

Expectations and Attention to Experience

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What are the Determinants of Household Expectations?

Beliefs play a crucial role in economic models. So far, the literature has detected multiple influences on households' expectations:

- ▶ Expectations are extrapolative (Greenwood and Shleifer 2014)
- ▶ Depend on individuals' lifetime experiences (Malmendier and Nagel 2011, 2016)
- ▶ And their demographic attributes (Dominitz and Manski 2007; Das, Kuhnen, and Nagel 2020)
- ▶ And even unobservable individual characteristics (Giglio, Maggiori, Stroebel, and Utkus 2021)

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Focus on Subjective Sharpe Ratios (SSRs)

Incorporate risk perceptions

Capture households' joint perceptions of multiple moments μ, σ

Important for portfolio choice

An investor i with mean-variance preferences seeks to maximize:

$$U_i(x_{it}) = x_{it}\mu_{it} - \frac{\gamma_i}{2}x_{it}^2\sigma_{it}^2,$$

where x denotes the fraction of wealth allocated to the risky market portfolio returning r_{t+1} , and remainder to cash (zero return).

She therefore chooses to allocate the the share

$$x_{it} = \frac{1}{\gamma_i\sigma_{it}} \cdot \frac{\mu_{it}}{\sigma_{it}}$$

of her wealth to the risky market portfolio, in direct proportion to her own perception of the Sharpe Ratio $\frac{\mu_{it}}{\sigma_{it}}$.

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Survey Data

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Household Holdings

Conclusion

Recovering Subjective SRs from Survey Microdata

Every month (2002-2022), respondents of the Michigan Surveys of Consumers are asked: *“What do you think is the percent chance that a one thousand dollar investment in a diversified stock mutual fund will increase in value in the year ahead, so that it is worth more than one thousand dollars one year from now?”*

$$\mathbb{E}_{it}[\mathbb{1}\{r_{t+1} > 0\}] = \mathbb{P}_{it}(r_{t+1} > 0)$$

Proposition: Assume now that the individual perceives the market return to be conditionally normally distributed, $r_{t+1} \sim \mathcal{N}(\mu_{it}, \sigma_{it})$, and the riskless rate to be zero. Then

$$SSR_{it} = \frac{\mu_{it}}{\sigma_{it}} = \text{probit}(\mathbb{P}_{it}(r_{t+1} > 0))$$

is her subjective perception of the market's conditional Sharpe Ratio over the next period.

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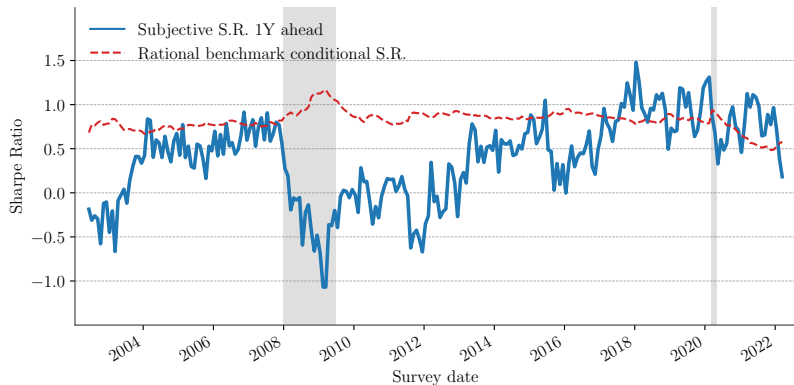
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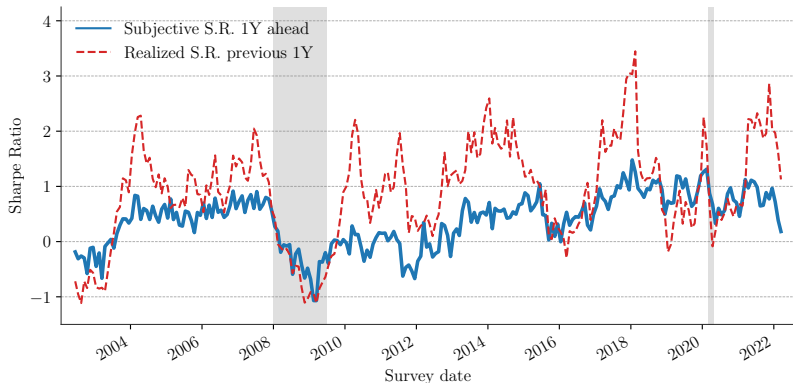
Subjective SRs vs. Rational Benchmark

- ▶ Average subjective Sharpe Ratio is procyclical
- ▶ Rational benchmark (Campbell and Cochrane 1999) is countercyclical



These Beliefs are Extrapolative

In keeping with Greenwood and Shleifer (2014)'s findings on the first moment; our measure includes first two moments



Input Demographics (1/2)

We exploit microdata from the Michigan Surveys of Consumers:

- ▶ Repeated cross-sectional survey, with attributes sampled to be representative of the whole population
- ▶ June 2002 to May 2022, covers full business cycle

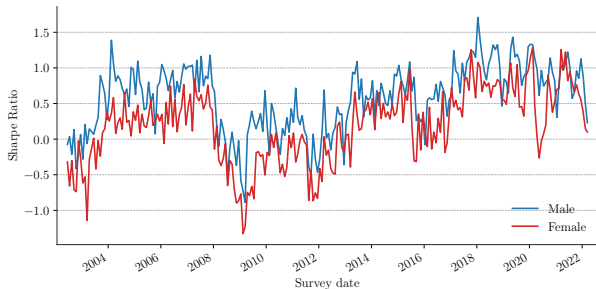
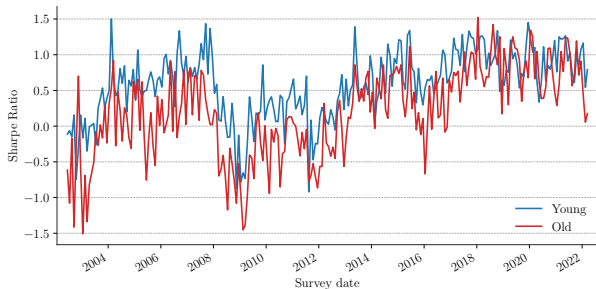
Data includes:

- ▶ **Demographics:** age, education level, sex, stock holdings, home value, household income, political affiliation, region
- ▶ **Macroeconomic beliefs:** income increase (prob.), business conditions (direction), interest rates (direction), unemployment (direction), inflation rate (1Y & 5Y), house prices change

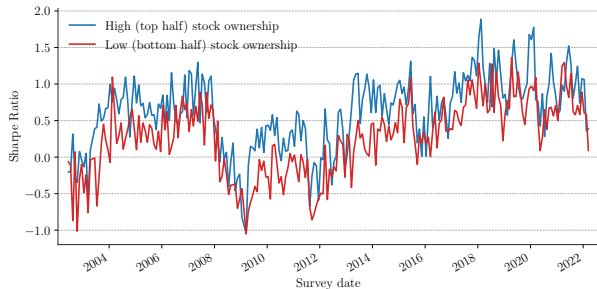
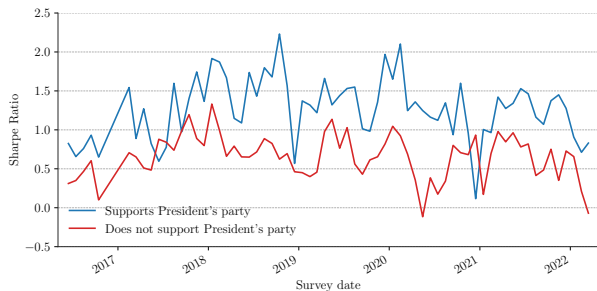
Input Demographics (2/2)

Variable			Percentile								Category		
Name	Unit	Survey Q.	N	Mean	S.D.	Min	25	50	75	Max	Unique	Top	Count
Age	Years	AGE	81,388	52.2	15.71	18	40	53	64	97			
Household income	USD	INCOME	78,358	108,302.90	85,855.88	1,200	55,000	85,000	132,000	500,000			
Stock holdings value	USD	INVAMT	67,893	332,204.22	793,601.04	1,000	30,000	100,000	300,000	10,000,000			
Home value	USD	HOMEAMT	55,307	363,983.42	390,612.18	1,000	160,000	255,000	425,000	5,000,000			
Forecast probability of increase in stock market over next year	Percent	PSTK	81,879	54.81	29.24	0	30	55	80	100			
Forecast probability of increase in personal income over next year	Percent	PINC2	81,301	52.46	36.77	0	10	50	85	100			
Forecast 1Y inflation rate	Percent	PX1Q2	65,719	4.35	3.51	1	2	3	5	40			
Forecast 5Y inflation rate	Percent	PX5Q2	74,293	3.23	2.35	1	2	3	4	30			
Forecast direction of business conditions over next year	{-1, 0, +1}	BEXP	80,411	0.11	0.74	-1	0	0	1	1			
Forecast direction of interest rates over next year	{-1, 0, +1}	RATEX	81,135	0.47	0.66	-1	0	1	1	1			
Forecast direction of unemployment over next year	{-1, 0, +1}	UNEMP	81,340	0.05	0.73	-1	0	0	1	1			
Forecast percent increase or decrease in local house prices over next year	Percent	HOMPX1Q2	27,775	6.34	5.13	1	3	5	9	35			
Is female	True/False	SEX	81,879	0.45	0.50	0	0	0	1	1			
Supports Republican party	True/False	POLAFF	36,158	0.30	0.46	0	0	0	1	1			
Supports Democratic party	True/False	POLAFF	36,158	0.32	0.47	0	0	0	1	1			
Supports current President's party	True/False	POLAFF	36,158	0.31	0.46	0	0	0	1	1			
Region of residence	Category	REGION	81,878								4	South	27,306
Education level	Category	EDUC	81,696								6	Grade 13-16 w/ col	25,529

Demographics Inform us About Heterogeneous Beliefs (1/2)



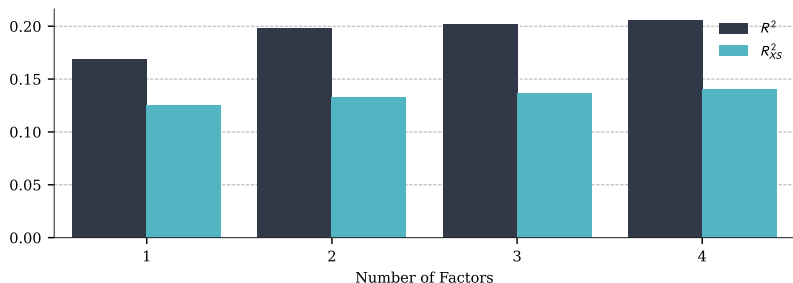
Demographics Inform us About Heterogeneous Beliefs (2/2)



Subjective SRs Have A Low-Dimensional Factor Structure

We apply IPCA (Kelly, Pruitt, and Su 2020) to the cross-section of subjective SRs to understand their (dynamic) factor structure:

$$SSR_{i,t} = \alpha_{i,t} + \beta_{i,t}f_{t+1} + \varepsilon_{i,t+1}, \quad \beta_{i,t} = [\mathbf{d}, \mathbf{b}]'_{i,t} \mathbf{\Gamma}_{\beta}^{AC}; \quad \alpha_{i,t} = [\mathbf{d}, \mathbf{b}]'_{i,t} \mathbf{\Gamma}_{\alpha}^{AC}$$



Single factor sufficient to drive out the explanatory power of other beliefs and demographics that is not already captured by the systematic factor.

Important Drivers Are Demographics *and* Other Beliefs

	<u>Coefficient</u>
<hr/>	
Panel A: Demographics	
(Constant)	0.170
Age	-0.115
Education level	0.187
Is female	-0.147
Stock holdings value	0.310
Home value	-0.032
Household income	0.018
Supports current President's party	0.009
<hr/>	
Panel B: Other Beliefs	
Forecast probability of income increase	0.742
Forecast direction of business conditions	0.366
Forecast direction of interest rates next year	0.051
Forecast direction of unemployment	-0.312
Forecast 1Y inflation rate	-0.110
Forecast 5Y inflation rate	-0.067
Forecast house prices change	-0.045
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Malmendier & Nagel (2011, QJE)

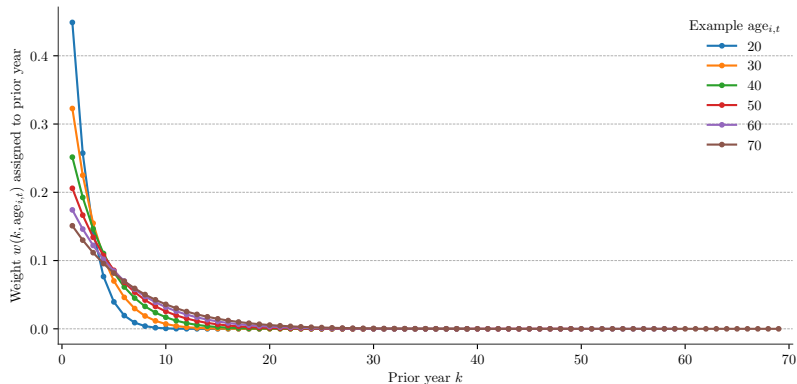
Malmendier and Nagel (2011) show that lifetime experiences of households explain their expectations using an adaptive expectation formation model:

$$\text{EXPERIENCE}(\text{age}_{i,t}) = \sum_{k=1}^{\text{age}_{i,t}-1} w_{i,t}(k, \text{age}_{i,t}) \times \text{SR}_{t-k} \quad (1)$$

$$\text{where } w_{i,t}(k, \text{age}_{i,t}) = \frac{(\text{age}_{i,t} - k)^\lambda}{\sum_{k=1}^{\text{age}_{i,t}-1} (\text{age}_{i,t} - k)^\lambda} \quad (2)$$

- ▶ Heterogeneity in expectations solely depends on age-differences.
- ▶ Weights $w_{i,t}$ capture **experience effects**.
 - ▶ All positive and sum to unity.

Malmendier & Nagel (2011, QJE)



Optimal $\hat{\lambda} = 10.39$, i.e., individuals place a high weight on their recent past experiences when forming expectations about the SR.

Instrumenting Experiences with Demographics

We allow for a general form of how experience effects explain household expectations, by instrumenting the former using observable demographics $\mathbf{d}_{i,t}$ and beliefs $\mathbf{b}_{i,t}$ about other macroeconomic state variables:

$$\text{EXPERIENCE}(\mathbf{d}_{i,t}, \mathbf{b}_{i,t}) = \sum_{k=1}^{\text{age}_{i,t}-1} w_{i,t}(k, \mathbf{d}_{i,t}, \mathbf{b}_{i,t}) \times \text{SR}_{t-k}$$

where $\mathbf{w}_{i,t} = g(\text{age}_{i,t}, \mathbf{d}_{i,t}, \mathbf{b}_{i,t})$

and
$$\sum_{k=1}^{\text{age}_{i,t}-1} w_{i,t}(k, \mathbf{d}_{i,t}, \mathbf{b}_{i,t}) = 1$$

and $w_{i,t}(k, \mathbf{d}_{i,t}, \mathbf{b}_{i,t}) \geq 0 \quad \forall k \in [1, \text{age}_{i,t} - 1]$.

Instrumenting Experiences with Demographics

We introduce a customized Transformer deep learning model:

- ▶ Attention weights, instrumented flexibly
- ▶ Takes **sequential** nature of data into account
- ▶ Captures **economic mechanism of experience effects...**
- ▶ ... and therefore parameters are **interpretable**

Instrumenting Experiences with Demographics

Weights $w_{i,t}$ are generated by comparing past experienced Sharpe ratios with the respondent's demographics $\mathbf{d}_{i,t}$ and other beliefs $\mathbf{b}_{i,t}$. Let

$$\mathbf{k}_{i,t} = \mathbf{W}_2^k \times \text{GELU} \left(\mathbf{W}_1^k \times \mathbf{SR}_{(t-\text{age}_{i,t}-1):t} + \mathbf{a}_1^k \right) + \mathbf{a}_2^k$$

$$\mathbf{q}_{i,t} = \mathbf{W}^q \times [\widehat{\mathbf{d}}_{i,t}, \widehat{\mathbf{b}}_{i,t}],$$

then respondent i 's weights on experienced Sharpe ratio \mathbf{SR}_{t-k} are

$$w_{i,t}(k, \mathbf{d}_{i,t}, \mathbf{b}_{i,t}) = \frac{e^{\text{ATTN}_{i,t}(k)}}{\sum_{k=1}^{\text{age}_{i,t}-1} e^{\text{ATTN}_{i,t}(k)}}, \quad \forall k \in [1, \text{age}_{i,t} - 1], \text{ with}$$

$$\text{Attn}_{i,t} = \frac{\mathbf{q}_{i,t} \times \mathbf{k}'_{i,t}}{\sqrt{d^{\text{ATTN}}}}.$$

Estimation via Adam/SGD by minimizing MSE on predicted versus observed SSRs, across all respondents and survey waves:

$$\widehat{\text{SSR}}_{i,t} = \text{EXPERIENCE}_{i,t}(\mathbf{d}_{i,t}, \mathbf{b}_{i,t}).$$

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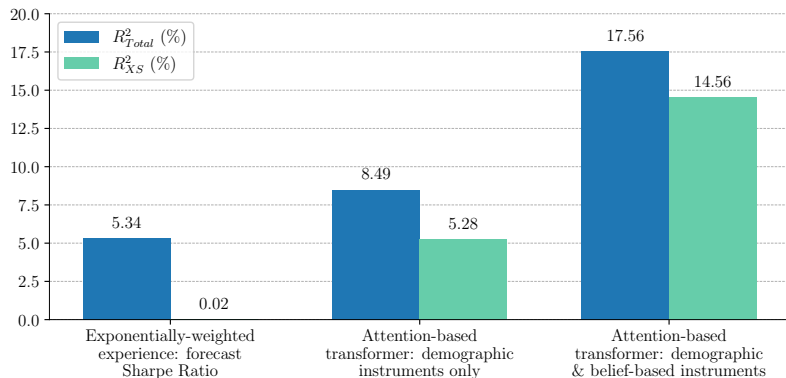
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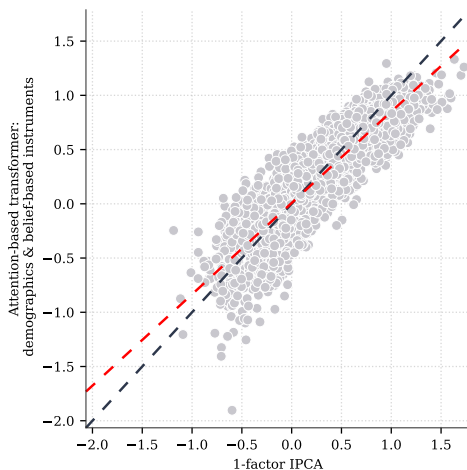
Conclusion

Lifetime Experiences Explain Subjective Expectations



Our generalized weighting function explains both the cross-sectional *and* overall variation in households' expected Sharpe ratios.

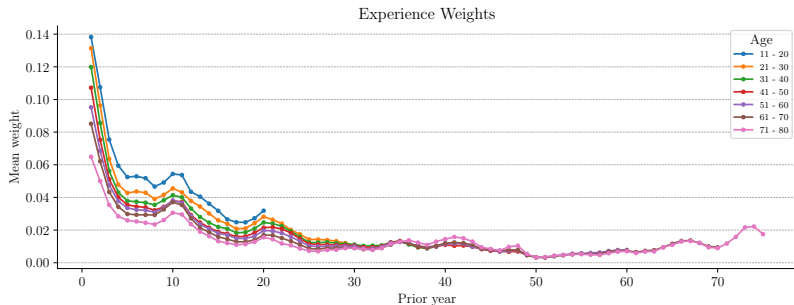
Predictions: Experience Effects vs. IPCA



Economic experience effects pick up the reduced-form explanatory power of the latent IPCA model (slope 0.84, insignificant intercept).

Heterogeneity in Experience Weights

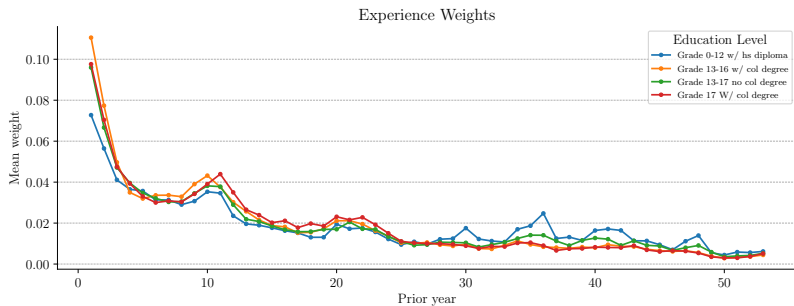
Average experience weights by age are close to an exponential decay, but differ from the simpler MN11 specification:



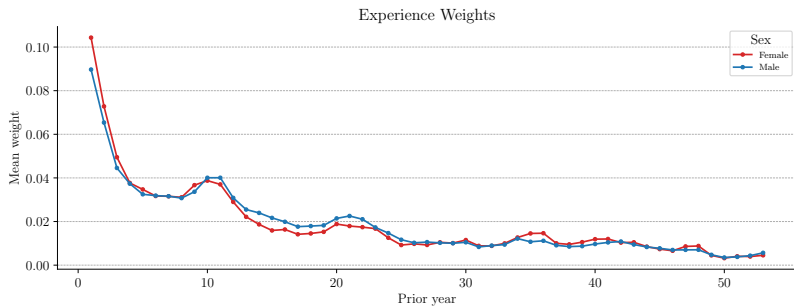
Ceteris paribus, greater weight placed on most recent decade by:

- ▶ The most educated
- ▶ Women
- ▶ Those who support current President's party
- ▶ Those who hold more stock

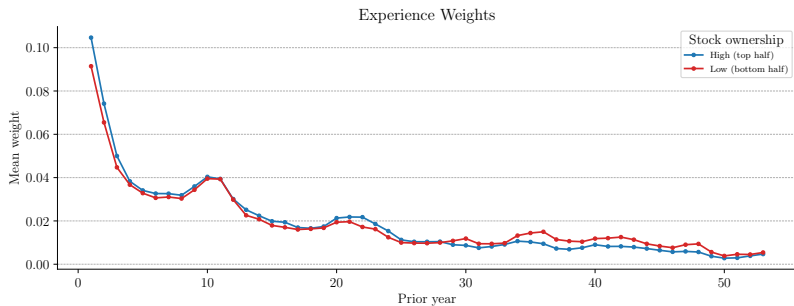
Heterogeneity: Education



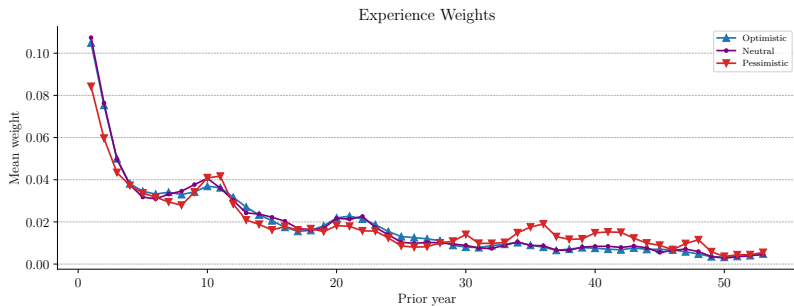
Heterogeneity: Gender



Heterogeneity: Stock Ownership



Heterogeneity: Generalized Optimism



Asymmetric Extrapolation of Recent Recessions

Dependent Variable:	Experience Weight $_{i,t,k}$ (%)			
Model:	(1)	(2)	(3)	(4)
<i>Variables</i>				
Experience Weight During Recession $_{t,k}$	0.8273*** (0.0519)	0.7496*** (0.0510)	0.7695*** (0.0375)	0.6470*** (0.0355)
Age $_{i,t}$	-0.0486*** (0.0002)	-0.0485*** (0.0002)	-0.0353*** (0.0003)	-0.0279*** (0.0005)
Experience Weight During Recession $_{t,k}$ × Surveyed During Recession $_{i,t}$		0.9115*** (0.1929)	0.0785 (0.1035)	-0.1532** (0.0617)
<i>Fixed-effects</i>				
Survey year-month	✓	✓	✓	✓
<i>Sample</i>				
Included experience weights k	All	All	$k > 5$	$k > 10$
<i>Fit statistics</i>				
Observations	3,804,951	3,804,951	3,425,406	3,045,861
R ²	0.05430	0.05564	0.05818	0.04834

Clustered (Survey year-month) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

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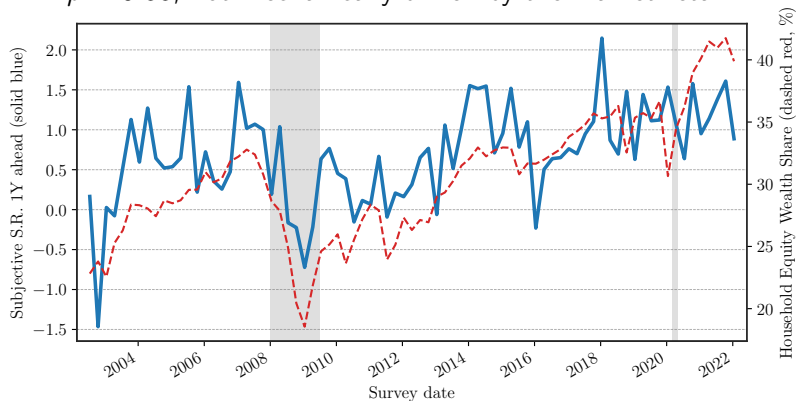
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Subjective Sharpe Ratios Correlate with HH's Equity Share

$\rho = 0.66$; not mechanically driven by the market return

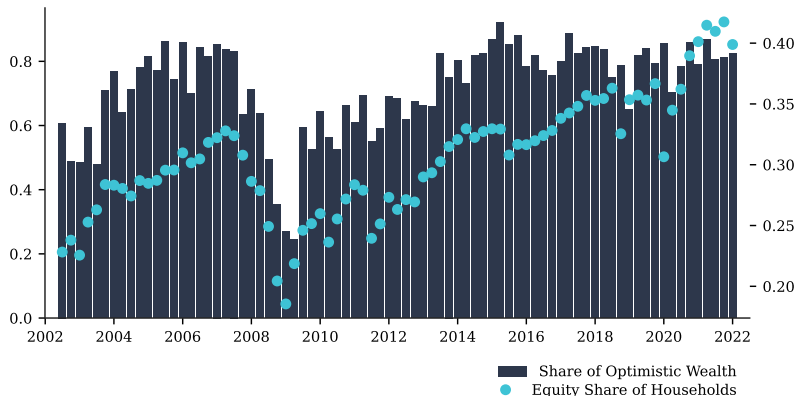


Share of Optimistic Wealth Explains HH's Equity Share

Optimistic household wealth, i.e.,

$$\frac{\sum_{i,t} (\text{EXPERIENCE}_{i,t} > 0) \times \text{STOCK WEALTH}_{i,t}}{\sum_{i,t} \text{STOCK WEALTH}_{i,t}},$$

even more strongly correlated ($\rho = 0.77$) to aggregate HH equity share



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Main Takeaways

- ▶ We introduce a new source of subjective expectations data about the conditional Sharpe Ratio of the market portfolio
- ▶ We show that these expectations follow a low-dimensional latent factor structure, which itself is well-explained by appropriately weighted lifetime experiences of individuals
- ▶ We instrument the weights placed on past experienced Sharpe ratios of individuals by their demographics and adjacent beliefs
⇒ experience effects now have greater explanatory power
- ▶ A greater share of optimistic wealth (from model's estimates of experience effects) explains aggregate household holdings of stocks

Thank you!

References I

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