendix A uses the same label for this category.

Part 1 Part 1 records where respondents start. Respondents allocated 100 percent of their financial assets across eight categories (cash and deposits; domestic stocks; domestic bonds; foreign stocks; foreign bonds; gold; crypto assets; and other), which yields a pre-treatment portfolio share for every asset class. Real estate, vehicles, and life insurance products were excluded from financial assets, and the interface required the shares to sum to 100 percent. Separate questions asked respondents, for domestic stocks and for crypto assets alike, whether they had never invested in the asset, had invested but no longer held it, or currently held it. The allocation question and the investment-experience questions together supply the pre-treatment variables used throughout the analysis: the share of financial assets allocated to an asset before any information is provided, and an indicator for holding a positive amount of it.

Pre-treatment holdings differ sharply across the four countries, and Table 1 describes them. Cash and deposits dominate every portfolio, but far more so in Japan, where they account for 74.9 percent of financial assets, than in the United States (58.1 percent), Germany (59.1 percent), or China (57.5 percent).

²The full questionnaire is provided in Appendix A.

The counterpart of Japan's larger cash share is not a smaller stock share. Domestic stocks, the asset about which we elicit beliefs, account for 7.3 percent of financial assets in Japan, against 8.3 percent in the United States, 6.0 percent in Germany, and 9.2 percent in China, and adding foreign stocks gives 9.2, 9.6, 10.8, and 10.1 percent. Japanese respondents therefore hold about as much in stocks as respondents elsewhere. Most of the gap in cash is instead matched by gold and by assets outside the listed categories, which together account for 13.2 percent of financial assets in Japan but 25.1, 23.9, and 25.3 percent in the United States, Germany, and China. Participation differs as well: the last two columns of Table 1 report the proportion of respondents who hold domestic stocks and crypto assets, computed from the investment-experience questions. Crypto assets are a small share of every portfolio but differ the most across countries in relative terms: they account for 0.7 percent of financial assets in Japan, against 3.8 percent in both the United States and Germany and 1.9 percent in China.

Tax rules in force when the survey was fielded are one reason such differences may persist. In September–October 2025, Japan generally taxed gains from crypto trading as miscellaneous income at progressive rates. In the top bracket, a 45 percent national income tax and a 10 percent local inhabitant tax combine to a marginal rate of 55 percent, and the special reconstruction income tax, a 2.1 percent surcharge on the national income tax, raises it to about 55.9 percent. Losses in the miscellaneous-income category could not be offset against gains on stocks or mutual funds.³ The United States treated investment crypto assets as property and applied capital-gains rules; a position held for more than one year generated a long-term rather than short-term capital gain or loss.⁴ Germany treated qualifying private disposals under §23 of its Income Tax Act: a sale within one year was generally taxable as a private-sale transaction, whereas a sale after the applicable holding period was generally non-taxable.⁵ At the time of the survey, China prohibited virtual-currency trading and related financial services under its 2021 notice.⁶

Japan subsequently enacted a prospective reform under which qualifying disposals of specified crypto assets through registered crypto-asset intermediaries will be subject to separate taxation at 20 percent (20.3 percent including the special reconstruction income tax) and eligible losses may be carried forward for three years. The reform applies from January 1 of the year after the relevant 2026 Financial Instruments

³National Tax Agency, "Tax Treatment of Crypto-Asset Transactions" (December 2025), <https://www.nta.go.jp/publication/pamph/shotoku/kakuteishinkokukankei/kasoutuka/>, and "No. 1500: Miscellaneous Income," <https://www.nta.go.jp/taxes/shiraberu/taxanswer/shotoku/1500.htm>, accessed September 4, 2026.

⁴Internal Revenue Service, "Digital Assets," <https://www.irs.gov/filing/digital-assets>, and "Topic No. 409: Capital Gains and Losses," <https://www.irs.gov/taxtopics/tc409>, accessed September 4, 2026.

⁵German Federal Ministry of Finance, "Questions regarding the income tax treatment of specific crypto-assets in Germany," March 6, 2025, https://www.bundesfinanzministerium.de/Content/DE/Downloads/BMF_Schreiben/Steuerarten/Einkommensteuer/2025-03-06-einzelfragen-kryptowerte.html, accessed September 4, 2026.

⁶People's Bank of China and nine other agencies, "Notice on Further Preventing and Disposing of Risks in Virtual Currency Trading and Speculation," September 24, 2021, <https://m.safe.gov.cn/safe/2021/0924/19911.html>. A notice issued on February 6, 2026 replaced the 2021 instrument while retaining the prohibition; China Securities Regulatory Commission, <https://www.cssrc.gov.cn/cssrc/c100028/c7614318/content.shtml>. Accessed September 4, 2026.

and Exchange Act provisions take effect, so the pre-reform rules above describe the survey period rather than the permanent post-reform regime.⁷

Part 1 also elicits prior beliefs, before respondents see any information. For the major stock index in each country (the Nikkei 225 in Japan, the S&P 500 in the United States, the DAX in Germany, and the Shanghai Composite Index in China) and for Bitcoin (BTC), respondents distributed 100 percentage points of probability across nine mutually exclusive intervals for the one-year-ahead return, from a gain of more than 35 percent to a loss of more than 35 percent.⁸ A distribution, unlike a single number, lets respondents express how uncertain they are as well as what they expect. We take the midpoint of each interval, weight it by the reported probability, and compute a prior mean and a prior standard deviation for each respondent and asset. These two moments enter the analysis as the prior belief and the prior uncertainty defined in Section 3.

Part 2 Part 2 randomly varies what respondents know about historical returns before they state their beliefs again. A control group (RCT0), 20 percent of respondents, saw no information.⁹ The remaining respondents were assigned to six treatment arms that cross two assets with three kinds of information. Arms RCT1–RCT3 described the domestic stock index; arms RCT4–RCT6 described Bitcoin.¹⁰ Within each asset, the first arm reported the cumulative change in the asset’s price over the past ten years, for instance, that the S&P 500 had tripled (RCT1) or that the price of Bitcoin had risen 408-fold (RCT4), and so described the level of past returns (10 percent of respondents each). The second arm reported the asset’s best and worst calendar years over the same period, for instance that the S&P 500 rose 30.4 percent in its best year and fell 19.6 percent in its worst, and so described their dispersion (RCT2 and RCT5, 10 percent each). The third arm reported both (RCT3 and RCT6, 20 percent each). Appendix A reproduces the wording of every screen and the corresponding figures for each country.¹¹ Crossing the asset with the kind of information is what later lets us examine which moment of beliefs carries the portfolio response.

⁷National Tax Agency, “Outline of the FY2026 Tax Reform” (May 2026), pp. 5–6, <https://www.nta.go.jp/publication/pamph/joto-sanrin/r08aramashi.pdf>; Financial Services Agency, “Bills Submitted to the Diet,” recording enactment of the relevant amendment on July 15, 2026, <https://www.fsa.go.jp/common/diet/index.html>. Accessed September 4, 2026.

⁸To elicit these beliefs, we followed the procedure of Coibion et al. (2024).

⁹The information module was administered to the 12,157 respondents who, in a preceding question (Q29 in Appendix A), had chosen a price at which they would buy a hypothetical asset paying \$12,000 or \$8,000 with equal probability. The 9,843 respondents who answered that they would not buy it were routed to a separate module and are not part of the experimental sample; the arm shares reported here refer to the 12,157. Appendix C compares the two groups. Respondents in the experimental sample are somewhat younger, more often male, and have higher income and education; they are more likely to hold domestic stocks and crypto assets and report higher prior expected returns. The experimental sample is therefore not fully representative of the surveyed population, and the estimates describe respondents who are willing to buy a 50/50 gamble at some price.

¹⁰Section 3 and Appendix A label the same arms by asset and content: C for RCT0, $T^{S,1}$, $T^{S,2}$, and $T^{S,12}$ for RCT1–RCT3, and $T^{B,1}$, $T^{B,2}$, and $T^{B,12}$ for RCT4–RCT6.

¹¹The second screen reports the range of annual outcomes rather than a standard deviation. We therefore describe it as information about dispersion rather than about volatility in the statistical sense, and we do not assume that respondents convert a best-and-worst pair into any particular second moment.

After the information screen, respondents described their beliefs again, this time in scenarios rather than intervals. Each respondent reported three one-year-ahead returns (the most pessimistic, the most likely, and the most optimistic) on a continuous slider bounded by a 50 percent decline and a 100 percent increase; the interface required the three to be weakly ordered. Respondents then assigned probabilities to the three scenarios, again summing to 100 percent. From the scenarios and probabilities we compute a posterior mean and a posterior standard deviation in the same way as their prior counterparts.¹²

One feature of this design governs how the belief measures should be read. Priors and posteriors come from different instruments: nine fixed intervals in Part 1 and three self-reported scenarios in Part 2. Their levels are therefore not directly comparable, and the gap between a respondent’s prior and posterior mean reflects the change in format as well as any updating.¹³ Our identification therefore rests on comparisons across treatment arms within the posterior, which share a single instrument, rather than on the prior-to-posterior difference. Tables 2 and 3 report prior and posterior moments by treatment arm and country for stock-index and Bitcoin returns, respectively.

Part 3 Part 3 elicits what respondents would hold. Respondents allocated 100 percent of their financial assets across the same eight categories as in Part 1, this time describing the portfolio they would ideally hold one year ahead. The same assets were excluded as in Part 1,¹⁴ and the interface again required the shares to sum to 100 percent.

Two outcome variables come from this question. The first, $Share_i^a$, is the unconditional intended allocation share: the share of financial assets the respondent would like to allocate to asset a , defined for every respondent and equal to zero for respondents who want none of it. As noted in the introduction, it is not an allocation conditional on holding. The second, D_i^a , equals one when the respondent reports a strictly positive desired allocation and zero otherwise. Every specification also controls for the pre-treatment holding. Conditional on that holding, the belief coefficients in the D_i^a equations measure intended entry: whether beliefs lead a respondent who did not hold the asset to want a positive share of it. For respondents who already held the asset, the same coefficients measure whether they want to keep a positive share.¹⁵

¹²Details on the elicitation procedure and the construction of subjective expected returns and uncertainty measures are provided in Appendix B.

¹³The two-format design follows Coibion et al. (2024), who elicit priors with a probability distribution over fixed bins and posteriors with three respondent-defined scenarios, and who note that, because prior and posterior expectations are measured with different questions, even their control group’s posterior does not reproduce its prior. The same holds here. In Tables 2 and 3, the posterior mean in the control arm exceeds the prior mean in every country, although these respondents received no information. The gap is a property of the two elicitation formats, not evidence of updating, and it does not affect the analysis, which compares arms within the posterior.

¹⁴Real estate, vehicles, and life insurance products were excluded from financial assets in both parts, so that the pre-treatment and the desired portfolio shares are defined over the same set of assets.

¹⁵Beliefs are elicited about Bitcoin, whereas the portfolio category respondents allocate to combines crypto assets in the narrow sense with stablecoins, security tokens, and non-fungible tokens. Among respondents currently holding any of the four, 77.2 percent in Japan, 70.4 percent in the United States, 75.6 percent in Germany, and 49.0 percent in China hold crypto assets in

Both outcomes record an intention rather than an executed trade, so both abstract from the transaction costs and adjustment frictions that delay actual rebalancing.

3 Empirical Strategy: A Two-Moment RCT-IV Design

We examine how the two moments of a respondent’s subjective-return distribution affect the respondent’s portfolio. Neither a randomized experiment nor an instrumental-variables strategy can answer that question on its own. An experiment identifies the effect of a message rather than the effect of a belief, and it cannot separate two moments that every message moves together. Instrumental variables can separate the moments in principle, but only under an exclusion restriction that observational instruments rarely satisfy. Our design combines the two. Randomized information provides exogenous variation; the two-moment treatment structure provides variation in more than one direction; and interactions between treatment assignment and prior beliefs provide variation in the size of each respondent’s belief revision. The framework follows Georgarakos et al. (2024) and Coibion et al. (2024).

3.1 Setup and Notation

Each respondent i reports beliefs about two assets, indexed by $a \in \{S, B\}$, where S denotes the respondent’s national stock index (the Nikkei 225 in Japan, the S&P 500 in the United States, the DAX in Germany, and the Shanghai Composite Index in China) and B denotes Bitcoin. For each asset we observe four belief moments. The two prior moments are elicited in Part 1 of the survey, before any information is provided:

$$\begin{aligned} \text{PriorMean}_i^a &= \text{subjective expected 12-month return on asset } a, \text{ in percent,} \\ \text{PriorUnc}_i^a &= \log(\text{SD}_{i,0}^a), \end{aligned}$$

where $\text{SD}_{i,0}^a$ is the standard deviation of respondent i ’s prior subjective-return distribution for asset a . The two posterior moments, PostMean_i^a and $\text{PostUnc}_i^a = \log(\text{SD}_{i,1}^a)$, are elicited in Part 2, immediately after the information treatment. Appendix B details how we recover both sets of moments from the elicitation instruments. We measure subjective-return uncertainty in logs because the subjective standard deviation is bounded below by zero and right-skewed; a coefficient on PostUnc_i^a therefore reads as the response of the outcome to a proportional increase in subjective uncertainty.

the narrow sense, and that category accounts for roughly a third of reported crypto-asset value in each country. The outcome is therefore broader than the object of the elicited beliefs, which attenuates any mapping from Bitcoin beliefs to crypto holdings toward zero.

Two outcomes are defined for each asset, both from Part 3 of the survey, in which respondents report their desired portfolio one year ahead:

$$D_i^a \in \{0, 1\}, \quad \text{equal to one if the desired portfolio allocates a positive share to asset } a,$$

$$Share_i^a \in [0, 100], \quad \text{the desired share of financial assets allocated to asset } a, \text{ in percent.}$$

We call D_i^a the extensive margin and $Share_i^a$ the intensive margin, and we write Y_i^a when a statement applies to either.

Three further terms enter the estimating equations. First, $PriorHold_i^a$ denotes respondent i 's pre-treatment holding of asset a , measured in Part 1: the ownership indicator when the outcome is D_i^a , and the portfolio share when the outcome is $Share_i^a$. It plays the role of the pre-treatment purchasing plan in Georgarakos et al. (2024), absorbing the baseline position from which any belief-driven adjustment starts. Second, C_i collects gender, age category (the ten-year brackets described in Section 2), marital status, an indicator for college education, and income-quintile indicators; specifications without controls omit this vector. Third, $\delta_{c(i)}$ denotes a fixed effect for the country $c(i)$ in which respondent i was surveyed; it is included in the pooled specifications and absorbed by construction in the country-specific ones. All standard errors are robust to heteroskedasticity.¹⁶

Respondents are randomly assigned to one control arm and six treatment arms, three for each asset. The control arm, RCT0 in Section 2, is denoted C ; the six treatment arms are the indicators defined next, and Appendix A reproduces each screen under the same labels. For asset a , let $T_i^{a,j}$ equal one if respondent i was assigned to the arm with moment content $j \in \{1, 2, 12\}$, where the index records which moment of past returns the arm describes: $j = 1$ the first moment, $j = 2$ the second, and $j = 12$ both. The first-moment arm reports the cumulative change in the price of asset a over the past ten years; the second-moment arm reports the asset's best and worst calendar years over the same period; the third arm reports both. The best-and-worst-year screen reports a range of outcomes rather than a standard deviation, so the labels describe the moment each arm emphasizes, not a moment each arm isolates. Assignment probabilities are 10, 10, and 20 percent for the three arms of each asset, leaving 20 percent in the pure control arm. Because assignment is random, all six indicators are independent of priors, preferences,

¹⁶The estimation samples are smaller than the 22,000 respondents surveyed, for three reasons. First, the information module was administered only to the 12,157 respondents who did not decline the hypothetical investment in Q29 (Section 2 and Appendix C). Second, each specification uses only the control arm and the three arms that provided information about the asset in question. Third, we estimate every specification on respondents with complete information. A respondent who selected "I don't know," "Prefer not to say," or "I don't remember" in any of the questions from which the outcome, belief, holding, or control variables are constructed, or who otherwise left such a question unanswered, is excluded from every specification in which the affected variable enters. This is why the number of observations, reported at the foot of each table, is smaller in the columns that include control variables than in those that do not. Panel B of each table has slightly more observations than Panel A because respondents whose posterior distribution has a standard deviation of zero, for whom the log of the standard deviation is undefined, drop out of the OLS estimates but receive fitted posterior moments from the first stage and remain in the 2SLS estimates (Appendix B).

wealth, and pre-treatment holdings.

3.2 Combining Randomization with Instrumental Variables

An experiment by itself does not answer the question this paper poses. It answers a narrower one: how the desired portfolio changes when a respondent is assigned to an information screen about historical returns. Portfolio theory, however, makes predictions about beliefs, not about information screens. The effect of a screen bundles two effects that we want to separate: the effect of the screen on beliefs and the effect of beliefs on portfolios. Because the first of these depends on what our particular screens said, the bundled effect cannot be compared across assets, across countries, or with estimates from other experiments. A second problem is more fundamental. No arm can be assumed to move one moment of beliefs alone. Tables 2 and 3 illustrate this. For Bitcoin, the arm that reports only the ten-year cumulative change shifts posterior uncertainty relative to the control arm in every country, and the arm that reports only the best and worst years shifts the posterior mean in three of the four countries. For stocks the pattern is weaker, but the same cross-moment shifts appear in every country for the posterior mean and in China for posterior uncertainty. This is not surprising: a respondent who learns how much an asset's price changed over ten years also learns something about how variable its returns are. A comparison of outcomes across arms therefore cannot tell whether an outcome difference comes from the first moment or from the second. To separate two parameters, we need exogenous variation in at least two directions. Randomization does not fail here; it simply does not, by itself, provide enough independent variation to identify two parameters.

Without an experiment, we would have to assume exogenous variation in beliefs rather than create it. The simplest approach regresses outcomes on elicited beliefs, as Panel A of each results table does. Those estimates are biased in two directions at once. First, elicited moments contain measurement error, which pulls coefficients toward zero. Second, beliefs and holdings are determined together: respondents who already own an asset follow its price and report beliefs, in both moments, that reflect the positions they hold. The contrast between Panels A and B in Section 4 shows both forces at work. Instrumenting eliminates the positive association with the expected return and makes the coefficient on uncertainty in the stock-share equation several times larger. Observational instruments would not repair this. Any variable that is correlated with a respondent's beliefs about stock returns, such as local labor-market conditions, the returns the respondent has experienced, education, or media consumption, plausibly affects portfolio choice directly, through wealth, risk tolerance, or the cost of acquiring information. The exclusion restriction is therefore untestable and usually implausible. The two belief moments make the problem harder still. Subjective means and subjective standard deviations are strongly correlated across respondents, so a single observational instrument shifts both at once and identifies neither, exactly as a single treatment arm would.

Combining the two designs supplies what each lacks. Random assignment delivers independence: assignment is unrelated to priors, preferences, and pre-treatment holdings. Exclusion, the requirement that assignment affect the desired portfolio only through the two elicited posterior moments, is a substantive assumption that we maintain.¹⁷ The two-moment treatment structure delivers rank: the arms differ in which moment they emphasize, so they shift the two endogenous regressors in different proportions. Interacting the arms with prior beliefs delivers variation in the size of each revision. Under Bayesian updating, a given signal moves a respondent’s belief by an amount that depends on how far the prior sits from the signal and on how confidently the prior is held (Georgarakos et al., 2024; Coibion et al., 2024). Under the maintained assumptions on the first stage, exclusion, and measurement error, 2SLS uses only the treatment-induced variation in the elicited posterior moments. It therefore reduces the attenuation that measurement error imparts to OLS, which is one reason the 2SLS uncertainty coefficients in Section 4 exceed their OLS counterparts in absolute value.

3.3 Second Stage

The second stage relates the desired portfolio to posterior beliefs, conditioning on priors and on the pre-treatment position:

$$Y_i^a = \alpha_1^a \text{PostMean}_i^a + \beta_1^a \text{PostUnc}_i^a + \alpha_0^a \text{PriorMean}_i^a + \beta_0^a \text{PriorUnc}_i^a + \phi^a \text{PriorHold}_i^a + \mathbf{C}_i' \gamma^a + \delta_{c(i)} + \varepsilon_i^a, \quad a \in \{S, B\}. \quad (1)$$

The parameter of primary interest is β_1^a , the causal effect of a proportional increase in subjective uncertainty on the desired allocation to asset a ; α_1^a is its first-moment counterpart. Because PostUnc_i^a is measured in logs, β_1^a is the change in the outcome per one-log-point increase in the subjective standard deviation, so dividing by ten gives the response to an increase of 0.1 log points, approximately a 10 percent increase, in subjective uncertainty. Prior moments enter as controls so that the posterior coefficients are identified from information-induced revisions rather than from cross-sectional differences in the level of beliefs. This distinction matters here because the prior and posterior moments are elicited with different instruments and are not directly comparable in levels. When the outcome is D_i^a , equation (1) is a linear probability model. Panel B of Tables 4–7 reports 2SLS estimates of equation (1) for $a = S$, and Panel B of Tables 8–11 reports them for $a = B$. Panel A of each table reports the OLS estimates that treat posterior beliefs as exogenous.

¹⁷Hansen’s J test of the seven overidentifying restrictions does not reject them. Computed by conventional 2SLS for every column of Tables 4–11 on the sample used in Panel A, the test has $p > 0.10$ in 46 of the 48 specifications. The two exceptions are the stock-share equations for China in columns (7) and (8) of Table 7, where $p = 0.005$. The restrictions are therefore consistent with the data, although this does not by itself establish exclusion, because all nine instruments derive from the same random assignment.

3.4 First Stage and Instrument Set

We treat both posterior moments as endogenous and instrument them with the randomized arms and their interactions with prior beliefs. Writing $\mathcal{J} \equiv \{1, 2, 12\}$ for the set of treatment arms devoted to each asset, the two first-stage equations are

$$\begin{aligned} PostMean_i^a = & a_0^a + \sum_{j \in \mathcal{J}} a_j^a T_i^{a,j} + \sum_{j \in \mathcal{J}} b_j^a T_i^{a,j} \times PriorMean_i^a + \sum_{j \in \mathcal{J}} c_j^a T_i^{a,j} \times PriorUnc_i^a \\ & + d_\mu^a PriorMean_i^a + e_\mu^a PriorUnc_i^a + C_\mu' \theta_\mu^a + \delta_{c(i)} + \nu_{\mu,i}^a, \end{aligned} \quad (2)$$

$$\begin{aligned} PostUnc_i^a = & \tilde{a}_0^a + \sum_{j \in \mathcal{J}} \tilde{a}_j^a T_i^{a,j} + \sum_{j \in \mathcal{J}} \tilde{b}_j^a T_i^{a,j} \times PriorMean_i^a + \sum_{j \in \mathcal{J}} \tilde{c}_j^a T_i^{a,j} \times PriorUnc_i^a \\ & + \tilde{d}_u^a PriorMean_i^a + \tilde{e}_u^a PriorUnc_i^a + C_u' \tilde{\theta}_u^a + \delta_{c(i)} + \tilde{\nu}_{u,i}^a, \end{aligned} \quad (3)$$

where d_μ^a , e_μ^a , $\tilde{d}_u^a$, and $\tilde{e}_u^a$ are the coefficients on the uninteracted prior moments, and $\nu_{\mu,i}^a$ and $\tilde{\nu}_{u,i}^a$ are the first-stage errors. The excluded instruments for asset a are therefore

$$\mathcal{Z}_i^a = \left\{ T_i^{a,j}, T_i^{a,j} \times PriorMean_i^a, T_i^{a,j} \times PriorUnc_i^a \right\}_{j \in \mathcal{J}}.$$

We instrument both posterior-belief moments using three treatment indicators and their interactions with the two prior-belief moments.

4 Estimation Results

This section reports the estimates that answer the three questions posed in the introduction. Section 4.1 covers domestic stocks, Section 4.2 covers crypto assets, and each subsection takes the questions in the same order. Each table answers the first question, whether correlational and experimental estimates agree, by juxtaposing two panels. Panel A reports OLS estimates that use elicited posterior beliefs. Panel B instruments posterior beliefs with the randomized information treatments and their interactions with priors, so its coefficients measure the response to exogenous belief updating. The ownership and portfolio-share regressions, read side by side, answer the second question: on which margin belief updating operates. The coefficients on the posterior mean and on posterior uncertainty, read jointly, answer the third: which moment of beliefs carries the response. Because retail investors' access to equity and crypto markets differs substantially across the four countries, we report a U.S.–Germany pooled sample in addition to the four-country pool throughout and use the country-specific estimates to locate where the two diverge.

4.1 Domestic-Stock Outcomes

We put the three questions first to domestic-stock holdings. Tables 4–7 report the estimates. Tables 4 and 5 cover the extensive margin, an indicator for domestic-stock ownership; Tables 6 and 7 cover the intensive margin, the domestic-stock portfolio share. Tables 4 and 6 contrast the four-country pooled sample in columns (1)–(2) with the U.S.–Germany pooled sample in columns (3)–(4); Tables 5 and 7 estimate the same specifications separately for Japan, the United States, Germany, and China. Odd-numbered columns exclude control variables, and even-numbered columns include them.

We first examine whether the OLS and IV estimates agree. Under OLS, the U.S.–Germany sample displays exactly the associations that portfolio theory predicts. In Panel A of Table 4, a higher posterior mean is associated with a higher probability of holding domestic stocks (0.00103 and 0.00085 in columns (3) and (4)), and higher posterior uncertainty with a lower probability (−0.02187 and −0.02503); all four coefficients are significant at conventional levels. In the four-country pool of columns (1) and (2), by contrast, neither posterior moment is distinguishable from zero. In Panel A of Table 6, posterior uncertainty enters the stock-share equation for the same U.S.–Germany sample at −0.894 and −0.910. Instrumenting posterior beliefs changes both conclusions. In Panel B of Table 4, no column yields a significant belief coefficient. In Panel B of Table 6, the coefficient on posterior uncertainty grows roughly sevenfold, to −6.344 and −6.146, while the coefficient on the posterior mean turns positive and insignificant in the U.S.–Germany sample. The divergence thus runs in both directions: the moment that is prominent under OLS loses significance, and the moment that is modest under OLS grows severalfold.

Three explanations are consistent with this gap. First, measurement error in elicited beliefs attenuates the OLS coefficients. Second, 2SLS identifies the response of respondents whose beliefs actually move in response to information. Third, respondents already invested in equities form their beliefs endogenously. Whichever combination of these explanations applies, the conclusion is the same: the cross-sectional association between beliefs and holdings is not a reliable guide to the causal response.

We next examine on which margin belief updating operates. On the extensive margin, instrumented beliefs have no detectable effect. In Panel B of Table 4, the fitted posterior uncertainty remains negative in the U.S.–Germany sample (−0.12376 and −0.11822), and its standard error is smaller there than in the four-country pool, but neither estimate approaches conventional significance. What survives instrumentation is persistence: prior ownership is associated with a 33 to 43 percentage point higher probability of intended ownership in every specification, and prior uncertainty enters positively and significantly throughout. The country-specific estimates in Table 5 show that the pooled null conceals a sign reversal across countries. In Panel A, posterior uncertainty is significantly negative in the United States (−0.03190 and −0.02995) and negative in Germany, where it becomes significant once controls are added (−0.02258). It is essentially zero in Japan and significantly *positive* in China (0.02597 and 0.03272). The posterior mean divides

the countries in the same way, with the opposite sign. Panel B preserves this sign pattern under instrumentation, with negative fitted uncertainty in Japan, the United States, and Germany and positive fitted uncertainty in China. The intensive margin, by contrast, does respond, as the next paragraph documents. Belief updating therefore changes how much invested respondents hold, not whether respondents invest. Participation behaves as a state variable: prior participation predicts intended participation so strongly that an information treatment of this size does not induce entry.

Finally, we investigate which moment of beliefs carries the intensive-margin response. The answer is the second, subjective uncertainty. In Panel B of Table 6, the fitted posterior uncertainty enters at -6.344 without controls and -6.146 with controls in columns (3) and (4), both significant at the ten percent level. An increase of 0.1 log points (approximately 10 percent) in the subjective standard deviation of stock returns thus lowers the domestic-stock share by roughly 0.6 percentage points. The four-country estimates in columns (1) and (2) are similar in magnitude (-5.907 and -5.682) but statistically indistinguishable from zero. The first moment shows no comparable pattern. The fitted posterior mean is negative and marginally significant in the four-country pool but positive and insignificant in the U.S.–Germany sample, so the data do not support a causal expected-return channel. Prior portfolio shares again dominate in level terms, entering at 0.55 to 0.63 across all specifications. Table 7 qualifies this claim. In Panel A, posterior uncertainty is significantly negative in both the United States (-1.042 and -1.000) and Germany (-0.782 and -0.895), insignificantly positive in Japan, and significantly *positive* in China (1.035 and 1.015). Panel B keeps the negative sign for the United States (-0.632 and -0.508) and Germany (-5.534 and -4.897) and the positive sign for China (4.130 and 4.979), while the Japanese estimates flip sign between columns and carry standard errors above thirteen. No country-level 2SLS coefficient reaches significance, and the German and U.S. point estimates differ by an order of magnitude. A common magnitude, however, is not what the design leads us to expect. The information each respondent received described the domestic index, and its content differed across countries.¹⁸ The treatment therefore shifts posterior uncertainty by a different amount, and from a different starting point, in each country, so the 2SLS coefficient identifies a local average treatment effect over a different range of belief revisions in each country. These local effects would coincide only if respondents everywhere responded to subjective uncertainty linearly and identically.¹⁹ Pooling the United States and Germany achieves the precision reported in Table 6 only by

¹⁸Over the past ten years the S&P 500 tripled, the DAX and the Nikkei 225 doubled, and the Shanghai Composite declined by 1.3 percent. The best and worst calendar years over the same period were $+30.4$ and -19.6 percent for the S&P 500, $+26.4$ and -18.1 percent for the DAX, $+29.5$ and -13.3 percent for the Nikkei 225, and $+22.1$ and -24.7 percent for the Shanghai Composite. Appendix A reproduces the wording of each screen.

¹⁹The Chinese estimates illustrate the point. The Shanghai Composite is the only index in our sample whose ten-year cumulative return was negative, and its worst year was deeper than its best year was high, so Chinese respondents received the least favorable signal on both moments. A signal of this kind moves a subjective distribution differently from one that reports a doubling or tripling: when the reported trend is flat, greater subjective uncertainty raises the probability that respondents attach to large gains as well as to large losses, and respondents who weight the upside may respond by holding more rather than less. The positive fitted-uncertainty coefficients for China in Tables 5 and 7 are consistent with this reading, but they are imprecise, and our design

imposing that assumption within the pair. The evidence for the uncertainty channel therefore consists of a common sign across countries, not a common magnitude.

4.2 Crypto-Asset Outcomes

We now examine the same three questions for crypto-asset holdings. Tables 8–11 mirror the stock tables in structure. Tables 8 and 9 cover the extensive margin, an indicator for holding any crypto asset; Tables 10 and 11 cover the intensive margin, the crypto-asset portfolio share. Tables 8 and 10 contrast the four-country and U.S.–Germany pooled samples, and Tables 9 and 11 estimate each country separately. Throughout, beliefs refer to Bitcoin returns, whereas holdings cover crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens, and non-fungible tokens.

We first examine whether the OLS and IV estimates agree. In Panel A of Table 8, the posterior mean enters positively and significantly at the one percent level in all four columns, with the largest coefficients in the U.S.–Germany sample (0.00135 and 0.00126). Posterior uncertainty is negative in that sample and significant once controls are added (-0.02820), but it is indistinguishable from zero in the four-country pool. Panel A of Table 10 repeats the pattern on the intensive margin: the posterior mean is strongly positive and significant in all four columns (0.017 to 0.026). Instrumentation eliminates every one of these associations. In Panel B of Table 8, the fitted posterior mean is negative in the four-country pool, positive in the U.S.–Germany pool, and insignificant everywhere; the fitted posterior uncertainty (-0.27770 and -0.13988 in the U.S.–Germany sample) is equally imprecise. In Panel B of Table 10, the fitted mean is likewise insignificant in every column. For crypto assets, then, the association between beliefs and holdings is entirely a cross-sectional phenomenon. This result sharpens rather than qualifies our first finding: where the correlational evidence is strongest, the experimental evidence does not confirm it.

We next examine on which margin belief updating operates. In the pooled samples, neither margin responds detectably to instrumented beliefs, and what structure exists sits on the intensive margin.²⁰ On the extensive margin, the robust predictors are again the prior-exposure variables: prior crypto ownership is associated with a 36 to 44 percentage point higher probability of intended ownership, and prior uncertainty enters positively and significantly at the one percent level in every column of Table 8. The country-specific OLS estimates in Table 9 reproduce the cross-country pattern observed for stocks. Posterior uncertainty is negative in the United States and Germany, significantly so in the German specification with

does not identify the mechanism. We therefore treat China as the country in which the signal departed most from the other three, not as evidence that Chinese respondents respond to subjective uncertainty through a different channel.

²⁰The country-specific estimates contain one exception. In Panel B of Table 9, the fitted posterior mean enters the U.S. ownership equation positively and significantly (0.00811 and 0.00932). It is the only instrumented first-moment coefficient in the paper with the sign that portfolio theory predicts; we note it without building on it, because it appears in no pooled specification and in no other country.

controls (-0.03210); it is significantly positive in China (0.03570 and 0.03106) and near zero in Japan. The intensive margin most closely resembles the stock results, although the estimates are not statistically significant. In Panel B of Table 10, the fitted posterior uncertainty is negative in the U.S.–Germany sample in both columns (3) and (4) (-2.972 and -2.278) and positive in the four-country pool (1.382 and 0.665), but the standard errors are above six in the U.S.–Germany sample and about three in the four-country pool, so none of the four estimates can be distinguished from zero. Panel A shows the same asymmetry with smaller magnitudes. Prior crypto shares and prior uncertainty remain the dominant predictors, entering at 0.36 and at 1.2 to 1.9 , respectively.

Finally, we investigate which moment of beliefs carries the response. As for stocks, the signs favor subjective uncertainty over the expected return, but the estimates do not support a causal claim. The negative fitted uncertainty in the U.S.–Germany share equation matches the stock evidence in Table 6 and carries the sign the two-moment framework predicts, while, in the pooled samples, the fitted posterior mean is insignificant under instrumentation on both margins. Table 11 locates the negative intensive-margin estimate in the U.S. sample and identifies China as the countervailing case. In Panel A, posterior uncertainty is negative in the United States (-0.204 and -0.251) and Germany (-0.143 and -0.151) and positive in Japan and China, though none of these estimates is significant. The posterior mean is positive and significant in Japan, the United States, and Germany, one more cross-sectional first-moment association with no experimental counterpart. In Panel B, only the United States retains a negative fitted-uncertainty coefficient (-4.938 and -3.457). Germany turns slightly positive, and China becomes large, positive, and significant at the five percent level (13.859 and 11.835). The pooled U.S.–Germany estimate in Table 10 is therefore driven by the United States, and China pulls the four-country pooled estimate toward zero and above it. We conclude that the uncertainty channel identified for equities does not extend, at the precision our design affords, to crypto assets.

5 Discussion

Two patterns in the results deserve discussion before we conclude, one across the two margins and one across the two moments. Across the margins, information about historical returns changed the size of intended positions but not the decision to hold an asset at all in the pooled estimates. One reading is that the two decisions depend on different inputs. Whether a respondent participates in a market depends on fixed costs, access, and familiarity, which a single information intervention leaves untouched (Christelis et al., 2010; van Rooij et al., 2011). How much a participating respondent holds depends on subjective uncertainty about returns, which is the quantity the information treatments move.

Across the moments, the response ran through subjective uncertainty rather than the expected return. The expected return tends to be positively associated with holdings in the OLS estimates but is not a chan-

nel through which our information operated: once posterior beliefs are instrumented, its coefficient is no longer positive and significant in any pooled specification, whereas the coefficient on subjective uncertainty keeps its sign and grows. What changed intended portfolios was therefore respondents' subjective uncertainty about returns, not the return they expected.

6 Conclusion

This paper examines which moment of a respondent's beliefs about a risky asset governs what the respondent holds. Separating the two moments is difficult in observational data, because respondents who expect high returns also tend to perceive low uncertainty, and because the portfolios respondents already own shape both beliefs. We address the problem with a randomized information intervention fielded to respondents in Japan, the United States, Germany, and China. The intervention lets us instrument posterior beliefs with the treatments and their interactions with priors, and it lets us examine the three questions posed in the introduction: whether correlational and experimental estimates agree, on which margin belief updating operates, and which moment of beliefs carries the response.

We report three findings. First, correlational and experimental estimates disagree. Expected returns tend to be positively associated with both ownership and portfolio shares in the OLS estimates, but neither positive association remains once beliefs are instrumented, whereas the coefficient on subjective uncertainty keeps its sign and grows in magnitude. We therefore interpret the OLS correlation between optimism and holdings as a product of endogenous belief formation among respondents already invested in the asset, not as evidence that information about the level of past returns reshapes portfolios. Second, belief updating moves how much respondents intend to hold rather than whether they hold at all. Among U.S. and German respondents, an exogenous increase in subjective uncertainty about stock returns lowers the intended domestic-equity share, while, in the pooled samples, no belief moment predicts intended participation once posterior beliefs are instrumented.²¹ Participation behaves as a state variable: prior participation predicts intended participation so strongly that a single information intervention does not induce entry, which leaves the scale of risk-taking as the margin on which information can act. Third, the response runs through the second moment of beliefs rather than the first, and the channel is bounded by asset class and by institutional setting. For crypto assets it carries the same negative sign but cannot be distinguished from zero, because positions are small. Across countries it divides rather than averages. It disappears in Japan, where cash and deposits account for three quarters of reported financial wealth and acting on a revised belief would mean opening a position rather than enlarging one. It reverses sign in China, where wide subjective distributions appear to mark engagement with a retail-dominated market

²¹The one country-specific exception, a positive instrumented effect of the posterior mean on crypto-asset ownership in the United States, is noted in Section 4.2.

rather than reluctance to enter it.

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Table 1: Asset Composition of Respondents by Country (%)

Country	Cash and Deposits	Domestic Stocks	Domestic Bonds	Foreign Stocks	Foreign Bonds	Gold	Crypto Assets	Others	Holds Domestic Stocks	Holds Crypto Assets	Observ- ations
Japan	74.9	7.3	1.5	1.9	0.6	4.5	0.7	8.7	23.9	5.3	10,000
United States	58.1	8.3	2.6	1.3	0.8	9.1	3.8	16.0	24.0	18.1	4,000
Germany	59.1	6.0	1.6	4.8	0.9	9.1	3.8	14.8	22.9	18.6	4,000
China	57.5	9.2	4.6	0.9	0.5	14.4	1.9	10.9	35.5	12.7	4,000

Notes: Crypto assets include crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs). Row sums of the first eight columns may differ from 100 percent because of rounding. The last two columns report the percentage of respondents who currently hold the asset, from the investment-experience questions (Q9 for domestic stocks and Q15 for crypto assets in Appendix A).

Table 2: Prior and Posterior Beliefs about Stock-Index Returns by Treatment Arm

Treatment arm	Observations	Prior mean	Posterior mean	Prior SD	Posterior SD
<i>Panel A: Japan</i>					
Control (RCT0)	923	3.8	17.5	13.4	15.5
Stock: mean (RCT1)	429	4.0	20.0	13.7	15.6
Stock: max/min (RCT2)	452	4.2	18.2	13.2	15.7
Stock: both (RCT3)	888	4.5	19.7	13.4	15.3
BTC: mean (RCT4)	444	4.1	18.3	12.8	16.4
BTC: max/min (RCT5)	477	3.3	18.4	13.6	17.9
BTC: both (RCT6)	839	3.5	18.1	13.4	17.3
<i>Panel B: United States</i>					
Control (RCT0)	440	4.5	25.7	19.5	19.4
Stock: mean (RCT1)	201	3.8	28.5	18.5	19.4
Stock: max/min (RCT2)	216	4.7	27.2	18.6	18.1
Stock: both (RCT3)	410	3.1	28.9	19.2	19.5
BTC: mean (RCT4)	234	5.3	29.1	18.0	18.2
BTC: max/min (RCT5)	223	5.5	28.1	18.0	18.0
BTC: both (RCT6)	408	6.1	30.8	18.6	19.5
<i>Panel C: Germany</i>					
Control (RCT0)	460	5.4	24.2	15.5	16.9
Stock: mean (RCT1)	235	3.0	24.4	16.8	16.9
Stock: max/min (RCT2)	216	5.3	22.9	15.3	15.6
Stock: both (RCT3)	491	4.0	22.1	16.1	16.0
BTC: mean (RCT4)	242	4.8	23.8	16.4	16.7
BTC: max/min (RCT5)	241	3.8	24.7	15.8	15.0
BTC: both (RCT6)	504	4.5	26.2	16.4	17.1
<i>Panel D: China</i>					
Control (RCT0)	682	6.8	27.1	17.3	16.9
Stock: mean (RCT1)	317	6.2	25.9	17.0	15.5
Stock: max/min (RCT2)	296	7.8	26.2	16.7	16.4
Stock: both (RCT3)	657	7.5	23.1	17.2	16.2
BTC: mean (RCT4)	325	7.3	28.4	17.4	17.5
BTC: max/min (RCT5)	304	7.0	24.7	17.6	17.0
BTC: both (RCT6)	603	7.3	28.3	17.3	18.4

Notes: Cells report treatment-arm averages of individual-level subjective expected returns (mean) and subjective standard deviations (SD) of one-year-ahead stock-index returns, in percent. Observations is the number of respondents in each treatment arm with non-missing posterior expected returns. Sample sizes differ from those in the estimation tables (Tables 4–11), which restrict treatment arms by asset. RCT0 is the control arm C of Section 3, and RCT1–RCT6 are $T^{S,1}$, $T^{S,2}$, $T^{S,12}$, $T^{B,1}$, $T^{B,2}$, and $T^{B,12}$. Prior and posterior moments are elicited with different question formats (nine fixed bins before the information, three respondent-defined scenarios after it), so their levels are not comparable; the higher posterior mean in the control arm reflects the change in format, not updating (Section 2).

Table 3: Prior and Posterior Beliefs about Bitcoin (BTC) Returns by Treatment Arm

Treatment arm	Observations	Prior mean	Posterior mean	Prior SD	Posterior SD
<i>Panel A: Japan</i>					
Control (RCT0)	923	3.4	17.3	13.3	17.4
Stock: mean (RCT1)	429	3.9	20.2	13.6	17.6
Stock: max/min (RCT2)	452	3.5	17.1	12.8	17.2
Stock: both (RCT3)	888	3.5	18.3	13.0	17.6
BTC: mean (RCT4)	444	3.4	21.1	11.9	18.2
BTC: max/min (RCT5)	477	2.8	19.2	12.6	20.4
BTC: both (RCT6)	839	3.1	19.8	13.5	20.3
<i>Panel B: United States</i>					
Control (RCT0)	440	5.1	26.9	19.0	20.0
Stock: mean (RCT1)	201	5.7	28.8	17.6	19.1
Stock: max/min (RCT2)	216	7.3	26.1	18.2	18.9
Stock: both (RCT3)	410	4.6	25.7	18.7	20.1
BTC: mean (RCT4)	234	6.4	29.0	17.5	18.4
BTC: max/min (RCT5)	223	6.5	29.0	17.1	19.4
BTC: both (RCT6)	408	6.9	28.7	17.6	19.7
<i>Panel C: Germany</i>					
Control (RCT0)	460	8.9	25.4	15.4	18.0
Stock: mean (RCT1)	235	6.0	26.3	17.3	18.2
Stock: max/min (RCT2)	216	8.4	25.1	15.5	17.0
Stock: both (RCT3)	491	7.3	23.6	15.9	17.4
BTC: mean (RCT4)	242	8.2	25.7	16.2	19.9
BTC: max/min (RCT5)	241	7.5	25.5	15.3	17.7
BTC: both (RCT6)	504	7.5	27.5	16.6	19.4
<i>Panel D: China</i>					
Control (RCT0)	682	6.0	25.6	17.5	17.6
Stock: mean (RCT1)	317	6.1	25.8	16.5	16.7
Stock: max/min (RCT2)	296	6.9	25.5	17.0	17.5
Stock: both (RCT3)	657	7.3	23.6	16.9	17.3
BTC: mean (RCT4)	325	7.5	28.7	17.2	18.8
BTC: max/min (RCT5)	304	7.1	24.7	17.2	18.3
BTC: both (RCT6)	603	7.0	28.1	17.6	19.2

Notes: Cells report treatment-arm averages of individual-level subjective expected returns (mean) and subjective standard deviations (SD) of one-year-ahead Bitcoin (BTC) returns, in percent. Observations is the number of respondents in each treatment arm with non-missing posterior expected returns. Sample sizes differ from those in the estimation tables (Tables 4–11), which restrict treatment arms by asset. RCT0 is the control arm C of Section 3, and RCT1–RCT6 are $T^{S,1}$, $T^{S,2}$, $T^{S,12}$, $T^{B,1}$, $T^{B,2}$, and $T^{B,12}$. Prior and posterior moments are elicited with different question formats (nine fixed bins before the information, three respondent-defined scenarios after it), so their levels are not comparable; the higher posterior mean in the control arm reflects the change in format, not updating (Section 2).

Table 4: Effects of Beliefs on Domestic-Stock Ownership (Extensive Margin): Pooled Samples

	(1)	(2)	(3)	(4)
	Domestic-Stock Outcomes			
	Extensive margin: D_i^S			
	Four-country pooled		U.S.–Germany pooled	
<i>Panel A: OLS</i>				
Post mean (Stock)	0.00006 (0.00024)	0.00016 (0.00024)	0.00103*** (0.00036)	0.00085** (0.00036)
Log post uncertainty (Stock)	−0.00385 (0.00681)	−0.00706 (0.00690)	−0.02187** (0.00979)	−0.02503** (0.00973)
Prior mean (Stock)	0.00391*** (0.00051)	0.00362*** (0.00052)	0.00211** (0.00084)	0.00140* (0.00084)
Log prior uncertainty (Stock)	0.13232*** (0.01022)	0.12946*** (0.01051)	0.15103*** (0.01743)	0.12424*** (0.01814)
Prior domestic-stock holder	0.42896*** (0.00855)	0.39844*** (0.00960)	0.35786*** (0.01441)	0.33351*** (0.01641)
Control variables	NO	YES	NO	YES
Mean of dependent variable	0.707	0.714	0.732	0.734
Observations	6,538	6,176	2,383	2,342
<i>Panel B: 2SLS</i>				
Post mean (Stock), fitted	−0.00036 (0.00538)	0.00289 (0.00497)	−0.00338 (0.00928)	−0.00156 (0.00821)
Log post uncertainty (Stock), fitted	−0.13982 (0.13475)	−0.18135 (0.12409)	−0.12376 (0.10624)	−0.11822 (0.10410)
Prior mean (Stock)	0.00480* (0.00277)	0.00292 (0.00257)	0.00413 (0.00365)	0.00263 (0.00326)
Log prior uncertainty (Stock)	0.16023*** (0.04385)	0.13595*** (0.03989)	0.22468** (0.10117)	0.17113** (0.08378)
Prior domestic-stock holder	0.43451*** (0.00853)	0.40351*** (0.00962)	0.36172*** (0.01455)	0.33248*** (0.01671)
Control variables	NO	YES	NO	YES
Mean of dependent variable	0.707	0.714	0.732	0.734
Observations	6,667	6,294	2,434	2,392

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is a domestic-stock ownership dummy (D_i^S). Columns (1)–(2) use the four-country pooled sample and Columns (3)–(4) use the U.S.–Germany pooled sample; pooled specifications include country fixed effects. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Effects of Beliefs on Domestic-Stock Ownership (Extensive Margin): By Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Domestic-Stock Outcomes							
	Extensive margin: D_i^S							
	Japan		United States		Germany		China	
<i>Panel A: OLS</i>								
Post mean (Stock)	−0.00057 (0.00044)	−0.00062 (0.00047)	0.00102** (0.00047)	0.00097** (0.00047)	0.00095* (0.00055)	0.00054 (0.00055)	−0.00118*** (0.00043)	−0.00035 (0.00043)
Log post uncertainty (Stock)	−0.00197 (0.01285)	−0.00534 (0.01398)	−0.03190** (0.01379)	−0.02995** (0.01383)	−0.01349 (0.01380)	−0.02258* (0.01358)	0.02597* (0.01355)	0.03272** (0.01345)
Prior mean (Stock)	0.00453*** (0.00087)	0.00474*** (0.00093)	0.00020 (0.00107)	−0.00013 (0.00108)	0.00441*** (0.00136)	0.00334** (0.00134)	0.00664*** (0.00092)	0.00615*** (0.00089)
Log prior uncertainty (Stock)	0.05935*** (0.01702)	0.07020*** (0.01824)	0.10220*** (0.02652)	0.09575*** (0.02853)	0.18903*** (0.02306)	0.14789*** (0.02337)	0.20244*** (0.01953)	0.18752*** (0.01887)
Prior domestic-stock holder	0.51306*** (0.01432)	0.49833*** (0.01672)	0.29330*** (0.02022)	0.27380*** (0.02348)	0.41854*** (0.02035)	0.38306*** (0.02291)	0.40662*** (0.01554)	0.34137*** (0.01698)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	0.642	0.651	0.774	0.773	0.693	0.696	0.754	0.755
Observations	2,285	1,974	1,150	1,130	1,233	1,212	1,870	1,860
<i>Panel B: 2SLS</i>								
Post mean (Stock), fitted	0.00002 (0.00748)	−0.00307 (0.00682)	−0.00856 (0.00579)	−0.00563 (0.00513)	0.00729 (0.00707)	0.00436 (0.00771)	0.00409 (0.00395)	0.00587 (0.00438)
Log post uncertainty (Stock), fitted	−0.22192 (0.46812)	−0.13213 (0.41837)	−0.07874 (0.10112)	−0.04846 (0.10133)	−0.07821 (0.14234)	−0.08703 (0.13849)	0.03444 (0.14479)	0.04641 (0.14301)
Prior mean (Stock)	0.00479 (0.00344)	0.00602* (0.00327)	0.00365* (0.00207)	0.00261 (0.00201)	0.00110 (0.00357)	0.00146 (0.00381)	0.00294 (0.00277)	0.00217 (0.00289)
Log prior uncertainty (Stock)	0.09643 (0.06900)	0.09969* (0.05208)	0.22594*** (0.07983)	0.18491** (0.07306)	0.14908** (0.06879)	0.13580** (0.06193)	0.16224*** (0.03487)	0.14518*** (0.03412)
Prior domestic-stock holder	0.52476*** (0.01412)	0.51087*** (0.01650)	0.28875*** (0.02084)	0.26076*** (0.02442)	0.43336*** (0.02005)	0.39566*** (0.02273)	0.41221*** (0.01551)	0.34597*** (0.01698)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	0.642	0.651	0.774	0.773	0.693	0.696	0.754	0.755
Observations	2,359	2,038	1,172	1,152	1,262	1,240	1,874	1,864

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is a domestic-stock ownership dummy (D_i^S). All specifications are estimated separately by country. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Effects of Beliefs on Domestic-Stock Portfolio Shares (Intensive Margin): Pooled Samples

	(1)	(2)	(3)	(4)
	Domestic-Stock Outcomes			
	Intensive margin: $Share_i^S$			
	Four-country pooled		U.S.–Germany pooled	
<i>Panel A: OLS</i>				
Post mean (Stock)	−0.013*	−0.012*	−0.003	−0.005
	(0.007)	(0.007)	(0.011)	(0.011)
Log post uncertainty (Stock)	0.013	−0.035	−0.894***	−0.910***
	(0.210)	(0.217)	(0.322)	(0.327)
Prior mean (Stock)	0.152***	0.147***	0.109***	0.103***
	(0.018)	(0.019)	(0.031)	(0.032)
Log prior uncertainty (Stock)	0.425	0.354	0.055	0.120
	(0.356)	(0.376)	(0.745)	(0.777)
Prior domestic-stock share	0.626***	0.612***	0.570***	0.559***
	(0.012)	(0.013)	(0.024)	(0.026)
Control variables	NO	YES	NO	YES
Mean of dependent variable	15.34	15.58	15.22	15.31
Observations	6,538	6,176	2,383	2,342
<i>Panel B: 2SLS</i>				
Post mean (Stock), fitted	−0.324*	−0.290	0.164	0.172
	(0.186)	(0.183)	(0.300)	(0.280)
Log post uncertainty (Stock), fitted	−5.907	−5.682	−6.344*	−6.146*
	(4.936)	(4.678)	(3.653)	(3.694)
Prior mean (Stock)	0.342***	0.316***	0.053	0.037
	(0.093)	(0.093)	(0.118)	(0.112)
Log prior uncertainty (Stock)	3.914***	3.384**	−0.304	−0.522
	(1.452)	(1.401)	(3.264)	(2.873)
Prior domestic-stock share	0.622***	0.607***	0.562***	0.548***
	(0.012)	(0.014)	(0.025)	(0.027)
Control variables	NO	YES	NO	YES
Mean of dependent variable	15.34	15.58	15.22	15.31
Observations	6,667	6,294	2,434	2,392

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is the domestic-stock portfolio share ($Share_i^S$). Columns (1)–(2) use the four-country pooled sample and Columns (3)–(4) use the U.S.–Germany pooled sample; pooled specifications include country fixed effects. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Effects of Beliefs on Domestic-Stock Portfolio Shares (Intensive Margin): By Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Domestic-Stock Outcomes							
	Intensive margin: $Share_i^S$							
	Japan		United States		Germany		China	
<i>Panel A: OLS</i>								
Post mean (Stock)	−0.030** (0.013)	−0.026* (0.015)	−0.003 (0.015)	−0.005 (0.015)	−0.003 (0.015)	−0.007 (0.015)	−0.015 (0.011)	−0.005 (0.012)
Log post uncertainty (Stock)	0.428 (0.379)	0.345 (0.423)	−1.042** (0.479)	−1.000** (0.479)	−0.782* (0.437)	−0.895** (0.443)	1.035*** (0.367)	1.015*** (0.361)
Prior mean (Stock)	0.141*** (0.029)	0.138*** (0.032)	0.088** (0.045)	0.089** (0.045)	0.121*** (0.041)	0.109** (0.043)	0.221*** (0.029)	0.215*** (0.029)
Log prior uncertainty (Stock)	0.247 (0.489)	0.300 (0.552)	−2.529** (1.267)	−1.901 (1.312)	1.883** (0.906)	1.657* (0.961)	0.784 (0.555)	0.677 (0.552)
Prior domestic-stock share	0.666*** (0.017)	0.650*** (0.019)	0.522*** (0.032)	0.502*** (0.034)	0.646*** (0.032)	0.642*** (0.034)	0.618*** (0.021)	0.593*** (0.024)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	16.00	16.68	16.77	16.83	13.78	13.90	14.68	14.74
Observations	2,285	1,974	1,150	1,130	1,233	1,212	1,870	1,860
<i>Panel B: 2SLS</i>								
Post mean (Stock), fitted	0.167 (0.228)	0.018 (0.222)	−0.136 (0.240)	−0.109 (0.217)	0.010 (0.200)	0.046 (0.225)	−0.071 (0.124)	−0.051 (0.143)
Log post uncertainty (Stock), fitted	−12.863 (14.469)	0.211 (13.178)	−0.632 (5.017)	−0.508 (5.231)	−5.534 (4.214)	−4.897 (4.167)	4.130 (4.561)	4.979 (4.412)
Prior mean (Stock)	0.075 (0.100)	0.100 (0.101)	0.138* (0.082)	0.135 (0.082)	0.118 (0.100)	0.080 (0.113)	0.226*** (0.086)	0.205** (0.093)
Log prior uncertainty (Stock)	1.485 (2.071)	−0.062 (1.572)	−1.030 (3.144)	−0.579 (2.944)	3.134 (2.239)	2.135 (2.147)	0.754 (1.039)	0.436 (1.077)
Prior domestic-stock share	0.666*** (0.018)	0.650*** (0.020)	0.510*** (0.033)	0.485*** (0.036)	0.646*** (0.032)	0.641*** (0.035)	0.620*** (0.021)	0.594*** (0.024)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	16.00	16.68	16.77	16.83	13.78	13.90	14.68	14.74
Observations	2,359	2,038	1,172	1,152	1,262	1,240	1,874	1,864

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is the domestic-stock portfolio share ($Share_i^S$). All specifications are estimated separately by country. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Effects of Beliefs on Crypto-Asset Ownership (Extensive Margin): Pooled Samples

	(1)	(2)	(3)	(4)
	Crypto-Asset Outcomes			
	Extensive margin: D_i^B			
	Four-country pooled		U.S.–Germany pooled	
<i>Panel A: OLS</i>				
Post mean (BTC)	0.00104*** (0.00025)	0.00110*** (0.00026)	0.00135*** (0.00041)	0.00126*** (0.00041)
Log post uncertainty (BTC)	−0.00056 (0.00726)	−0.00417 (0.00757)	−0.01939 (0.01203)	−0.02820** (0.01207)
Prior mean (BTC)	0.00098** (0.00048)	0.00093* (0.00050)	0.00203** (0.00079)	0.00155* (0.00081)
Log prior uncertainty (BTC)	0.19156*** (0.00923)	0.18808*** (0.00969)	0.25572*** (0.01675)	0.22038*** (0.01714)
Prior crypto-asset holder	0.44199*** (0.01408)	0.41550*** (0.01506)	0.39756*** (0.01937)	0.35703*** (0.02094)
Control variables	NO	YES	NO	YES
Mean of dependent variable	0.384	0.397	0.509	0.512
Observations	6,220	5,877	2,339	2,303
<i>Panel B: 2SLS</i>				
Post mean (BTC), fitted	−0.00570 (0.00555)	−0.00629 (0.00581)	0.00302 (0.00545)	0.00440 (0.00503)
Log post uncertainty (BTC), fitted	0.16039 (0.13090)	0.13093 (0.14615)	−0.27770 (0.21107)	−0.13988 (0.19945)
Prior mean (BTC)	0.00323 (0.00232)	0.00364 (0.00247)	0.00188 (0.00249)	0.00055 (0.00220)
Log prior uncertainty (BTC)	0.20551*** (0.02880)	0.21540*** (0.03212)	0.27130*** (0.05992)	0.20906*** (0.04674)
Prior crypto-asset holder	0.44441*** (0.01401)	0.41949*** (0.01498)	0.40151*** (0.01926)	0.36080*** (0.02091)
Control variables	NO	YES	NO	YES
Mean of dependent variable	0.384	0.397	0.509	0.512
Observations	6,289	5,938	2,372	2,335

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is a crypto-asset ownership dummy (D_i^B). Crypto assets include crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs). Columns (1)–(2) use the four-country pooled sample and Columns (3)–(4) use the U.S.–Germany pooled sample; pooled specifications include country fixed effects. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Effects of Beliefs on Crypto-Asset Ownership (Extensive Margin): By Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Crypto-Asset Outcomes Extensive margin: D_t^B							
	Japan		United States		Germany		China	
<i>Panel A: OLS</i>								
Post mean (BTC)	0.00113*** (0.00034)	0.00107*** (0.00038)	0.00094* (0.00056)	0.00092 (0.00056)	0.00175*** (0.00058)	0.00150** (0.00059)	0.00021 (0.00053)	0.00004 (0.00054)
Log post uncertainty (BTC)	−0.00143 (0.00976)	0.00029 (0.01068)	−0.02133 (0.01799)	−0.02796 (0.01814)	−0.02089 (0.01612)	−0.03210** (0.01604)	0.03570** (0.01638)	0.03106* (0.01665)
Prior mean (BTC)	0.00073 (0.00070)	0.00077 (0.00079)	0.00189* (0.00111)	0.00131 (0.00116)	0.00235** (0.00113)	0.00222* (0.00115)	0.00082 (0.00104)	0.00072 (0.00105)
Log prior uncertainty (BTC)	0.09481*** (0.01178)	0.09139*** (0.01296)	0.29663*** (0.02632)	0.26175*** (0.02722)	0.22700*** (0.02128)	0.18989*** (0.02166)	0.25295*** (0.02148)	0.24790*** (0.02171)
Prior crypto-asset holder	0.64321*** (0.03175)	0.63439*** (0.03398)	0.30902*** (0.02864)	0.28784*** (0.03055)	0.47904*** (0.02584)	0.42077*** (0.02871)	0.38355*** (0.02642)	0.35726*** (0.02892)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	0.178	0.186	0.538	0.539	0.481	0.487	0.461	0.460
Observations	2,079	1,780	1,126	1,113	1,213	1,190	1,802	1,794
<i>Panel B: 2SLS</i>								
Post mean (BTC), fitted	0.00308 (0.00421)	0.00242 (0.00359)	0.00811* (0.00454)	0.00932** (0.00439)	0.01131 (0.01140)	0.01108 (0.00928)	−0.00079 (0.00672)	−0.00101 (0.00619)
Log post uncertainty (BTC), fitted	0.05768 (0.10576)	0.04113 (0.10370)	0.06508 (0.26537)	0.23830 (0.25796)	−0.33645 (0.26153)	−0.13486 (0.20890)	0.09592 (0.30524)	0.06144 (0.27380)
Prior mean (BTC)	−0.00044 (0.00185)	−0.00007 (0.00186)	−0.00087 (0.00204)	−0.00167 (0.00190)	−0.00050 (0.00437)	−0.00146 (0.00368)	0.00090 (0.00330)	0.00102 (0.00292)
Log prior uncertainty (BTC)	0.07824*** (0.02068)	0.08080*** (0.02329)	0.21535*** (0.06581)	0.16242*** (0.05780)	0.20688*** (0.06413)	0.15140*** (0.04569)	0.25161*** (0.04051)	0.25018*** (0.03829)
Prior crypto-asset holder	0.63514*** (0.03182)	0.63065*** (0.03396)	0.30653*** (0.02860)	0.28442*** (0.03052)	0.48963*** (0.02539)	0.43096*** (0.02843)	0.38734*** (0.02626)	0.35969*** (0.02879)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	0.178	0.186	0.538	0.539	0.481	0.487	0.461	0.460
Observations	2,112	1,806	1,142	1,129	1,230	1,206	1,805	1,797

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is a crypto-asset ownership dummy (D_i^B). Crypto assets include crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs). All specifications are estimated separately by country. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Effects of Beliefs on Crypto-Asset Portfolio Shares (Intensive Margin): Pooled Samples

	(1)	(2)	(3)	(4)
	Crypto-Asset Outcomes			
	Intensive margin: $Share_i^B$			
	Four-country pooled		U.S.–Germany pooled	
<i>Panel A: OLS</i>				
Post mean (BTC)	0.017*** (0.005)	0.019*** (0.005)	0.025*** (0.009)	0.026*** (0.009)
Log post uncertainty (BTC)	0.058 (0.134)	0.042 (0.143)	−0.108 (0.258)	−0.164 (0.265)
Prior mean (BTC)	0.014 (0.012)	0.015 (0.013)	0.040 (0.027)	0.038 (0.027)
Log prior uncertainty (BTC)	1.729*** (0.207)	1.692*** (0.219)	1.944*** (0.511)	1.658*** (0.527)
Prior crypto-asset share	0.358*** (0.030)	0.355*** (0.031)	0.369*** (0.039)	0.366*** (0.041)
Control variables	NO	YES	NO	YES
Mean of dependent variable	4.74	4.94	6.85	6.93
Observations	6,220	5,877	2,339	2,303
<i>Panel B: 2SLS</i>				
Post mean (BTC), fitted	0.043 (0.107)	0.067 (0.115)	0.096 (0.158)	0.120 (0.143)
Log post uncertainty (BTC), fitted	1.382 (2.874)	0.665 (3.168)	−2.972 (6.620)	−2.278 (6.170)
Prior mean (BTC)	−0.005 (0.044)	−0.010 (0.048)	0.019 (0.069)	0.009 (0.060)
Log prior uncertainty (BTC)	1.335** (0.561)	1.292** (0.644)	1.653 (1.783)	1.205 (1.362)
Prior crypto-asset share	0.363*** (0.030)	0.361*** (0.031)	0.376*** (0.039)	0.372*** (0.041)
Control variables	NO	YES	NO	YES
Mean of dependent variable	4.74	4.94	6.85	6.93
Observations	6,289	5,938	2,372	2,335

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is the crypto-asset portfolio share ($Share_i^B$). Crypto assets include crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs). Columns (1)–(2) use the four-country pooled sample and Columns (3)–(4) use the U.S.–Germany pooled sample; pooled specifications include country fixed effects. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 11: Effects of Beliefs on Crypto-Asset Portfolio Shares (Intensive Margin): By Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Crypto-Asset Outcomes Intensive margin: $Share_i^B$							
	Japan		United States		Germany		China	
<i>Panel A: OLS</i>								
Post mean (BTC)	0.014** (0.006)	0.014** (0.007)	0.022** (0.011)	0.023** (0.011)	0.027* (0.014)	0.029** (0.014)	0.009 (0.010)	0.008 (0.011)
Log post uncertainty (BTC)	0.073 (0.117)	0.093 (0.131)	−0.204 (0.386)	−0.251 (0.391)	−0.143 (0.343)	−0.151 (0.357)	0.434 (0.295)	0.428 (0.306)
Prior mean (BTC)	0.015 (0.010)	0.014 (0.011)	0.061** (0.025)	0.063** (0.026)	0.018 (0.045)	0.017 (0.046)	−0.014 (0.023)	−0.013 (0.022)
Log prior uncertainty (BTC)	0.973*** (0.171)	0.921*** (0.196)	2.913*** (0.670)	2.782*** (0.648)	1.181* (0.699)	0.825 (0.732)	2.612*** (0.364)	2.660*** (0.367)
Prior crypto-asset share	0.396*** (0.080)	0.396*** (0.084)	0.233*** (0.038)	0.227*** (0.039)	0.528*** (0.061)	0.534*** (0.064)	0.276*** (0.038)	0.264*** (0.039)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	1.77	1.88	7.06	7.11	6.66	6.76	5.42	5.43
Observations	2,079	1,780	1,126	1,113	1,213	1,190	1,802	1,794
<i>Panel B: 2SLS</i>								
Post mean (BTC), fitted	−0.001 (0.053)	−0.005 (0.050)	0.206 (0.135)	0.232* (0.126)	0.019 (0.256)	0.004 (0.220)	−0.162 (0.121)	−0.154 (0.112)
Log post uncertainty (BTC), fitted	1.792 (1.564)	1.986 (1.648)	−4.938 (5.984)	−3.457 (5.569)	1.493 (6.344)	0.866 (5.202)	13.859** (6.270)	11.835** (5.810)
Prior mean (BTC)	0.012 (0.023)	0.015 (0.024)	−0.004 (0.057)	−0.006 (0.049)	0.016 (0.102)	0.028 (0.084)	−0.014 (0.055)	−0.005 (0.050)
Log prior uncertainty (BTC)	0.713*** (0.268)	0.711** (0.305)	1.485 (1.970)	1.090 (1.647)	0.830 (1.941)	0.834 (1.360)	2.193*** (0.713)	2.368*** (0.685)
Prior crypto-asset share	0.400*** (0.080)	0.400*** (0.083)	0.237*** (0.037)	0.231*** (0.039)	0.539*** (0.061)	0.543*** (0.064)	0.283*** (0.037)	0.270*** (0.039)
Control variables	NO	YES	NO	YES	NO	YES	NO	YES
Mean of dependent variable	1.77	1.88	7.06	7.11	6.66	6.76	5.42	5.43
Observations	2,112	1,806	1,142	1,129	1,230	1,206	1,805	1,797

Notes: Panel A reports OLS estimates and Panel B reports 2SLS estimates, in which posterior beliefs are instrumented by the randomized information treatments and their interactions with prior beliefs. The dependent variable is the crypto-asset portfolio share ($Share_i^B$). Crypto assets include crypto assets in the narrow sense (Bitcoin, Ethereum, and similar tokens), stablecoins, security tokens (STs), and non-fungible tokens (NFTs). All specifications are estimated separately by country. Uncertainty is measured as the log of the standard deviation of the individual subjective-return distribution. Prior asset holdings enter only the structural equation (1), not the first-stage equations (2)–(3). Control variables are gender, age category, marital status, college education, and income quintiles. Robust standard errors are reported in parentheses. The mean of the dependent variable is computed on the sample of Panel A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix

A Questionnaire

The text below reproduces the U.S. English version of the instrument. The Japanese, German, and Chinese versions are translations of the same questionnaire, with the national stock index, the currency and amounts, and the historical-return figures replaced by their country-specific counterparts; the substituted figures are given in the footnotes to the treatment screens. Where the instrument referred to the category comprising crypto assets, stablecoins, security tokens, and NFTs as “new digital financial products,” we label it “crypto assets,” the term used throughout the paper, and “crypto assets (narrow)” denotes the first item of that category. The treatment screens are labeled as in Section 3; Section 2 and Tables 2 and 3 refer to the same arms as RCT0–RCT6. For Q1–Q13, only the question text is reproduced; the answer choices and item lists are omitted.

Q1. Please select your gender.

Q2. Please select your age.

Q3. What is the highest level of education you have completed?

※ If you are currently in school, select the level you are currently attending.

Q4. Please indicate your current marital status.

Q5. What was your total personal income before taxes last year?

Q6. How much in financial assets do you personally own? Please select the closest amount.

※ Include crypto assets (including stablecoins, security tokens, and NFTs).

※ Do not include life insurance or physical assets such as real estate or cars.

※ Do not subtract any loans or other debts.

Q7. If you don’t mind, how much do you currently owe in loans or debt? Please select the amount that is closest to your total debt.

Q8. How familiar are you with each of the following financial products?

[This question is displayed only to respondents who selected an option other than “Don’t know / Have

never heard of it” in Q8.]

Q9. Please indicate your investment experience with each of the following financial products.

Q10. Do your parents or siblings have experience investing in stocks, bonds, or similar financial products?

Q11. Have you ever received financial education at home, school, or work?

※ Financial education refers to educational programs that teach about the overall workings of money, including economic policy, asset management, and financial troubles.

[This question is displayed only to respondents who selected an option other than “Don’t know / Have never heard of it” in Q8.]

Q12. What do you think about domestic stocks and mutual funds that invest primarily in domestic stocks? (Select all that apply)

Q13. What do you think the rate of change in the S&P 500 will be 12 months from now? Please assign probabilities to each of the following scenarios so that the total equals 100%.

※ Germany: DAX, Japan: Nikkei 225, China: Shanghai Composite Index

Q14. How familiar are you with each of the following crypto assets and related digital products?

※ Response options: (1) Don’t know / Have never heard of it; (2) Have heard of it, but don’t know much about it; (3) Have some knowledge, but not enough to teach others; (4) Know enough about it to teach others

- Crypto assets (narrow): Digital assets that can be transferred over the internet using blockchain (distributed ledger) and token (coin) technology; also called cryptocurrencies or virtual currencies (e.g., Bitcoin, Ethereum, Litecoin, XRP (Ripple), Stellar)
- Stablecoins: Cryptocurrencies designed to be pegged to a stable asset such as the U.S. dollar or gold (e.g., USDT, USDC, BUSD)
- Security tokens (STs): Digital securities created by applying blockchain (distributed ledger) and token (coin) technology to securities such as stocks and bonds
- Non-fungible tokens (NFTs): Digital tokens without fungibility issued using blockchain technology (e.g., CryptoKitties, CryptoPunks)
- Central bank digital currencies (CBDCs): Digital currencies issued by a central bank

[This question is displayed only to respondents who selected an option other than “Don’t know / Have never heard of it” for each product in Q14.]

Q15. Please indicate your investment experience with each of the following crypto assets. (Select one for each)

※ Response options: (1) Never invested; (2) Have invested but do not currently hold; (3) Currently hold

- Crypto assets (narrow)
- Stablecoins
- Security tokens (STs)
- Non-fungible tokens (NFTs)

[This question is displayed only to respondents who selected “Currently hold” for each product in Q15.]

Q16. What is the current value of your holdings of each of the following crypto assets? Please answer based on today’s market value, not the amount you paid. (Select one for each)

※ Response options: (1) Less than \$100; (2) \$100 – \$499; (3) \$500 – \$999; (4) \$1,000 – \$4,999; (5) \$5,000 – \$9,999; (6) \$10,000 – \$49,999; (7) \$50,000 – \$99,999; (8) \$100,000 – \$499,999; (9) \$500,000 – \$999,999; (10) \$1,000,000 or more

- Crypto assets (narrow)
- Stablecoins
- Security tokens (STs)
- Non-fungible tokens (NFTs)

Q17. What percentage of your financial assets is held in each of the following categories?

※ Make sure the total is 100%.

※ Do not include life insurance or physical assets such as real estate or cars.

1. Cash and deposits
2. Domestic stocks and mutual funds/ETFs that invest primarily in domestic stocks
3. Domestic bonds
4. Foreign stocks and mutual funds/ETFs that invest primarily in foreign stocks
5. Foreign bonds
6. Gold
7. Crypto assets (crypto assets in the narrow sense, stablecoins, security tokens, NFTs)

8. Other

[This question is displayed only to respondents who selected “Currently hold” for each product in Q15.]

Q18. How has the amount you have invested in each of the following crypto assets changed over the past year? Please count only money you put in or took out, not changes in market prices. (Select one for each)

※ Response options: (1) Started investing in this product over the past year; (2) Increased the amount I invested; (3) Slightly increased the amount I invested; (4) Almost no change in the amount I invested; (5) Slightly decreased the amount I invested; (6) Decreased the amount I invested

- Crypto assets (narrow)
- Stablecoins
- Security tokens (STs)
- Non-fungible tokens (NFTs)

[This question is displayed only to respondents who selected “Have invested but do not currently hold” or “Currently hold” for crypto assets in Q15.]

Q19. What was your purpose in acquiring or holding crypto assets? (Select all that apply)

1. As a short-term investment (less than 1 year)
2. As a long-term investment (1 year or longer)
3. To purchase other crypto assets, stablecoins, security tokens, or NFTs
4. To use as a means of payment for goods or services (excluding purchases of crypto assets or stablecoins)
5. For remittance purposes
6. To learn about crypto assets, blockchain technology, etc.
7. Received as a gift or for free
8. To participate in the crypto asset community (including for emotional support)
9. Other

[This question is displayed only to respondents who selected an option other than “Don’t know / Have never heard of it” for each product in Q14.]

Q20. What do you think about crypto assets (crypto assets in the narrow sense, stablecoins, STs, NFTs)? (Select all that apply)

1. I expect profits and price appreciation
2. Spreading my money across financial products whose prices move differently reduces investment risk
3. They are convenient
4. I am interested in the new technology and products and expect them to have future potential
5. I am concerned about losing money
6. The product structure and how to invest are difficult to understand
7. I cannot trust the issuers or brokers, or I am concerned about personal information leaks, etc.
8. Regulations and taxes make them difficult to use
9. Other
10. No particular impression

Q21. What do you think the rate of change in the price of Bitcoin will be 12 months from now? Please assign probabilities to each of the following scenarios so that the total equals 100%.

1. Increase of 35% or more
2. Increase of 25% or more but less than 35%
3. Increase of 15% or more but less than 25%
4. Increase of 5% or more but less than 15%
5. Change between -5% and $+5\%$
6. Decrease of 5% or more but less than 15%
7. Decrease of 15% or more but less than 25%
8. Decrease of 25% or more but less than 35%
9. Decrease of 35% or more

Q22. What is your primary method of payment in daily life?

1. Primarily cash
2. Primarily cashless (credit cards, debit cards, electronic money, QR code payments, etc.)
3. I don't know

Q23. What do you think about the following statement? Please choose the response that best reflects your feelings.

“Men should have paid jobs to keep their families financially stable.”

1. Agree
2. Somewhat agree
3. Somewhat disagree
4. Disagree
5. Prefer not to answer

Q24. What do you think about the following statement? Please choose the response that best reflects your feelings.

“Men are better suited to be leaders of organizations.”

1. Agree
2. Somewhat agree
3. Somewhat disagree
4. Disagree
5. Prefer not to answer

Q25. This is not a question to test whether your answer is correct, so please answer as you think. Suppose you deposited \$100,000 into a savings account with an annual interest rate of 2%. How much do you think would be in the account after five years, if you made no other deposits or withdrawals? Ignore any taxes on the interest.

1. More than \$110,000
2. Exactly \$110,000
3. Less than \$110,000
4. I don't know

Q26. Which of the two options below do you think would give the higher real return?

1. 2% interest rate on deposits, with a 0% future inflation rate

2. 5% interest rate on deposits, with a 4% future inflation rate
3. They would give the same real return
4. I don't know

Q27. Please indicate how you feel about the following statement.

“Buying shares of a single company is usually safer than buying a mutual fund.”

1. True
2. False
3. I don't know

Q28. Imagine you have the opportunity to either receive \$1,000 immediately or receive a larger amount with certainty one year from now. If you were to choose “receive one year later,” how much would you need to receive at minimum to prefer waiting?

1. \$1,005
2. \$1,010
3. \$1,020
4. \$1,030
5. \$1,040
6. \$1,050
7. \$1,060
8. \$1,070
9. \$1,080
10. \$1,090
11. \$1,100
12. \$1,150
13. \$1,200
14. \$1,300
15. \$1,500 or more

16. I would choose to receive the money immediately, regardless of how much I could receive a year later

Q29. Suppose there is an investment product that offers a 50% chance of yielding \$12,000 and a 50% chance of yielding \$8,000. How much would you be willing to pay for this investment product? Select the maximum amount you would be willing to pay.

1. I would buy even if it costs more than \$10,000
2. \$10,000
3. \$9,800
4. \$9,600
5. \$9,400
6. \$9,200
7. \$9,000
8. \$8,800
9. \$8,600
10. \$8,400
11. \$8,200
12. \$8,000
13. I wouldn't buy it

Randomized Information Treatment

The following questions were asked to respondents who selected any option other than “I wouldn't buy it” in Q29. Respondents were randomly assigned to one of seven groups. The control group (C) received no information. Treatment groups ($T^{S,1}$ – $T^{B,12}$) received the following information before answering questions about their expectations for stock-index returns and Bitcoin-price changes. The labels are those of Section 3, where $T_i^{a,j}$ indicates assignment to arm $T^{a,j}$; Section 2 and Tables 2 and 3 refer to the same arms as RCT0 (C) and RCT1–RCT6 ($T^{S,1}$, $T^{S,2}$, $T^{S,12}$, $T^{B,1}$, $T^{B,2}$, $T^{B,12}$).

C (RCT0; Control group, 20%): No information provided.

$T^{S,1}$ (RCT1; 1st moment, 10%): The S&P 500 has tripled over the past ten years.²²

$T^{S,2}$ (RCT2; 2nd moment, 10%): Looking back over the past ten years, the S&P 500 rose by 30.4% in its best year and fell by 19.6% in its worst year.²³

$T^{S,12}$ (RCT3; 1st and 2nd moments, 20%): The S&P 500 has tripled over the past ten years. However, looking back over the past ten years, the S&P 500 rose by 30.4% in its best year and fell by 19.6% in its worst year.^{22,23}

$T^{B,1}$ (RCT4; 1st moment, 10%): The price of Bitcoin has increased 408-fold over the past ten years.

$T^{B,2}$ (RCT5; 2nd moment, 10%): Looking back over the past ten years, the price of Bitcoin increased 14-fold in its best year and fell by 72.2% in its worst year.

$T^{B,12}$ (RCT6; 1st and 2nd moments, 20%): The price of Bitcoin has increased 408-fold over the past ten years. However, looking back over the past ten years, the price of Bitcoin increased 14-fold in its best year and fell by 72.2% in its worst year.

After the information treatment, respondents answered the following questions.

Q30. What do you think the rate of change in the S&P 500 will be 12 months from now? Please provide your most pessimistic, most likely (standard), and most optimistic outlooks.

※ Use the slider to indicate the rate of change for each scenario.

※ The slider ranges from −50% to +100%, with the initial position at 0% (no change).

1. Most pessimistic outlook: [−50% to +100%]
2. Most likely (standard) outlook: [−50% to +100%]
3. Most optimistic outlook: [−50% to +100%]

Q31. For each of the three scenarios you provided in the previous question (most pessimistic to most optimistic outlooks), how likely do you think they are to occur? Please ensure that the total equals 100%.

1. Probability of the most pessimistic outlook
2. Probability of the most likely (standard) outlook
3. Probability of the most optimistic outlook

²²Corresponding figures for other countries: DAX (Germany): doubled; Nikkei 225 (Japan): doubled; Shanghai Composite (China): declined by 1.3%.

²³Corresponding figures for other countries: DAX (Germany): +26.4% (best), −18.1% (worst); Nikkei 225 (Japan): +29.5% (best), −13.3% (worst); Shanghai Composite (China): +22.1% (best), −24.7% (worst).

Q32. What do you think the rate of change in the price of Bitcoin will be 12 months from now? Please provide your most pessimistic, most likely (standard), and most optimistic outlooks.

※ Use the slider to indicate the rate of change for each scenario.

※ The slider ranges from -50% to $+100\%$, with the initial position at 0% (no change).

1. Most pessimistic outlook: $[-50\%$ to $+100\%]$
2. Most likely (standard) outlook: $[-50\%$ to $+100\%]$
3. Most optimistic outlook: $[-50\%$ to $+100\%]$

Q33. For each of the three scenarios you provided in the previous question (most pessimistic to most optimistic outlooks), how likely do you think they are to occur? Please ensure that the total equals 100%.

1. Probability of the most pessimistic outlook
2. Probability of the most likely (standard) outlook
3. Probability of the most optimistic outlook

Q34. What percentage of your financial assets would you ideally hold in each of the following categories one year from now?

※ Do not include life insurance or physical assets such as real estate or cars.

1. Cash and deposits
2. Domestic stocks and mutual funds/ETFs that invest primarily in domestic stocks
3. Domestic bonds
4. Foreign stocks and mutual funds/ETFs that invest primarily in foreign stocks
5. Foreign bonds
6. Gold
7. Crypto assets (crypto assets in the narrow sense, stablecoins, security tokens, NFTs)
8. Other

[The following questions were asked to respondents who answered “I wouldn’t buy it” in Q29.]

Q35. Why did you choose not to buy the investment product? (Select all that apply)

1. The question was difficult to understand
2. It was difficult to understand how much I would gain or lose
3. I answered without thinking carefully
4. I want to avoid uncertainty
5. Although the probability is 50-50, I tend to have bad luck with lotteries
6. I have failed at investments in the past, or have heard stories of failures, so I have decided not to invest
7. I am not interested in investment in the first place; I do not like investment as a value
8. I don't have the financial capacity to invest; the investment amount is too large
9. I might buy if the potential profit were large and the price were low, like a lottery
10. I would like to consult with someone before answering
11. Other
12. I don't want to answer hypothetical questions; the scenario is not realistic

B Construction of Subjective-Belief Moments

This appendix describes how we construct subjective expected returns and uncertainty from the belief-elicitation modules of the survey. The elicitation method differs between Parts 1 and 2 of the survey.

In both parts, respondents report beliefs about one-year-ahead returns on Bitcoin (BTC) and on the relevant national stock-market index (the Nikkei 225 for Japan, the S&P 500 for the United States, the DAX for Germany, and the Shanghai Composite Index for China). Beliefs are elicited in probabilistic form in both cases, which lets us recover both expected returns and perceived uncertainty.

B.1 Part 1 (Prior) Belief Elicitation: Histogram-Based Probabilities

In Part 1, respondents report prior beliefs by allocating probabilities across predefined return intervals for the next 12 months. Specifically, they assign probabilities summing to 100 percent to nine mutually exclusive return bins, from declines of more than 35 percent to increases of more than 35 percent.

Let $B_j = [x_j, \bar{r}_j]$ denote return bin j , and let p_{ij} be the probability that respondent i assigns to bin j . We approximate the subjective-return distribution by assigning each bin its midpoint $\tilde{r}_j$; for the two open-ended bins, a gain of more than 35 percent and a loss of more than 35 percent, we assign +40 and −40 percent, respectively. From this discretized distribution we compute the subjective expected return as

$$\mathbb{E}_i[R] = \sum_j p_{ij} \tilde{r}_j, \quad (\text{B.1})$$

and perceived uncertainty as the corresponding variance,

$$\text{Var}_i(R) = \sum_j p_{ij} (\tilde{r}_j - \mathbb{E}_i[R])^2, \quad (\text{B.2})$$

with standard deviation $\text{SD}_i(R) = \sqrt{\text{Var}_i(R)}$.

The uncertainty measure used in the analysis is $\log \text{SD}_i(R)$, with no constant added inside the logarithm. A respondent who assigns all probability to a single bin has $\text{SD}_i(R) = 0$; the prior uncertainty of such a respondent is therefore missing, and because prior uncertainty enters every equation as a regressor, the respondent is excluded from every specification.

These measures summarize the level and dispersion of respondents' prior beliefs before any information treatment.

B.2 Part 2 (Posterior) Belief Elicitation: Scenario-Based Distributions

In Part 2, respondents state their beliefs after the randomized information treatment. Instead of allocating probabilities across fixed return bins, they construct a subjective-return distribution from scenarios.

Respondents first report three return scenarios for the next 12 months: a pessimistic outcome, a most likely (modal) outcome, and an optimistic outcome. We denote each scenario outcome by

$$r_i^{(k)} \in [-50, 100], \quad k \in \{p, m, o\},$$

where p , m , and o correspond to the pessimistic, modal, and optimistic scenarios, respectively. The survey interface enforces the ordering

$$r_i^{(p)} \leq r_i^{(m)} \leq r_i^{(o)}.$$

Respondents then assign probabilities to the scenarios,

$$p_i^{(k)} \geq 0, \quad \sum_{k \in \{p, m, o\}} p_i^{(k)} = 1,$$

which defines an individual-level subjective-return distribution.

From the reported scenarios and probabilities we compute the subjective expected return as

$$\mathbb{E}_i[R] = \sum_{k \in \{p, m, o\}} p_i^{(k)} r_i^{(k)}, \tag{B.3}$$

and perceived uncertainty as

$$\text{Var}_i(R) = \sum_{k \in \{p, m, o\}} p_i^{(k)} \left(r_i^{(k)} - \mathbb{E}_i[R] \right)^2, \tag{B.4}$$

with $\text{SD}_i(R) = \sqrt{\text{Var}_i(R)}$.

A respondent who assigns all probability to one scenario, or who reports three identical scenario values, has $\text{SD}_i(R) = 0$ and a missing posterior uncertainty. The OLS estimates in Panel A of each table exclude these respondents. The 2SLS estimates treat them differently: the first-stage equations (2) and (3) are estimated on respondents with non-missing posterior moments, and fitted posterior moments are then computed for every respondent with non-missing prior moments, instruments, and controls, so respondents with a missing posterior uncertainty remain in the second stage. Panel B of each table therefore has slightly more observations than Panel A.

C Respondents Inside and Outside the Experimental Sample

The information module described in Section 2 was administered only to respondents who chose a price for the hypothetical investment product in Q29 (options 1–12). Respondents who answered “I wouldn’t buy it” (option 13) were routed to a separate module and are not part of the experimental sample. Table C.1 compares the two groups on the characteristics used in the analysis. Respondents in the experimental sample are somewhat younger, more often male, and have higher income and education. They are about twice as likely to hold domestic stocks and several times as likely to hold crypto assets, and they report higher prior expected returns and slightly wider prior distributions for both assets. The pattern is the same in every country. The experimental sample therefore over-represents respondents who are willing to buy a 50/50 gamble at some price and who are already engaged with financial markets.

Table C.1: Observable Characteristics of Respondents by Response to Q29

	Pooled		Japan		United States		Germany		China	
	Exp. sample	Ex-cluded	Exp. sample	Ex-cluded	Exp. sample	Ex-cluded	Exp. sample	Ex-cluded	Exp. sample	Ex-cluded
Age category	4.16	4.85	4.37	4.86	3.89	4.71	4.05	5.06	4.12	4.72
Male	0.57	0.42	0.59	0.42	0.58	0.41	0.57	0.39	0.52	0.44
Income quintile	3.23	2.64	3.31	2.72	3.15	2.62	3.28	2.68	3.16	2.20
College or higher	0.48	0.30	0.52	0.34	0.42	0.29	0.32	0.18	0.57	0.26
Holds domestic stocks	0.34	0.15	0.34	0.16	0.31	0.16	0.29	0.14	0.42	0.12
Domestic-stock share (%)	9.9	4.8	10.3	4.9	10.1	6.2	7.5	3.8	10.9	2.7
Holds crypto assets	0.18	0.04	0.09	0.02	0.29	0.06	0.27	0.06	0.15	0.02
Crypto-asset share (%)	3.1	0.7	1.1	0.3	6.0	1.2	5.3	1.5	2.3	0.4
Prior mean, stock index (%)	5.0	2.0	3.9	1.6	4.7	2.7	4.5	1.7	7.1	4.1
Prior SD, stock index (%)	15.9	14.1	13.4	12.8	18.8	17.2	16.0	13.8	17.2	17.0
Prior mean, Bitcoin (%)	5.6	1.3	3.4	−0.2	5.9	2.7	7.8	3.8	6.8	3.5
Prior SD, Bitcoin (%)	15.6	13.1	13.0	11.4	18.1	16.1	16.0	13.3	17.2	16.8
Respondents	12,157	9,843	4,452	5,548	2,132	1,868	2,389	1,611	3,184	816

Notes: Cells report group means. “Exp. sample” denotes respondents who chose a price in Q29 (options 1–12) and received the information module; “Excluded” denotes respondents who answered “I wouldn’t buy it” (option 13). Age category is the bracket of Q2 (1 = 10–19 years, ..., 8 = 80 years or older). Income quintile is the within-country quintile of reported annual income and excludes respondents who did not report income. Holder indicators and portfolio shares are the pre-treatment variables of Part 1 (Q9, Q15, and Q17). Prior moments are computed from the histogram questions (Q13 and Q21) as described in Appendix B; the standard deviations are in percent, not logs. Respondents is the number in each group; rows affected by item nonresponse have fewer observations.