Online Appendix

"Higher-Order Beliefs and Risky Asset Holdings"

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I. Additional results

Table A.1: Summary Statistics Conditional on Both Waves

	Mean	SD	Mean	SD	Mean	SD	*p*-values	Mean	SD	*p*-values
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: All		Panel B: Control		Panel C: Treatment 1			Panel D: Treatment 2		
Age	38.77	11.48	38.68	10.95	39.65	11.90	0.11	37.99	11.54	0.25
Female	0.39	0.49	0.37	0.48	0.41	0.49	0.13	0.40	0.49	0.33
Wealth (K)	355.46	616.62	363.31	639.59	361.59	624.43	0.96	341.37	584.81	0.50
Income (K)	75.42	66.28	75.23	64.17	76.83	72.00	0.65	74.22	62.39	0.77
Return	3.84	18.68	4.27	16.78	4.08	19.89	0.85	3.17	19.28	0.26
Financial%	0.50	0.32	0.51	0.32	0.49	0.32	0.15	0.49	0.31	0.23
Stock %	0.26	0.28	0.26	0.27	0.27	0.30	0.48	0.26	0.29	0.71
ETF %	0.18	0.25	0.18	0.25	0.17	0.24	0.15	0.18	0.25	0.92
Derivative %	0.02	0.06	0.02	0.05	0.02	0.06	0.72	0.02	0.06	0.89
Bond %	0.36	0.32	0.36	0.32	0.37	0.33	0.61	0.36	0.33	0.85
Pension %	0.12	0.25	0.12	0.25	0.12	0.25	0.80	0.12	0.25	0.88
Risky_F%	0.46	0.32	0.46	0.32	0.45	0.32	0.75	0.46	0.32	0.76
Risky%	0.23	0.23	0.23	0.24	0.22	0.23	0.26	0.22	0.23	0.43
First order beliefs										
E[Return]	3.70	5.18	3.72	4.93	3.84	5.24	0.67	3.53	5.37	0.49
E[Δ S&P500]	3.41	5.25	3.43	4.98	3.54	5.53	0.69	3.25	5.25	0.51
SD[Return]	5.64	3.58	5.70	3.38	5.60	3.73	0.61	5.62	3.62	0.69
SD[Δ S&P500]	6.52	3.36	6.55	3.15	6.44	3.47	0.52	6.55	3.47	0.98
Higher order beliefs										
E[Δ S&P500]	3.77	5.32	3.71	5.09	4.00	5.60	0.29	3.59	5.25	0.69
SD[Δ S&P500]	6.48	3.54	6.48	3.34	6.39	3.58	0.62	6.58	3.7	0.59
N		2151		725			712			714

Note: This table reproduces Table 1 in the main text conditional on those who completed both waves of surveys.

Table A.2: Determinants of Strategic Concerns

	(1) Earnings Errors	(2) HOB Errors	(3) Mom Tendency	(4) Strategic Responses
Level-K	0.00	-0.02**	-0.02***	-0.02***
	(0.01)	(0.01)	(0.01)	(0.00)
Past Return	-0.07	0.11	0.17**	0.09**
	(0.06)	(0.08)	(0.07)	(0.05)
Years of Trading	-0.00	-0.01	-0.02***	-0.03***
	(0.00)	(0.01)	(0.00)	(0.00)
# Trades	0.01***	0.01*	0.04***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Young	-0.05*	-0.11***	-0.01	0.01
	(0.03)	(0.04)	(0.03)	(0.02)
Female	-0.02	-0.01	0.15***	0.03
	(0.02)	(0.03)	(0.02)	(0.02)
Full Time	-0.01	-0.11***	0.03	-0.02
	(0.03)	(0.04)	(0.03)	(0.02)
College	0.02	-0.04	0.06**	0.07***
	(0.03)	(0.04)	(0.03)	(0.02)
log Wealth	-0.02***	-0.02*	-0.02***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Log Income	0.04***	-0.00	0.02*	0.00
	(0.01)	(0.02)	(0.01)	(0.01)
React Faster	0.07***	0.16***	0.04*	-0.00
	(0.02)	(0.03)	(0.02)	(0.02)
Intercept	1.52***	1.46***	0.42***	0.55***
	(0.13)	(0.17)	(0.13)	(0.09)
N	3258	3365	3188	3104
R^2	0.01	0.02	0.06	0.06

Note: This table examines the determinants of investors' strategic concerns. Earnings Errors and HOB Errors are defined as the absolute differences between investors' priors and the corresponding true values. Momentum tendency is measured as the ratio of the planned change in risky asset holdings to a hypothetical $x\%$ increase in stock market returns over the past three months. Strategic response is defined as the absolute difference between (i) the planned change in risky asset holdings in response to a hypothetical $x\%$ increase in the S&P 500 and (ii) the planned change under the same scenario when other investors are assumed not to react. Suppose answer to the guess 2/3 question is g_0, then level-k is $log\ (g_0/50)/log\ (2/3)$, and corresponds to the level that the participants respond. Regressions are based on Huber robust regressions. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A.3: The Effects of Information Treatments on Beliefs with Controls

	E[Port]	E[Port]	FOB	FOB	HOB	HOB
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Expectations			
T1	-1.02***	-0.39*	-1.09***	-0.27	-1.19***	-0.33
	(0.18)	(0.22)	(0.15)	(0.19)	(0.19)	(0.24)
T2	-0.35*	0.16	-0.15	0.38**	-1.30***	0.03
	(0.18)	(0.22)	(0.15)	(0.19)	(0.18)	(0.23)
Prior		0.56***		0.54***		0.59***
		(0.03)		(0.03)		(0.03)
T1 x Prior		-0.20***		-0.24***		-0.24***
		(0.04)		(0.04)		(0.04)
T2 x Prior		-0.16***		-0.14***		-0.35***
		(0.04)		(0.04)		(0.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	3183	3170	3166	3171	3165	3174
R^2	0.13	0.29	0.10	0.30	0.03	0.20
			Panel B: Uncertainty			
T1	-1.90***	-1.57***	-2.25***	-2.24***	-2.52***	-1.86***
	(0.19)	(0.32)	(0.17)	(0.37)	(0.20)	(0.39)
T2	-1.93***	-1.37***	-2.26***	-1.84***	-2.70***	-1.62***
	(0.19)	(0.32)	(0.17)	(0.36)	(0.20)	(0.38)
Prior		0.53***		0.39***		0.55***
		(0.04)		(0.04)		(0.04)
T1 x Prior		-0.05		0.01		-0.10*
		(0.05)		(0.05)		(0.06)
T2 x Prior		-0.08		-0.05		-0.17***
		(0.05)		(0.05)		(0.05)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	3249	3225	3279	3269	3289	3268
R^2	0.07	0.19	0.08	0.15	0.08	0.18

Note: This table reproduces Table 4 while adding pre-experiment controls.

Table A.4: The Effects of Information Treatments on Beliefs after 3 Months

	E[Port]	E[Port]	FOB	FOB	HOB	HOB
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Expectations			
T1	0.12	-0.09	0.15	0.17	-0.08	-0.25
	(0.19)	(0.22)	(0.18)	(0.20)	(0.20)	(0.23)
T2	0.06	-0.09	0.21	0.31	-0.09	-0.10
	(0.19)	(0.21)	(0.18)	(0.20)	(0.20)	(0.23)
Prior		0.31***		0.36***		0.26***
		(0.03)		(0.03)		(0.03)
T1 x Prior		0.05		-0.05		0.02
		(0.04)		(0.04)		(0.04)
T2 x Prior		0.06		-0.04		0.01
		(0.04)		(0.04)		(0.04)
Controls	No	No	No	No	No	No
N	2137	2136	2151	2138	2151	2151
R^2	0.00	0.19	0.00	0.17	0.00	0.11
			Panel B: Uncertainty			
T1	-0.36**	-0.08	-0.02	-0.05	-0.12	0.25
	(0.16)	(0.23)	(0.15)	(0.27)	(0.15)	(0.28)
T2	-0.29*	0.20	-0.16	0.06	-0.33**	0.43
	(0.16)	(0.24)	(0.15)	(0.28)	(0.15)	(0.27)
Prior		0.61***		0.56***		0.57***
		(0.03)		(0.03)		(0.03)
T1 x Prior		-0.05		0.02		-0.06
		(0.04)		(0.04)		(0.04)
T2 x Prior		-0.09**		-0.02		-0.12***
		(0.04)		(0.04)		(0.04)
Controls	No	No	No	No	No	No
N	2151	2148	2151	2148	2151	2151
R^2	0.00	0.37	0.00	0.37	0.00	0.32

Note: This table reproduces Table 4 with left-hand side variables replaced with those from the second wave of surveys.

Table A.5: Beliefs and Asset Holding – OLS

	Risky%	Risky_F%	$Risky_{w.pen}$%	$Risky_{no.der}$%
	(1)	(2)	(3)	(4)
FOB	-0.10	-0.13	-0.07	-0.09
	(0.13)	(0.20)	(0.13)	(0.13)
HOB	0.15	0.30*	0.14	0.16
	(0.10)	(0.16)	(0.11)	(0.10)
Controls	Yes	Yes	Yes	Yes
N	1,989	1,990	1,989	1,989

Note: The table reports the OLS estimates for equation (12b). Risky_F% is the share of financial assets invested in single stocks, ETF and index funds, and financial derivatives. Risky% is the product of Risky_F% and the share of financial assets. $Risky_{no.der}$% is Risky% excluding financial derivatives. $Risky_{w.pen}$% is Risky% including equity allocated through pension. All dependent variables are from the second wave. Controls are all pre-experiment and include prior expectations, pre-experiment risky asset allocations, sex, age, indicator for full-time employees, indicator for having at least college degree, ethnic group fixed effects, implied prior return volatilities, reaction speeds, log income, and portfolio returns. Outliers and influential observations are identified and removed according to the procedure described in Coibion et al. (2023). FOB and HOB are winsorized at 1% and 99% levels. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A.6: The Effects of Beliefs on Asset Holding within Financial Assets

	Stock	ETF	Der	Bonds	Pension
	(1)	(2)	(3)	(4)	(5)
FOB	0.60	0.74	0.20	-2.48**	-0.49
	(0.58)	(0.58)	(0.14)	(1.23)	(0.72)
HOB	-0.27	-1.17***	-0.03	2.10**	0.63
	(0.40)	(0.45)	(0.09)	(0.95)	(0.61)
Controls	Yes	Yes	Yes	Yes	Yes
N	1990	1990	1989	1990	1990
	First-stage *F*-stats				
FOB	18.54	18.54	18.54	18.54	18.54
HOB	17.41	17.41	17.41	17.41	17.41
KP Wald rK	11.02	11.02	11.02	11.02	11.02

Note: Stock%, ETF%, Der%, Bonds%, and Pension% are respectively the share of financial wealth invested in single companies, ETF and other index funds, financial derivatives, bonds, and pension. Controls are all pre-experiment and include prior expectations, risky asset share, sex, age, indicator for full-time employees, indicator for having at least college degree, ethnic group fixed effects, implied prior return volatilities, reaction speeds, log income, and portfolio returns. Outliers and influential observations are identified and removed according to the procedure described in Coibion et al. (2023). FOB and HOB are winsorized at 1% and 99% level. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A.7: Average Effects of Treatments on Asset Holdings

	Risk%	Risk%	Risky_F%	Risky_F%
	(1)	(2)	(3)	(4)
T1	-1.33	0.29	-1.26	0.35
	(0.85)	(0.56)	(0.79)	(0.54)
T2	0.63	1.01*	0.58	1.04*
	(0.86)	(0.56)	(0.79)	(0.54)
Controls	No	Yes	No	Yes
N	2151	2081	2151	2151

Note: Risky_F% is the share of financial assets invested in single stocks, ETF and index funds, and financial derivatives. Risky% is the product of Risky_F% and the share of financial assets. Controls are all pre-experiment and include prior expectations, pre-experiment risky asset allocations, sex, age, indicator for full-time employees, indicator for having at least college degree, ethnic group fixed effects, implied prior return volatilities, reaction speeds, log income, and portfolio returns. Regressions are based on Huber robust regressions. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Robert Shiller Investor Confidence Surveys Questions

C. (4) How much of a change in percentage terms do you expect [for the Dow Jones index] in the following 1 month? 3 months? 6 months? 1 year? 10 years?

D. (5) Although I expect a substantial drop in stock prices in the U.S. ultimately, I advise being relatively heavily invested in stocks for the time being because I think that prices are likely to rise for a while

1. True. Your best guess for date of peak
2. False.
3. No opinion.

E. (6) Although I expect a substantial rise in stock prices in the U.S. ultimately, I advise being less invested in stocks for the time being because I think that prices are likely to drop for a while

1. True. Your best guess for date of bottom
2. False.
3. No opinion.

F. (11) Many people are showing a great deal of excitement and optimism about the prospects for the stock market in the United States, and I must be careful not to be influenced by them

1. True. 2. False. 3. No opinion

G. (12) Many people are showing a great deal of pessimism about the prospects for the stock market in the United States, and I must be careful not to be influenced by them

1. True. 2. False. 3. No opinion

K. (16) Are you inclined now to buy stocks overall, or sell stock overall, or hold steady and why?

1. Buy. 2. Sell. 3. Hold

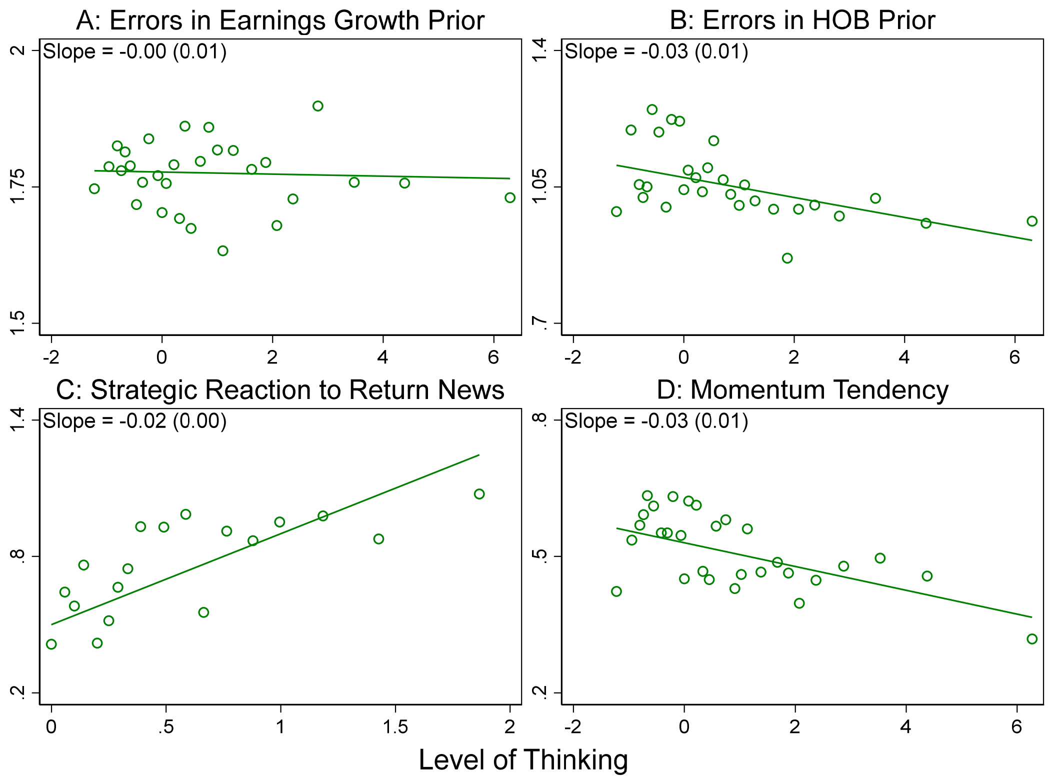
Why:

Table A.8: Higher-Order Beliefs and Buy-Hold Decisions – ICF Data

	Buy-Sell			
	(1)	(2)	(3)	(4)
FOB-1M	1.475***			
	(0.210)			
FOB-3M		2.105***		
		(0.139)		
FOB-6M			2.034***	
			(0.104)	
FOB-12M				1.872***
				(0.072)
HOB	-0.076***	-0.071***	-0.065***	-0.058***
	(0.006)	(0.006)	(0.006)	(0.005)
Date FE	Yes	Yes	Yes	Yes
R^2	0.04	0.06	0.09	0.12
N	6242	6343	6504	6834
	Buy-Sell-Speculative			
	(5)	(6)	(7)	(8)
FOB-1M	9.385***			
	(0.557)			
FOB-3M		8.688***		
		(0.343)		
FOB-6M			5.984***	
			(0.260)	
FOB-12M				3.729***
				(0.184)
HOB	-0.071***	-0.046***	-0.042***	-0.043***
	(0.015)	(0.015)	(0.015)	(0.015)
Date FE	Yes	Yes	Yes	Yes
R^2	0.05	0.10	0.08	0.07
N	6293	6392	6549	6877

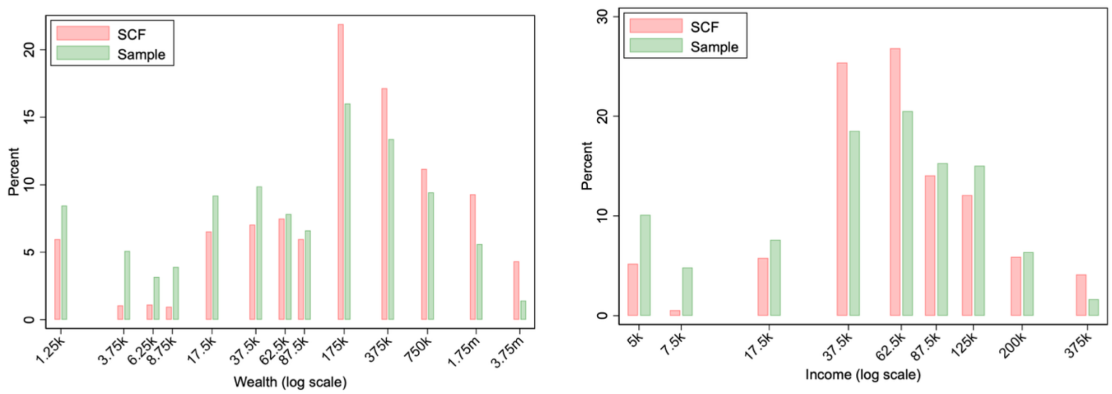
Note: This table shows results of buy-sell preferences on higher-order beliefs using Robert Shiller Investor Confidence surveys. The questions are shown above and data is from Schmidt-Engelbertz and Vasudevan (2023). Buy-Sell is the answer to K. (16). Buy-Sell-Speculative is the difference between the answers to questions D. (5) and E. (6). HOB is the difference between the answers to questions F. (11) and G. (12). Following Engelbertz and Vasudevan (2023), we encode all answers of True/Buy with 1, False/Sell with -1, and No opinion/Hold with 0. FOB-1M to FOB-12M are respectively the answers to questions C. (4). The FOB variables, which are continuous, are winsorized at 1%-99% levels. All columns include survey-filling date fixed effects. Results are based on Huber robust regressions. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Figure A.1: Level-of Thinking and Strategic Concerns



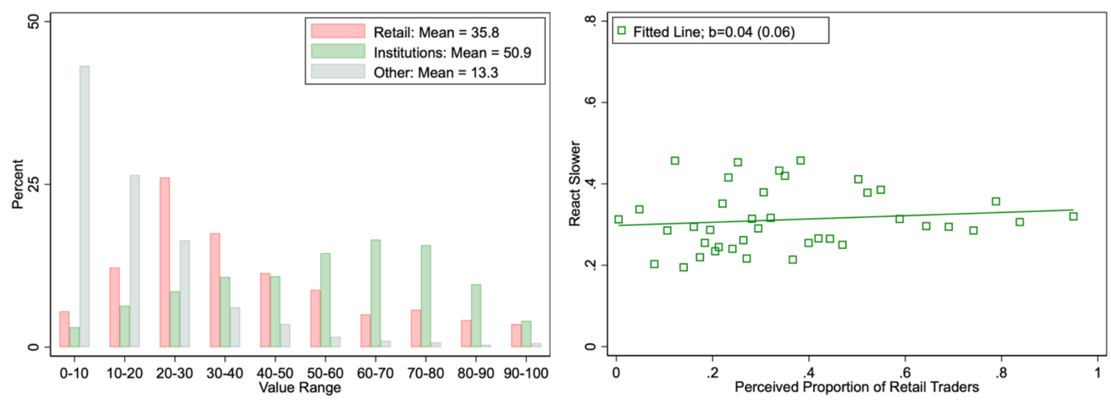
Note: This figure examines the relationship between investors' level of thinking and several measures of investor strategic concern. The y variables for Panel A and B are the absolute differences between investors' priors and the corresponding true values, respectively. The y variable for Panel C is defined as the absolute difference between (i) the planned change in risky asset holdings in response to a hypothetical x% increase in the S&P 500 and (ii) the planned change under the same scenario when other investors are assumed not to react. The y variable for Panel D is measured as the ratio of the planned change in risky asset holdings to a hypothetical x% increase in stock market returns over the past three months. The x variables are the level of thinking. In particular, suppose answers to the guess 2/3 question is g_0, then Level-K is $log(g_0/50)/log(2/3)$, and corresponds to the level that the participants respond.

Figure A.2: Distribution Comparison of Income and Wealth with SCF



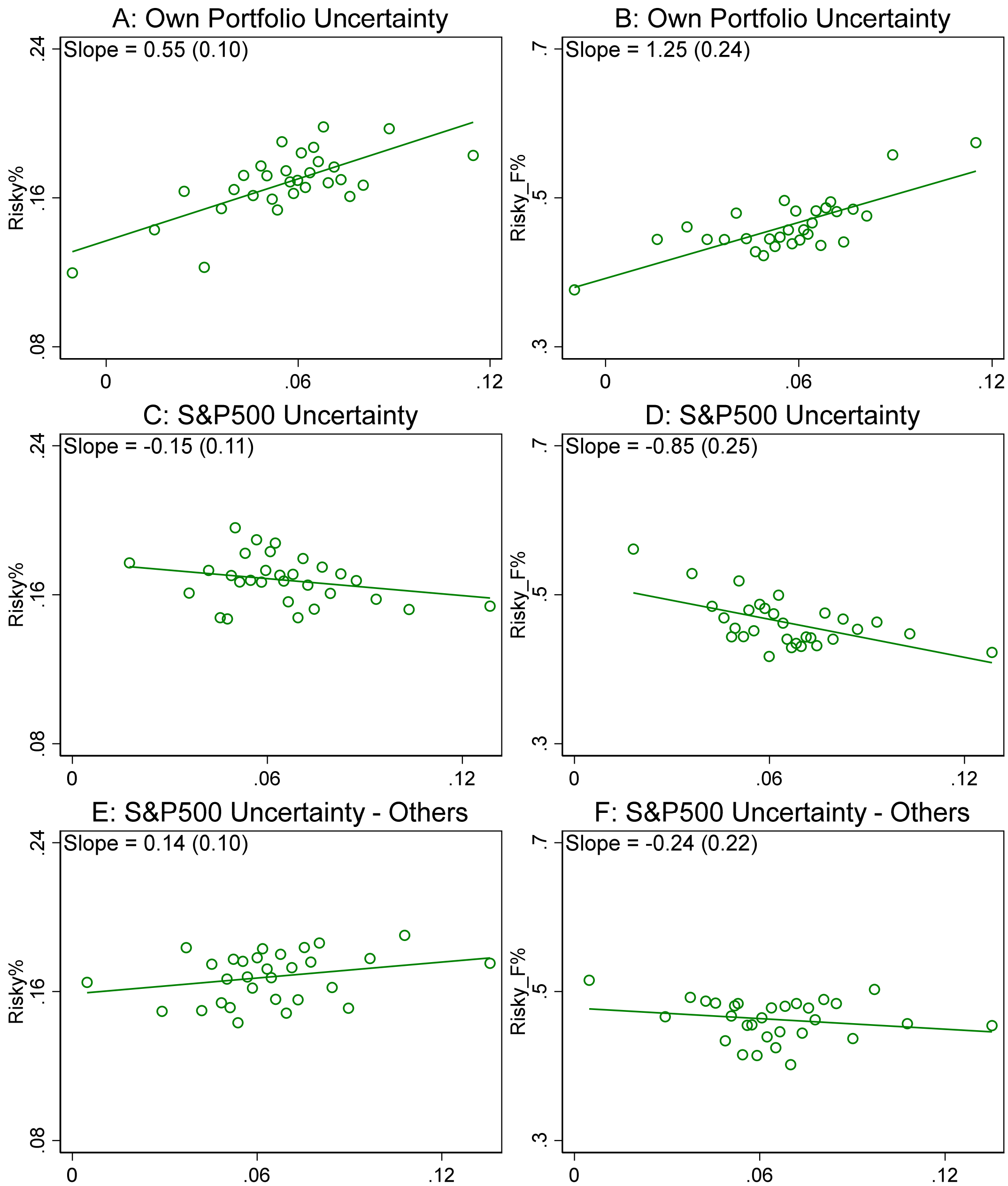
Note: This figure compares the distribution of wealth and income in 2022 Survey of Consumer Finance and the main sample. Wealth is total assets minus debt. Income is wage income. Both income and wealth are household level divided by two if married, and one otherwise. We drop those with wealth above 5 million dollars to comply with our sample.

Figure A.3: Subjective Composition of Other Investors



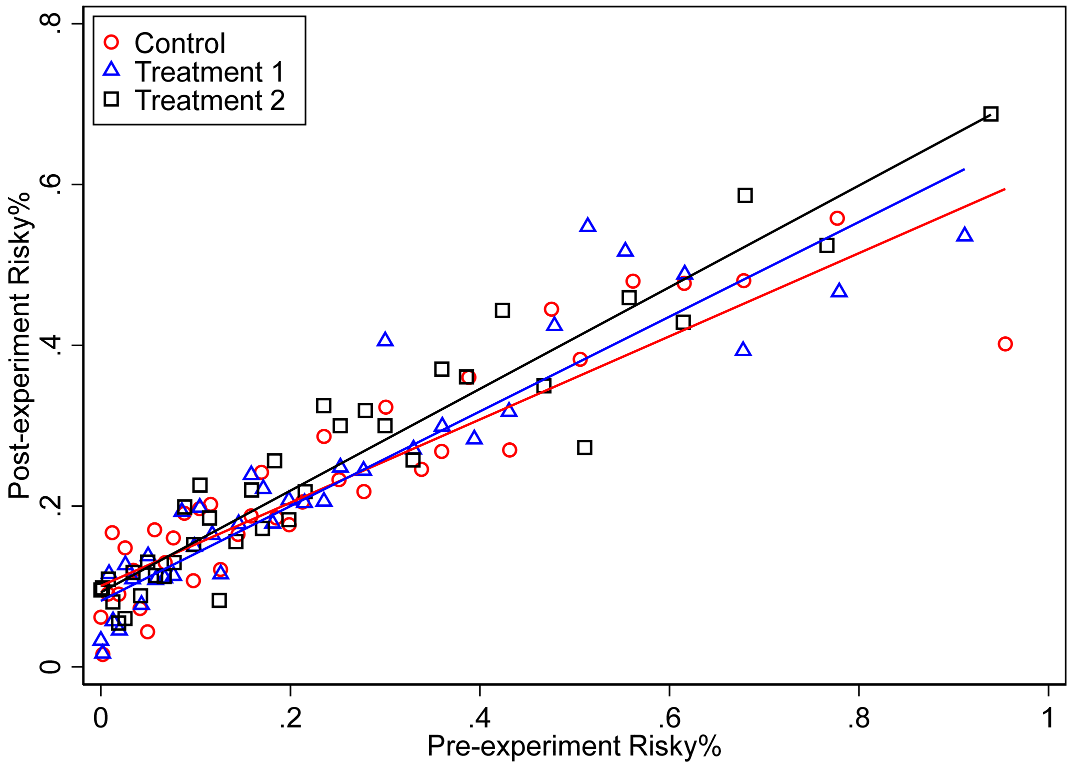
Note: The left panel presents histograms of participants' perceived composition of other investors, distinguishing between retail traders, institutional traders, and investors who are neither retail nor institutional. The right panel shows a binned scatter plot of whether participants believe they react more slowly to significant news, plotted against the perceived share of retail traders among other investors. Controls are all pre-experiment and include prior expectations, pre-experiment risky asset allocations, sex, age, indicator for full-time employees, indicator for having at least college degree, ethnic group fixed effects, implied prior return volatilities, reaction speeds, log income, portfolio returns, and the other two subjective uncertainties. Fitted lines are estimated using Huber-robust regressions.

Figure A.4: Subjective Uncertainty and Portfolio Choices



Note: This figure gives the binned scatter plots of risky asset share on subjective uncertainty. The y variables in the left column and the right column are risky asset holding to total asset and risky asset holding to total financial asset, respectively. The x variables in Panel A and Panel B are subjective uncertainty about own portfolio, that in Panel C and Panel D are subjective uncertainty about S&P 500 return, and that in Panel E and Panel F are subjective uncertainty about other investor's belief about S&P 500 return. Controls are all pre-experiment and include prior expectations, pre-experiment risky asset allocations, sex, age, indicator for full-time employees, indicator for having at least college degree, ethnic group fixed effects, implied prior return volatilities, reaction speeds, log income, portfolio returns, and the other two subjective uncertainties.

Figure A.5: Post-experiment and Pre-experiment Risky Asset Holdings



Note: Risky% is the product of share of financial assets invested in single stocks, ETF and index funds, and financial derivatives and the share of financial assets.

II. Proofs

a. Proof of Lemma 1 and Lemma 2

We will guess and verify that

$$\bar{E}[\tilde{r}_2|s_i, s_{im}] = \kappa_D \tilde{r}_2 + \lambda\theta. \tag{A1}$$

where $\theta \sim N(0, \sigma_\theta^2)$ is the noise-trader belief (and the associated net supply shock), and (κ_D, λ) are constants pinned down in equilibrium. Intuitively, with noise traders holding belief θ, the cross-sectional average belief loads on θ in addition to the fundamental $\tilde{r}_2$.

Rational investor i receives a signal about the cross-sectional average belief. We assume

$$s_{im} = \bar{E}[\tilde{r}_2|s_i, s_{im}] + \eta_i = \kappa_D \tilde{r}_2 + \lambda\theta + \eta_i,$$

where $\eta_i \sim N(0, \sigma_\eta^2)$ is an idiosyncratic shock independent across i and independent of $(\tilde{r}_2, \theta)$. To simplify notation, we normalize the variance of $\tilde{r}_2$ to $\sigma_0^2 = 1$ and define $\tau \in (0,1)$ such that $\sigma_v^2 = \frac{\tau}{1-\tau}\sigma_0^2 = \frac{\tau}{1-\tau}$. These assumptions imply $var(s_i) \equiv \sigma_{s_i}^2 = \frac{1}{1-\tau}$ and $var(s_{im}) \equiv \sigma_{s_{im}}^2 = \kappa_D^2 + \lambda^2\sigma_\theta^2 + \sigma_\eta^2 > \kappa_D^2$.

The covariance structure of the random variables is

$$\begin{bmatrix} \tilde{r}_2 \\ s_i \\ s_{im} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & 1 & \kappa_D \\ 1 & \dfrac{1}{1-\tau} & \kappa_D \\ \kappa_D & \kappa_D & \sigma_{s_{im}}^2 \end{bmatrix} \right),$$

Conditional expectation of p_2 of rational trader i given the two signals is

$$E_i[\tilde{r}_2] \equiv E[\tilde{r}_2|s_i, s_{im}] = [1 \quad \kappa_D] \begin{bmatrix} \dfrac{1}{1-\tau} & \kappa_D \\ \kappa_D & \sigma_{s_{im}}^2 \end{bmatrix}^{-1} \begin{bmatrix} s_i \\ s_{im} \end{bmatrix} = \kappa_s s_i + \kappa_{sm} s_{im}.$$

Let $\Delta = \sigma_{s_{im}}^2/(1-\tau) - \kappa_D^2 > 0$. Then we have $\kappa_s = \frac{\sigma_{s_{im}}^2 - \kappa_D^2}{\Delta} = (1-\tau)\frac{\lambda^2\sigma_\theta^2 + \sigma_\eta^2}{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2}$, $\kappa_{sm} = \frac{\tilde{\kappa}}{\kappa_D}$, $\tilde{\kappa} \equiv \frac{\tau}{(1-\tau)\Delta}$. This proves Lemma 2.

Averaging $E_i[\tilde{r}_2]$ across R gives

$$\bar{E}_R[\tilde{r}_2|s_i, s_{im}] = \kappa_s \tilde{r}_2 + \kappa_{sm}\kappa_D \tilde{r}_2 = (\kappa_s + \tilde{\kappa})\tilde{r}_2 + \kappa_{sm}\lambda\theta.$$

The cross-sectional average belief across all investors is

$$\bar{E}[\tilde{r}_2|s_i, s_{im}] = (1-\alpha)(\kappa_s + \tilde{\kappa})\tilde{r}_2 + (\alpha + (1-\alpha)\kappa_{sm}\lambda)\theta. \tag{A2}$$

Matching coefficients between (A1) and (A2) gives

$$\kappa_D = \frac{(1-\alpha)\kappa_s}{1-(1-\alpha)\kappa_{sm}}, \qquad \lambda = \frac{\alpha}{1-(1-\alpha)\kappa_{sm}}$$

We can also calculate the subjective variance of D given s_i and s_{im}, which is

$$var(\tilde{r}_2|s_i, s_{im}) = 1 - [1 \quad \kappa_D] \begin{bmatrix} \frac{1}{1-\tau} & \kappa_D \\ \kappa_D & \sigma_{s_{im}}^2 \end{bmatrix}^{-1} \begin{bmatrix} 1 \\ \kappa_D \end{bmatrix} = 1 - (\kappa_s + \tilde{\kappa}).$$

Note that $\kappa_D = (1-\alpha)(\kappa_s + \tilde{\kappa}) < \kappa_s + \tilde{\kappa}$. Given $1 > var(\tilde{r}_2|s_i, s_{im}) > 0$, $\kappa_D \in (0,1)$.

Meanwhile, note that matching coefficients between (A1) and (A2) gives $\kappa_D = (1-\alpha)(\kappa_s + \kappa_{sm}\kappa_D)$. Rearranging gives $1 - (1-\alpha)\kappa_{sm} = (1-\alpha)\kappa_s/\kappa_D > 0$. Therefore, $\lambda = \frac{\alpha\kappa_D}{(1-\alpha)\kappa_s} > 0$, which proves Lemma 1.

b. Proof of Lemma 3

Combining rational investor i's optimality condition at t_1 (equation (4)) and market clearing gives

$$\tilde{r}_1 = \bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_1] + D\theta, \tag{A3}$$

where $D \equiv \frac{\alpha\gamma\hat{\sigma}^2}{1-\alpha}$. By joint normality, the posterior mean after observing price is linear in the price innovation

$$E_i[\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_1] = E_i[\tilde{r}_2 \mid s_i, s_{im}] + \beta_P(\tilde{r}_1 - E_i[\tilde{r}_1 \mid s_i, s_{im}]), \tag{A4}$$

where

$$\beta_P \equiv \frac{\text{Cov}(\tilde{r}_2, \tilde{r}_1 \mid s_i, s_{im})}{\text{Var}(\tilde{r}_1 \mid s_i, s_{im})}$$

Averaging (A4) across rational investors yields

$$\bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_1] = \bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] + \beta_P(\tilde{r}_1 - \bar{E}_R[\tilde{r}_1 \mid s_i, s_{im}]). \tag{A5}$$

Substitute (A5) into (A3) to get:

$$\tilde{r}_1 = \bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] + \beta_P(\tilde{r}_1 - \bar{E}_R[\tilde{r}_1 \mid s_i, s_{im}]) + D\,\theta \tag{A6}$$

Conjecture that equilibrium price is linear in the underlying shocks:

$$\tilde{r}_1 = B\,\tilde{r}_2 + C\,\theta. \tag{A7}$$

Then, conditioning on (s_i, s_{im}) and averaging across rational investors,

$$\bar{E}_R[\tilde{r}_1 \mid s_i, s_{im}] = B\,\bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] + C\,\bar{E}_R[\theta \mid s_i, s_{im}] \tag{A8}$$

From Lemma 2, $\bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] = \kappa_s\,\tilde{r}_2 + \kappa_{sm}\,\bar{E}$. Lemma 1 gives $\bar{E} = \kappa_D\tilde{r}_2 + \lambda\theta$. Therefore,

$$\bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] = (\kappa_s + \kappa_{sm}\kappa_D)\,\tilde{r}_2 + (\kappa_{sm}\lambda)\,\theta. \tag{A9}$$

Define $\kappa_R \equiv \kappa_s + \kappa_{sm}\kappa_D$ and $\lambda_R \equiv \kappa_{sm}\lambda$. From the Lemma 2 Bayesian updating structure and positivity of posterior variance, $\kappa_R \in (0,1)$ and $\lambda_R > 0$.

Because $\tilde{r}_2$, θ, s_i, and s_{im} are jointly Gaussian, the conditional expectation of noise-trader demand is linear: $E_R[\theta \mid s_i, s_{im}] = a_s s_i + a_m s_{im}$, where $[a_s \quad a_m] = \text{Cov}\big(\theta, (s_i, s_{im})\big)\text{Var}\big((s_i, s_{im})\big)^{-1}$. Using $s_i = \tilde{r}_2 + \nu_i, s_{im} = \kappa_D\tilde{r}_2 + \lambda\theta + \eta_i$ with $\text{Var}(\tilde{r}_2) = 1$, $\text{Var}(\nu_i) = \tau/(1-\tau)$, $\text{Var}(\theta) = \sigma_\theta^2$, and $\text{Var}(\eta_i) = \sigma_\eta^2$, we have $\text{Cov}(\theta, (s_i, s_{im})) = [0 \quad \lambda\sigma_\theta^2]$, and

$$\mathrm{Var}((s_i, s_{im})) = \begin{bmatrix} \dfrac{1}{1-\tau} & \kappa_D \\ \kappa_D & \sigma_{s_{im}}^2 \end{bmatrix}$$

where $\sigma_{s_{im}}^2 = \kappa_D^2 + \lambda^2\sigma_\theta^2 + \sigma_\eta^2$. Let

$$\Delta \equiv \frac{\sigma_{s_{im}}^2}{1-\tau} - \kappa_D^2 = \frac{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2}{1-\tau} > 0.$$

Then

$$\mathrm{Var}((s_i, s_{im}))^{-1} = \frac{1}{\Delta}\begin{bmatrix} \sigma_{s_{im}}^2 & -\kappa_D \\ -\kappa_D & \dfrac{1}{1-\tau} \end{bmatrix},$$

so

$$a_s = -\frac{\lambda\kappa_D\sigma_\theta^2}{\Delta} = -\frac{(1-\tau)\lambda\kappa_D\sigma_\theta^2}{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2},$$

$$a_m = \frac{\lambda\sigma_\theta^2}{(1-\tau)\Delta} = \frac{\lambda\sigma_\theta^2}{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2}.$$

Hence $a_s < 0$ and $a_m > 0$. Substituting the signal expressions into $a_s s_i + a_m s_{im}$gives

$$\bar{E}_R[\theta \mid s_i, s_{im}] = (a_s + \kappa_D a_m)\tilde{r}_2 + (\lambda a_m)\theta + a_s\nu_i + a_m\eta_i.$$

Averaging across rational investors eliminates the idiosyncratic terms, so

$$\bar{E}_R[\,\theta \mid s_i, s_{im}\,] = A\tilde{r}_2 + G\theta, \tag{A10}$$

where

$$A = a_s + \kappa_D a_m = \frac{\tau\lambda\kappa_D\sigma_\theta^2}{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2} > 0,$$

$$G = \lambda a_m = \frac{\lambda^2\sigma_\theta^2}{\lambda^2\sigma_\theta^2 + \sigma_\eta^2 + \tau\kappa_D^2} \in (0,1).$$

Plug (A9) and (A10) into (A8):

$$\bar{E}_R[\,\tilde{r}_1 \mid s_i, s_{im}\,] = B(\kappa_R\tilde{r}_2 + \lambda_R\theta) + C(A\tilde{r}_2 + G\theta) = (B\kappa_R + CA)\tilde{r}_2 + (B\lambda_R + CG)\theta \tag{A11}$$

Now substitute (A9), (A11), and (A7) into equation (A6), the left-hand side is $\tilde{r}_1 = B\tilde{r}_2 + C\theta$, and the right-hand side becomes $\bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] + \beta_P(\tilde{r}_1 - \bar{E}_R[\tilde{r}_1 \mid s_i, s_{im}]) + D\theta = (\kappa_R\tilde{r}_2 + \lambda_R\theta) + \beta_P((B\tilde{r}_2 + C\theta) - ((B\kappa_R + CA)\tilde{r}_2 + (B\lambda_R + CG)\theta)) + D\theta$. Collecting and matching coefficients yields

$$B = \frac{\kappa_R - \beta_P AC}{1 - \beta_P(1-\kappa_R)}, C = \frac{\lambda_R(1-\beta_P B) + D}{1 - \beta_P(1-G)}. \tag{A12}$$

This proves the existence of a linear equilibrium rule of the form $\tilde{r}_1 = B\tilde{r}_2 + C\theta$. The conjecture is self-confirming because all conditional expectations used above are linear under joint normality and a linear price rule.

Focusing on the stable linear equilibrium in which aggregate rational demand slopes downward in price. Under (A4), investor i's posterior mean is affine in price with slope

$\partial E_i[\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_1]/\partial \tilde{r}_1 = \beta_P$. Therefore, $\frac{\partial x_i}{\partial \tilde{r}_1} = \frac{1}{\gamma \hat{\sigma}^2}(\beta_P - 1)$. Thus the stability-demand condition is $\beta_P < 1$. In addition, if $\beta_P < 0$, then from equation (A12) $B > 0$ and price is a positive signal of payoffs, which leads to a negative β_P. Thus $\beta_P \in (0,1)$.

Let aggregate rational demand be $X_R(\tilde{r}_1) := \int_R x_i \, di$. Under $\beta_P < 1$, $X_R'(\tilde{r}_1) < 0$. Market clearing is $X_R(\tilde{r}_1) + \theta = 0$. By the implicit function theorem, $\frac{d\tilde{r}_1}{d\theta} = -\frac{1}{X_R'(\tilde{r}_1)} > 0$. Under the linear price rule (A7), holding $\tilde{r}_2$ fixed, $d\tilde{r}_1/d\theta = C$. Hence $C > 0$.

Note that $\beta_P > 0$ implies $B > 0$. From (A12), $B = \frac{\kappa_R - \beta_P AC}{1 - \beta_P(1-\kappa_R)}$. Since $A > 0$, $C > 0$, and $\beta_P > 0$, we have $\kappa_R - \beta_P AC < \kappa_R$, hence $B < \frac{\kappa_R}{1-\beta_P(1-\kappa_R)}$. But $1 - \beta_P(1-\kappa_R) = \kappa_R + (1-\beta_P)(1-\kappa_R) > \kappa_R$ because $\kappa_R \in (0,1)$ and $\beta_P \in (0,1)$. Therefore $\kappa_R/(1-\beta_P(1-\kappa_R)) < 1$, implying $B < 1$.

c. Proof of Proposition 1

Combing the optimal holdings at t_1 and belief updating gives

$$x_i = \frac{1}{\gamma \hat{\sigma}^2}\left(E_i[\tilde{r}_2 \mid s_i, s_{im}] - \beta_P \, E_i[\tilde{r}_1 \mid s_i, s_{im}] - (1-\beta_P)\tilde{r}_1\right)$$

Note that $E_i[\tilde{r}_1 \mid s_i, s_{im}] = B\, E_i[\tilde{r}_2 \mid s_i, s_{im}] + C\, E_i[\theta \mid s_i, s_{im}]$. By Lemma 1, $\bar{E}[\tilde{r}_1 \mid s_i, s_{im}] = \kappa_D \tilde{r}_2 + \lambda\theta$. Taking conditional expectations yields

$$E_i[\bar{E} \mid s_i, s_{im}] = \kappa_D \, E_i[\tilde{r}_2 \mid s_i, s_{im}] + \lambda \, E_i[\theta \mid s_i, s_{im}]$$

Hence, $E_i[\theta \mid s_i, s_{im}] = \frac{E_i[\bar{E} \mid s_i, s_{im}] - \kappa_D E_i[\tilde{r}_2 \mid s_i, s_{im}]}{\lambda}$. This gives

$$E_i[\tilde{r}_1 \mid s_i, s_{im}] = \left(B - \frac{C\kappa_D}{\lambda}\right) E_i[\tilde{r}_2 \mid s_i, s_{im}] + \frac{C}{\lambda} E_i[\bar{E} \mid s_i, s_{im}].$$

Substitute back to the optimal condition,

$$x_i = \frac{1}{\gamma \hat{\sigma}^2}\left[E_i[\tilde{r}_2 \mid s_i, s_{im}] - \beta_P\left(\left(B - \frac{C\kappa_D}{\lambda}\right) E_i[\tilde{r}_2 \mid s_i, s_{im}] + \frac{C}{\lambda} E_i[\bar{E} \mid s_i, s_{im}]\right) - (1-\beta_P)\tilde{r}_1\right].$$

Collect terms:

$$x_i = -\frac{1-\beta_P}{\gamma \hat{\sigma}^2}\tilde{r}_1 + \frac{1 - \beta_P\left(B - \frac{C\kappa_D}{\lambda}\right)}{\gamma \hat{\sigma}^2} E_i[\tilde{r}_2 \mid s_i, s_{im}] - \frac{\beta_P}{\gamma \hat{\sigma}^2}\frac{C}{\lambda} E_i[\bar{E} \mid s_i, s_{im}].$$

Thus, $x_i = \omega_0 + \omega_F F_i + \omega_H H_i$, with

$$\omega_0 = -\frac{1-\beta_P}{\gamma \hat{\sigma}^2}\tilde{r}_1, \qquad \omega_F = \frac{1 - \beta_P\left(B - \frac{C\kappa_D}{\lambda}\right)}{\gamma \hat{\sigma}^2}, \qquad \omega_H = -\frac{\beta_P}{\gamma \hat{\sigma}^2}\frac{C}{\lambda}.$$

Finally, Lemma 3 gives $\beta_P \in (0,1)$, $0 < B < 1$, and $C > 0$, while Lemma 1 gives $\kappa_D \in (0,1)$ and $\lambda > 0$. Therefore $\omega_H < 0$ and $\omega_F > 0$.

d. Extension with Faster Traders

We now extend the model to include an additional type of investors who can trade faster. Specifically, within the rational traders, a fraction of μ is "fast speculators" ($\mathcal{F}$) and the rest is "slow fundamental" traders ($\mathcal{S}$). While the behavior of $\mathcal{S}$ is the same as in the benchmark, $\mathcal{F}$ react faster to news than $\mathcal{S}$, and intend to take advantage of $\mathcal{S}$'s slow reaction speed. We also assume that, as in Eyster et al. (2019), $\mathcal{F}$ ignore the information contained in the trading price. This is similar to the assumption that $\mathcal{F}$ believe they are the only investors who can react faster and execute trades at the price they trade at, similar to the noise traders.[1] Besides, we assume that only a random $1-\phi$ of $\mathcal{F}$ can rewind their asset. Otherwise $\mathcal{F}$ will always hold zero assets over t_1.

To characterize the heterogeneity in reaction speed, we further split t_1 into two sub-periods, $t_{1,1}$ and $t_{1,2}$. At the beginning of $t_{1,1}$. The timeline of t_1 can be summarized as follows:

1. At the beginning of $t_{1,1}$, $\mathcal{F}$ receives two signals: one about p_2, the other about everyone else's average belief about p_2. Based on these 2 signals, $\mathcal{F}$ forms a posterior view about p_2.
2. In $t_{1,1}$, $\mathcal{F}$ speculates on the log equilibrium price $p_{1,2}$ at $t_{1,2}$ given subjective beliefs, and chooses the level of holding by maximizing utility over total wealth in $t_{1,2}$. In contrast, $\mathcal{S}$ holds zero dollars of the asset. The equilibrium price $P_{1,1}$ is realized.
3. In $t_{1,2}$, a random $1-\phi$ of $\mathcal{F}$ sell their asset. In addition, $\mathcal{S}$ receives two signals: one about p_2, the other about everyone else's average belief about p_2. Based on these two signals, $\mathcal{S}$ forms a posterior view about p_2.
4. $\mathcal{S}$ chooses the holding level to maximize utility over subjective beliefs about p_2. In addition, $\mathcal{S}$ uses the posteriors from Stage 3 as priors and learns about others' valuations from $p_{1,2}$, which is the log of the noisy rational expectation equilibrium (REE) price at the end of t_1.

We first solve for the optimal equity share given the beliefs and then derive each investor's subjective beliefs. Let R_{t+1} be investor i's final return of risky asset. For $\mathcal{F}$ in $t_{1,1}$, $R_{t+1} = P_{1,2}/P_{1,1} - 1$. For $\mathcal{S}$ in $t_{1,2}$, $R_{t+1} = P_2/P_{1,2} - 1$. The optimization problem for investor i yields

$$x_i = \frac{E_i[r_{t+1}]}{\gamma\sigma_i^2} = \frac{E_i[\tilde{r}_{t+1}] - \tilde{r}_t}{\gamma\sigma_i^2}, \tag{A13}$$

where σ_i^2 is the conditional variance of r_{t+1}, $\tilde{r}_h = p_h - p_0$ is the log return from t_0 to t_h.

Integrating both sides of (A13) gives

$$\tilde{r}_t = \int \frac{\sigma_i^{-2}}{\int \sigma_i^{-2}\, di} E_i[\tilde{r}_{t+1}]\, di - \frac{\gamma\, x}{\int \sigma_i^{-2}\, di} \; . \tag{A14}$$

Hence, the equilibrium prices (scaled by p_0) is the subjective certainty-weighted average belief of all individuals minus the risk premium.

[1] The main results would not change if we do not assume that $\mathcal{F}$ is "cursed". However, making this assumption abstracts from beliefs higher than second order. Since we do not have a measure of third-order beliefs, we try to keep the model close to our data. In addition, most people are shown to have only one or two levels of reasoning (e.g., Nagel 1995, Camerer et al. 2004). Consistent with earlier studies, the average guess of a 2/3 guessing game in our sample is 42, and only around 10% of the answers are below 14.8, which is the value for engaging third-order reasoning. Hence, third-order or higher-order beliefs are unlikely to be relevant in practice for most people.

Equilibrium Prices: we first derive the equilibrium prices. In $t_{1,1}$, $\mathcal{S}$ is dormant and hold zero dollar of the asset. Then total demand in the market is

$$\alpha\theta + (1-\alpha)\mu \frac{\bar{E}\left[\tilde{r}_{1,2}|s_i, s_{im}\right] - \tilde{r}_{1,1}}{\gamma\, V_{\mathcal{F}}} = 0, \tag{A15}$$

where $V_{\mathcal{F}} \equiv var(p_{1,2}|s_i, s_{im})$.

Denote $\mu_k \equiv \mu\phi$ as the fraction of A that keeps their asset in $t_{1,2}$. In $t_{1,2}$,

$$\alpha\theta + (1-\alpha)\left(\mu_k \frac{\bar{E}\left[\tilde{r}_{1,2}|s_i, s_{im}\right] - \tilde{r}_{1,1}}{\gamma\, V_{\mathcal{F}}} + (1-\mu)\frac{\bar{E}\left[\tilde{r}_2|s_i, s_{im}, \tilde{r}_{1,2}\right] - \tilde{r}_{1,2}}{\gamma\, V_{\mathcal{S}}}\right) = 0. \tag{A16}$$

(A15) and (A16) yields

$$\tilde{r}_{1,1} = \bar{E}\left[\tilde{r}_{1,2}|s_i, s_{im}\right] + \frac{\alpha\,\gamma\, V_{\mathcal{F}}}{(1-\alpha)\mu}\theta \tag{A17}$$

$$\tilde{r}_{1,2} = \bar{E}\left[\tilde{r}_2|s_i, s_{im}, \tilde{r}_{1,2}\right] + \frac{\alpha(1-\phi)\,\gamma\, V_{\mathcal{S}}}{(1-\alpha)(1-\mu)}\theta \tag{A18}$$

Define $\tilde{r}_2^0 \equiv \tilde{r}_2|s_i, s_{im}$. Based on Bayesian learning,

$$E\left[\tilde{r}_2^0|\,\tilde{r}_{1,2}\right] = E\left[\tilde{r}_2^0\right] + \beta_P\left(\tilde{r}_{1,2} - E_i\left[p_{1,2}|s_i, s_{im}\right]\right). \tag{A19}$$

$$\beta_P = \frac{cov\left(\tilde{r}_2^0, \tilde{r}_{1,2}\right)}{var(\tilde{r}_{1,2})},$$

$$V_{\mathcal{S}} = \left(1 - corr\left(\tilde{r}_2^0, \tilde{r}_{1,2}\right)^2\right) var(\tilde{r}_2^0) = var(\tilde{r}_2^0) - cov\left(\tilde{r}_2^0, \tilde{r}_{1,2}\right)\beta_P.$$

Based on the same logic as in the benchmark case, we have $0 < \beta_P < 1$, Define $D \equiv \frac{(1-\mu_k)\alpha\,\gamma\, V_B}{(1-\alpha)(1-\zeta)}$, then for $\mathcal{S}$. Combining the optimal holdings at t_1 and belief updating gives

$$x_i^B = \frac{1}{\gamma V_{\mathcal{S}}}\left(E_i[\tilde{r}_2 \mid s_i, s_{im}] - \beta_P\, E_i\left[\,\tilde{r}_{1,2} \mid s_i, s_{im}\,\right] - (1-\beta_P)\tilde{r}_{1,2}\right)$$

Note that $E_i[\tilde{r}_{1,2} \mid s_i, s_{im}] = B\, E_i[\tilde{r}_2 \mid s_i, s_{im}] + C\, E_i[\theta \mid s_i, s_{im}]$ .By Lemma 1, $\bar{E}\left[\,\tilde{r}_{1,2} \mid s_i, s_{im}\,\right] = \kappa_D \tilde{r}_2 + \lambda\theta$. Taking conditional expectations yields $E_i[\bar{E} \mid s_i, s_{im}] = \kappa_D\, E_i[\tilde{r}_2 \mid s_i, s_{im}] + \lambda\, E_i[\theta \mid s_i, s_{im}]$. Hence, $E_i[\theta \mid s_i, s_{im}] = \frac{E_i[\bar{E}|s_i, s_{im}] - \kappa_D E_i[\tilde{r}_2|s_i, s_{im}]}{\lambda}$. This gives

$$E_i[\tilde{r}_{1,2} \mid s_i, s_{im}] = \left(B - \frac{C\kappa_D}{\lambda}\right) E_i[\tilde{r}_2 \mid s_i, s_{im}] + \frac{C}{\lambda} E_i[\bar{E} \mid s_i, s_{im}].$$

Optimal Holding For those in $\mathcal{F}$ who can sell their asset in $t_{1,2}$, their net holding in t_1 is zero. For the other investors, the average rational investor's holding is

$$\frac{x_i^R}{1-\alpha} = \frac{\mu_k}{\gamma\, V_{\mathcal{F}}}\left(E\left[\tilde{r}_{1,2}|s_i, s_{im}\right] - \tilde{r}_{1,1}\right) + \frac{1-\mu}{\gamma\, V_{\mathcal{S}}}\left(E\left[\tilde{r}_2|s_i, s_{im}, \tilde{r}_{1,2}\right] - \tilde{r}_{1,2}\right). \tag{13}$$

$$= \frac{\mu_k}{\gamma V_{\mathcal{F}}}\left(\left(B - \frac{C\kappa_D}{\lambda}\right) E_i[\tilde{r}_2 \mid s_i, s_{im}] + \frac{C}{\lambda} E_i[\bar{E} \mid s_i, s_{im}] - \tilde{r}_{1,1}\right)$$

$$+ \frac{1-\zeta}{\gamma V_{\mathcal{S}}}\left(-(1-\beta_P)\tilde{r}_{1,2} + \left(1 - \beta_P\left(B - \frac{C\kappa_D}{\lambda}\right)\right) E_i[\tilde{r}_2 \mid s_i, s_{im}]\right.$$

$$\left. - \frac{C}{\lambda}\beta_P E_i[\bar{E} \mid s_i, s_{im}]\right)$$

Collect terms,

$$\omega_0 = -\frac{\mu_k}{\gamma V_{\mathcal{F}}}\tilde{r}_{1,1} - \frac{1-\mu}{\gamma V_{\mathcal{S}}}(1-\beta_P)\tilde{r}_{1,2}$$

$$\omega_F = \frac{\mu_k}{\gamma V_{\mathcal{F}}}\left(B - \frac{C\kappa_D}{\lambda}\right) + \frac{1-\mu}{\gamma V_{\mathcal{S}}}\left(1 - \beta_P\left(B - \frac{C\kappa_D}{\lambda}\right)\right)$$

$$\omega_H = \frac{C}{\gamma\lambda}\left(\frac{\mu_k}{V_{\mathcal{F}}} - \frac{1-\mu}{V_{\mathcal{S}}}\beta_P\right).$$

Then for all traders, the average holding is $(1-\alpha)x_i^R + \alpha\theta$.

The intuition for the slow traders is the same as the benchmark with one type of traders. However, that for fast traders $\mathcal{F}$ is more subtle. Since $\mathcal{F}$ also trade against the average beliefs of $\mathcal{S}$, when they expect others to be more optimistic, their subjective payoff increases. As a result, they increase their holdings of total assets at t_1. This logic is similar to De Long et al. (1990), Brunnermeier and Nagel (2004), and Chen et al. (2021).

However, holding HOB constant, a higher first-order belief has two countervailing forces. Note that $\mathcal{F}$ wants to exploit both $\mathcal{S}$ and N. When exploiting the slow rational traders $\mathcal{S}$, a higher FOB leads fast traders $\mathcal{F}$ to believe that $\mathcal{S}$ will continue to be more optimistic after seeing the equilibrium price. $\mathcal{F}$ therefore want to invest more when FOB is higher. This is captured by the term $\mu_k B/(\gamma V_{\mathcal{F}})$ in ω_F. To the contrary, a higher FOB also leads fast traders to infer that this optimism is more likely to be justified by fundamentals rather than driven by sentiment. This inference reduces the perceived scope for transient mispricing that can be exploited over the fast trading window, which is captured by $\mu_k C\kappa_D/(\lambda\gamma V_{\mathcal{F}})$ in ω_F. As a result, even though payoffs look stronger, the expected resale value relevant for fast traders can fall, leading them to reduce their positions. Consequently, whether FOB increase or decrease $\mathcal{F}$'s holding depends on the relative proportion of $\mathcal{S}$ and N.

In sum, the sign of ω_F and ω_H depends on the composition of investors that determines which channel dominates the effects of HOB on average holding. When $\mu \to 0$ (that is, when no one believes that they can react faster than others), $\omega_F > 0$ and $\omega_H < 0$. When $\mu_k \to 1$, $\omega_H > 0$ and the sign of ω_F becomes ambiguous.

III. Model Calibration

a. Calibration Details

Note that the covariance structure of the random variables is

$$\begin{bmatrix} \tilde{r}_2 \\ s_i \\ s_{im} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & 1 & \kappa_D \\ 1 & \dfrac{1}{1-\tau} & \kappa_D \\ \kappa_D & \kappa_D & \sigma_{s_{im}}^2 \end{bmatrix} \right).$$

where $\sigma_{s_{im}}^2 = \kappa_D^2 + \lambda^2\sigma_\theta^2 + \sigma_\eta^2$. When only given s_i, the Kalman gain is $(1-\alpha)(1-\tau)$. From Panel A of Table 4, this number is 0.23. When only given s_{im}, the Kalman gain is $(1-\alpha)\frac{\kappa_D}{\sigma_{s_{im}}^2}$. From Panel A of Table 4, this number is 0.13. Meanwhile, $var(\tilde{r}_2|s_i, s_{im}) = (1-\alpha)\big(1-(\kappa_s+\tilde{\kappa})\big)$, given $var(\tilde{r}_2|s_i, s_{im})$ reduces by around 55% for both treatment groups, we have $(1-\alpha)\big(1-(\kappa_s+\tilde{\kappa})\big)+\alpha = 0.45$. So we can calculate $(1-\alpha)\left(1-\left(\frac{\sigma_{s_{im}}^2-\kappa_D^2}{\Delta}+\frac{\tau}{(1-\tau)\Delta}\right)\right)+\alpha = 0.45$ and $(1-\alpha)\frac{\kappa_D}{\sigma_{s_{im}}^2} = 0.13$. When only given s_{im}, the Kalman gain for $E_i\big[\bar{E}[\tilde{r}_2|s_i, s_{im}]\big]$ is $(1-\alpha)\frac{\kappa_D^2+\lambda^2\sigma_\theta^2}{\kappa_D^2+\lambda^2\sigma_\theta^2+\sigma_\eta^2}$ which is 0.35 from Table 4. Let $\Delta = \sigma_{s_{im}}^2/(1-\tau)-\kappa_D^2 > 0$, we have $\kappa_s = \frac{\sigma_{s_{im}}^2-\kappa_D^2}{\Delta} = (1-\tau)\frac{\lambda^2\sigma_\theta^2+\sigma_\eta^2}{\lambda^2\sigma_\theta^2+\sigma_\eta^2+\kappa_D^2}$, $\kappa_{sm} = \frac{\tilde{\kappa}}{\kappa_D}$, $\tilde{\kappa} \equiv \frac{\tau}{(1-\tau)\Delta}$. In the end, we have $\kappa_D = \frac{(1-\alpha)\kappa_s}{1-(1-\alpha)\kappa_{sm}}$. Solving the system gives $\tau = 0.76$, $\kappa_D = 0.33$, $\sigma_{s_{im}}^2 = 2.43$, and $\alpha = 0.03$. In the end, $\lambda = \frac{\alpha}{1-(1-\alpha)\kappa_{sm}}$. So $\Delta = 10.14$, $\kappa_s = 0.23$, $\tilde{\kappa} = 0.32$, $\kappa_{sm} = 0.97$, $\lambda = 0.53$, and $\sigma_\theta^2 = 4.18$.

The information treatment results help to estimate the signal structure. We then use the experimental results on investment decisions to calibrate the risk premium γV_i. We first set the fraction of fast traders as the fraction of participants that think they can react faster than others, this gives $\mu = 0.22$. For μ_k, it's the product of μ and those who fail to sell over the period, ϕ. We set $\phi = 0.05$ as the fraction of individuals who believe that they can only incorporate information no faster than 3 months. Therefore, $\mu_k = 0.01$.

Given the information structure, we can get B, C, γ, and β_p. In particular, the equilibrium coefficients B and C are pinned down by the two fixed-point conditions that link price loadings to learning and market clearing,

$$B = \frac{\kappa_R - \beta_P AC}{1-\beta_P(1-\kappa_R)}, \qquad C = \frac{\lambda_R(1-\beta_P B) + D}{1-\beta_P(1-G)}, \tag{C1}$$

where $D = \frac{(1-\phi)\alpha}{(1-\alpha)(1-\mu)} \gamma V_B$ captures the fast-trader risk-bearing term and κ_R, λ_R, A, and G are determined by the signal structure.

The behavioral price-sensitivity parameter β_P can be directly calculated by the empirical ratio moment,

$$\frac{\mu_k q + (1-\mu)(1-\beta_P q)}{(C/\lambda)(\mu_k - (1-\mu)\beta_P)} = \frac{\omega_F}{\omega_H}, \tag{C2}$$

where $q \equiv B - \frac{C\kappa_D}{\lambda}$. This ratio governs how strongly investors' portfolio weights respond to price innovations. Finally, the risk-aversion parameter γ is identified using the portfolio-slope moment,

$$\omega_F = \frac{\mu_k q + (1-\mu)(1-\beta_P q)}{\gamma V_B}. \tag{C3}$$

Since γV_i jointly determines the noises in price and trading decisions, they are not separately identified. In the model, we set $var(\tilde{r}_2) = 1$ for simplicity. This allows us to study how much subjective uncertainty reduces in the game. However, directly using the assumption that $var(\tilde{r}_2) = 1$ is misleading to calculating the equilibrium relationship between trading decisions and expectations, and therefore the equilibrium relationship between price and payoffs. We therefore follow Giglio et al. (2021) and set $\hat{\sigma}^2 = 0.04$ for both fast and slow traders, which matches an annual standard deviation of 20% for the general US stock market. In the end, we use (C1) - (C3) to jointly solve for B, C, γ and β_P.

b. Counterfactual with Common Knowledge

In the spirit of Bacchetta and Van Wincoop (2008) and Barillas and Nimark (2017), we test the impact of higher-order beliefs by comparing the model-implied market outcome when investors believe that they have common beliefs. That is, upon entering t_1, rational investors believe $E_i[\,\bar{E}[\tilde{r}_2] \mid s_i, s_{im}\,] = E_i[\,\tilde{r}_2 \mid s_i, s_{im}\,]$. In this case, investors no longer have strategic inference about noise traders and $E_i[\,\theta \mid s_i, s_{im}\,] = 0$.

First, consider the benchmark REE case, Lemma 1 and Lemma 2 state that $\bar{E}[\tilde{r}_2|s_i, s_{im}] = \kappa_D \tilde{r}_2 + \lambda\theta$ and $\tilde{r}_1 = B\,\tilde{r}_2 + C\theta$. This gives $\tilde{r}_1 = \frac{B}{\kappa_D}\,\bar{E}[\tilde{r}_2|s_i, s_{im}] + \left(C - \frac{\lambda B}{\kappa_D}\right)\theta$. From the expectation updating equation (A4),

$$\begin{aligned} E_i[\,\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_{1,2}\,] &= E_i[\,\tilde{r}_2 \mid s_i, s_{im}\,] + \beta_P\big(\tilde{r}_{1,2} - \kappa_D E_i[\,\tilde{r}_{1,2} \mid s_i, s_{im}\,] - \lambda E_i[\,\theta \mid s_i, s_{im}\,]\big) \\ &= (1-\beta_P\kappa_D) E_i[\,\tilde{r}_2 \mid s_i, s_{im}\,] - \lambda\beta_P E_i[\,\theta \mid s_i, s_{im}\,] + \beta_P \tilde{r}_{1,2} \end{aligned}$$

This gives

$$\tilde{r}_{1,2} = \frac{(1-\beta_P\kappa_D)}{1-\beta_P}\bar{E}_R[\,\tilde{r}_2 \mid s_i, s_{im}\,] - \frac{\lambda\beta_P}{1-\beta_P}\bar{E}_R[\,\theta \mid s_i, s_{im}\,] + \frac{1}{1-\beta_P}C\theta$$

As for the common-knowledge case, since $E_i[\bar{E}[\tilde{r}_2] \mid s_i, s_{im}] = E_i[\tilde{r}_2 \mid s_i, s_{im}]$ and $E_i[\theta \mid s_i, s_{im}] = 0$, $\bar{E}[\tilde{r}_2 \mid s_i, s_{im}] = \kappa_D \tilde{r}_2$.The posterior expectation after incorporating $\tilde{r}_{1,2}$ becomes $E_i[\tilde{r}_2 \mid s_i, s_{im}, \tilde{r}_{1,2}] = \left(1 - \frac{B}{\kappa_D}\beta_P\right) E_i[\tilde{r}_2 \mid s_i, s_{im}] + \beta_P \tilde{r}_{1,2}$, which gives the

$$\tilde{r}_1 = \frac{(1 - B\beta_P/\kappa_D)}{1 - \beta_P} \bar{E}_R[\tilde{r}_2 \mid s_i, s_{im}] + \frac{1}{1 - \beta_P} C\theta.$$

Under the common-knowledge counterfactual, the cross-sectional average belief about fundamentals does not load on the noise-trader shock. Therefore $\bar{E}[\tilde{r}_2 \mid s_i, s_{im}] = \kappa_D \tilde{r}_2$. Matching coefficients with the conjectured price rule $\tilde{r}_1 = B\tilde{r}_2 + C\theta$ implies $B = \frac{1 - B\beta_P/\kappa_D}{1 - \beta_P} \kappa_D$. Multiplying both sides by $1 - \beta_P$ and simplifying gives $B = \kappa_D$.

c. Estimate S&P500 Price Informativeness

As a comparison, Dávila and Parlatore (2025) measure price informativeness using a noisy rational-expectations equilibrium framework in the spirit of Grossman and Stiglitz (1985). In their approach, price informativeness, defined as the extent to which prices reflect future fundamentals, is computed from the following two regressions:

$$\tilde{r}_t = X_t \mathbf{B}_{0,s} + \epsilon_{s,t},$$
$$\tilde{r}_t = X_t \mathbf{B}_{0,l} + X_{t+1} \mathbf{B}_{1,l} + \epsilon_{l,t},$$

where $\tilde{r}_t$ is the period-t return, X_t is a vector of contemporaneous fundamental controls, and X_{t+1} denotes fundamentals realized in period $t + 1$. Let the corresponding R^2 values be R_s^2 and R_l^2. Price informativeness is then defined as $(R_l^2 - R_s^2)/(1 - R_s^2)$, which captures the incremental explanatory power of future fundamentals for current prices.

Using a panel of individual stocks, Dávila and Parlatore (2025) document a steady increase in price informativeness from the 1980s to the 2010s. By 2015, the average stock-level informativeness, when estimation is for each stock, is 0.093, with the 95th percentile equal to 0.339. Although our benchmark estimate lies toward the upper end of this distribution, this is expected: our calibration targets the aggregate stock market, where idiosyncratic noise is largely diversified away.

To assess this interpretation directly, we replicate their regression approach at the aggregate level using the S&P 500. Specifically, we set $\tilde{r}_t$ equal to the quarterly S&P 500 return and include real GDP growth, PCE inflation, the unemployment rate, the Michigan consumer sentiment index, and the 10-year minus 2-year Treasury yield spread in X_t. We find $R_l^2 = 0.449$ and $R_s^2 = 0.199$, implying a price informativeness measure of 0.313.

IV. Questionnaires

a. First Wave Survey

What is the total level ($) of your current wealth?

Note: wealth includes checking/saving accounts, pensions/retirement, brokerage account, real estate assets, and other assets.

- 0 - 2,500
- 2,500 - 5,000
- 5,000 - 7,500
- 7,500 - 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 100,000
- 100,000 - 250,000
- 250,000 - 500,000
- 500,000 - 1,000,000
- 1,000,000 - 2,500,000
- 2,500,000 - 5,000,000
- > 5,000,000

How long have you been investing in the stock market?

- Never invested in the stock market.
- Less than 1 year.
- 1 to 3 years.
- 3 to 5 years.
- 5-10 years
- More than 10 years

Approximately what percentage of your current wealth is financial wealth?

Note: financial wealth includes stocks, ETFs, financial derivatives, bonds, pension funds, bank savings, and other wealth in the financial system.

0 10 20 30 40 50 60 70 80 90 100

%

Around how many times do you check the current value of your stock-market wealth every year?

0 20 40 60 80 100 120 140 160 180 200

Number of times

Around how many times do you change your wealth allocation to the stock market every year?

0 20 40 60 80 100 120 140 160 180 200

Number of times

We would now like to ask how your current financial assets (excluding real estate) are distributed across different asset classes. Please enter the approximate percentage you currently have invested in the following asset classes.

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

Stocks (Individual Companies)	0	%
ETFs or index fund	0	%
Financial derivatives (option, future, forward, etc)	0	%
Bonds	0	%
Pension fund (401k, IRA etc)	0	%
Other	0	%
Total	0	%

Over the **past** twelve months, by how much (in % changes relative to the current level) have your stock market portfolio changed?

Note: please use negative values for a decrease and positive values for an increase.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Your total pre-tax earnings ($) over the **past** 12 months were:

Note: earnings include wages, salaries, bonuses, commission, etc., excluding capital gains.

- less than 5,000
- 5,000 - 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 100,000
- 100,000-150,000
- 150,000 - 250,000
- 250,000 - 500,000
- more than 500,000

Each of the following 4 questions are sent to a random 25% of participants

Suppose that the S&P500 index has increased by 5% over the past three months. How would you change your stock holdings.

e.g. if you would allocate 10% more of your wealth to the stock market, select 10%. If you would sell 10% of your stock market wealth, select -10%.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Suppose that the S&P500 index has increased by 10% over the past three months. How would you change your stock holdings.

e.g. if you would allocate 10% more of your wealth to the stock market, select 10%. If you would sell 10% of your stock market wealth, select -10%.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Suppose that the S&P500 index has increased by 15% over the past three months. How would you change your stock holdings.

e.g. if you would allocate 10% more of your wealth to the stock market, select 10%. If you would sell 10% of your stock market wealth, select -10%.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Suppose that the S&P500 index has increased by 20% over the past three months. How would you change your stock holdings.

e.g. if you would allocate 10% more of your wealth to the stock market, select 10%. If you would sell 10% of your stock market wealth, select -10%.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Please assign probabilities (from 0-100) to the following ranges of possible overall stock price changes (%) for the **S&P500 index** over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0	%
From 15% to 20%	0	%
From 10% to 15%	0	%
From 5% to 10%	0	%
From 0% to 5%	0	%
From -5% to 0%	0	%
From -10% to -5%	0	%
From -15% to -10%	0	%
From -20% to -15%	0	%
Less than -20%	0	%
Total	0	%

Please assign probabilities (from 0-100) to the following ranges of possible overall changes (%) for **your stock market portfolio** over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0	%
From 15% to 20%	0	%
From 10% to 15%	0	%
From 5% to 10%	0	%
From 0% to 5%	0	%
From -5% to 0%	0	%
From -10% to -5%	0	%
From -15% to -10%	0	%
From -20% to -15%	0	%
Less than -20%	0	%
Total	0	%

We would like to know what your opinion is about what **other investors** think will happen to the stock market price. Please assign probabilities (from 0-100) to the following ranges of beliefs that **other investors** might hold about overall price changes in the S&P 500 index over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0 %
From 15% to 20%	0 %
From 10% to 15%	0 %
From 5% to 10%	0 %
From 0% to 5%	0 %
From -5% to 0%	0 %
From -10% to -5%	0 %
From -15% to -10%	0 %
From -20% to -15%	0 %
Less than -20%	0 %
Total	0 %

By what percentage do you think the earnings of the companies listed on S&P500 have changed overall over the past 12 months?

-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

%

- Shown to treatment group 1

We would now like to show you some information on the S&P 500 index.

Over the past 12 months, the earnings of the companies represented in the S&P500 index have increased by approximately 2%. This is lower than the average of around 7.5% annually over the past 10 years.

Please proceed to the next page.

- Shown to treatment group 2

We would now like to show you some information on the S&P 500 index.

Other investors participated in this survey on average believe that the 12-month return of S&P500 index from October 2023 to September 2024 would be 3.21%. This is lower than the average of an around 9% annual return on S&P500 over the past 10 years.

Please proceed to the next page.

Now we'd like you to think about what you perceive as the most pessimistic and most optimistic outlooks for the **S&P500 return** over the 12 months from October 2023 to September 2024. What do you think the lowest 12-month return might be for this time period and what do you think the highest might be? (please provide an answer as % per year).

Now we want to ask you to think about the chance of the **S&P500 return** you entered in the previous question. Please assign a percentage chance to each return to indicate how likely you think it is that this return will actually happen to S&P500 index over the 12 months from October 2023 to September 2024.

Note: your answers have to be greater than or equal to 1%, where 1% means nearly no chance that this growth rate will happen. The sum should total to 100%.

S&P500 return will be -50%	0	%
S&P500 return will be 0%	0	%
S&P500 return will be 50%	0	%
Total	0	%

Now we'd like you to think about what you perceive as the most pessimistic and most optimistic outlooks for your stock market portfolio over the 12 months from October 2023 to September 2024. What do you think the lowest 12-month return might be for this time period and what do you think the highest might be? (please provide an answer as % per year).

Now we want to ask you to think about the chance of the the returns of **your stock market portfolio** you entered in the previous question. Please assign a percentage chance to each return to indicate how likely you think it is that this return will actually happen to S&P500 index over the 12 months from October 2023 to September 2024.

Note: your answers have to be greater than or equal to 1%, where 1% means nearly no chance that this growth rate will happen. The sum should total to 100%.

S&P500 return will be -70%	0	%
S&P500 return will be -46%	0	%
S&P500 return will be -25%	0	%
Total	0	%

Now we'd like you to think about what your opinion is about what **other investors** perceive as the most pessimistic and most optimistic outlooks for the **S&P500 return** over the 12 months from October 2023 to September 2024. What do you think that **other investors** would say the lowest 12-month return might be for this time period and what do you think the highest might be? (please provide an answer as % per year).

-100 -80 -60 -40 -20 0 20 40 60 80 100

Lowest return (%)

Most likely return (%)

Highest return (%)

Now we want to ask you to think about the chance of the the returns of **S&P500** index as **perceived by other investors** you entered in the previous question. Please assign a percentage chance to each return to indicate how likely you think it is that this return will actually happen to S&P500 index over the 12 months from October 2023 to September 2024.

Note: your answers have to be greater than or equal to 1%, where 1% means nearly no chance that this growth rate will happen. The sum should total to 100%.

S&P500 return will be -29%	0	%
S&P500 return will be -13%	0	%
S&P500 return will be 11%	0	%
Total	0	%

The next question is about the following problem. In questionnaires like ours, sometimes some participants do not carefully read the questions and just quickly click through the survey. This means that there are a lot of random answers which compromise the results of research studies. To show that you read our questions carefully, please select other as your answer to the next question. What is your favorite color?

- green
- blue
- yellow
- red
- black
- white
- other

Each of the following 4 texts is sent to a random 25% of participants

For the next three questions, suppose that you get news that the S&P500 index would increase by 5% over the 12 months between October 2023 to September 2024.

For the next three questions, suppose that you get news that the S&P500 index would increase by 10% over the 12 months between October 2023 to September 2024.

For the next three questions, suppose that you get news that the S&P500 index would increase by 15% over the 12 months between October 2023 to September 2024.

For the next three questions, suppose that you get news that the S&P500 index would increase by 20% over the 12 months between October 2023 to September 2024.

by what percentage would you change your wealth allocated to the stock market?

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

by what percentage do you think **other investors** would change their wealth allocated to the stock market?

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

by what percentage would you change your wealth allocated to the stock market if **other investors** do not change how much they would allocate to the stock market?

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

This question is being asked to all participants in the survey, drawn from a representative sample of stock investors in the US. Please choose a number from 1 to 100. We will take your number as well as the numbers chosen by **other investors** to calculate the average pick. The winning number will be the number that is closest to two-thirds (2/3) of the average. If your number is the winning number, you will receive a bonus payment of 20 dollars.

1 11 21 31 41 51 60 70 80 90 100

number

Other investors are also asked to guess a number from 1 to 100, with the goal of making their guess as close as possible to two-thirds of the average guess of all those participating in the contest. What percentage (%) of **other investors'** guesses do you think will fall in each of the following ranges?

1-10	0	%
11-20	0	%
21-30	0	%
31-40	0	%
41-50	0	%
51-60	0	%
61-70	0	%
71-80	0	%
81-90	0	%
91-100	0	%
Total	0	%

b. Second Wave Survey

What is the total level ($) of your current wealth?

Note: wealth includes checking/saving accounts, pensions/retirement, brokerage account, real estate assets, and other assets.

- 0 - 2,500
- 2,500 - 5,000
- 5,000 - 7,500
- 7,500 - 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 100,000
- 100,000 - 250,000
- 250,000 - 500,000
- 500,000 - 1,000,000
- 1,000,000 - 2,500,000
- 2,500,000 - 5,000,000
- > 5,000,000

Approximately what percentage of your current wealth is financial wealth?

Note: financial wealth includes stocks, ETFs, financial derivatives, bonds, pension funds, bank savings, and other wealth in the financial system.

0 10 20 30 40 50 60 70 80 90 100

%

We would now like to ask how your current financial assets (excluding real estate) are distributed across different asset classes. Please enter the approximate percentage you currently have invested in the following asset classes.

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

Stocks (Individual Companies)	0	%
ETFs or index fund	0	%
Financial derivatives (option, future, forward, etc)	0	%
Bonds	0	%
Pension fund (401k, IRA etc)	0	%
Other	0	%
Total	0	%

By how much has the value of your stock market portfolio changed in percentage over the **past three months**?

Note: please use a negative value for a decrease and a positive value for an increase.

-100 -80 -60 -40 -20 0 20 40 60 80 100

%

Please assign probabilities (from 0-100) to the following ranges of possible overall stock price changes (%) for the **S&P500 index** over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0	%
From 15% to 20%	0	%
From 10% to 15%	0	%
From 5% to 10%	0	%
From 0% to 5%	0	%
From -5% to 0%	0	%
From -10% to -5%	0	%
From -15% to -10%	0	%
From -20% to -15%	0	%
Less than -20%	0	%
Total	0	%

Please assign probabilities (from 0-100) to the following ranges of possible overall changes (%) for **your stock market portfolio** over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0	%
From 15% to 20%	0	%
From 10% to 15%	0	%
From 5% to 10%	0	%
From 0% to 5%	0	%
From -5% to 0%	0	%
From -10% to -5%	0	%
From -15% to -10%	0	%
From -20% to -15%	0	%
Less than -20%	0	%
Total	0	%

We would like to know what your opinion is about what **other investors** think will happen to the stock market price. Please assign probabilities (from 0-100) to the following ranges of beliefs that **other investors** might hold about overall price changes in the S&P 500 index over the 12 months from October 2023 to September 2024:

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

More than 20%	0	%
From 15% to 20%	0	%
From 10% to 15%	0	%
From 5% to 10%	0	%
From 0% to 5%	0	%
From -5% to 0%	0	%
From -10% to -5%	0	%
From -15% to -10%	0	%
From -20% to -15%	0	%
Less than -20%	0	%
Total	0	%

The next question is about the following problem. In questionnaires like ours, sometimes some participants do not carefully read the questions and just quickly click through the survey. This means that there are a lot of random answers which compromise the results of research studies. To show that you read our questions carefully, please select other as your answer to the next question. What is your favorite color?

- green
- blue
- yellow
- red
- black
- white
- other

Based on your experience and observations as a stock market investor, how many days do you believe it typically takes for **you** to react to significant news events in the stock market? Consider news events such as earnings reports, geopolitical developments, and macroeconomic data releases, etc.

0 10 20 30 40 50 60 70 80 90 100

days

Based on your experience and observations as a stock market investor, how many days do you believe it typically takes for **other investors** to react to significant news events in the stock market? Consider news events such as earnings reports, geopolitical developments, and macroeconomic data releases, etc.

0 10 20 30 40 50 60 70 80 90 100

days

What proportion of your pension fund is currently allocated to equity investments?

Note: If you don't have any pension fund, please select zero.

0 10 20 30 40 50 60 70 80 90 100

%

When you think about "other investors" in the stock market, for example, what other investors believe the future level of the stock market index will be, which group do you mainly have in mind?

Note: the sum of the answers has to be equal to 100%. Answers can range from 0% to 100%.

Retail/individual investors	0
Institutional investors (e.g., hedge funds, mutual funds)	0
Investors that are neither retail investors nor institutional investors	0
Total	0