Beliefs and Portfolios: Causal Evidence

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Motivation

- Low interest rate environment and elevated asset valuations
  - How does monetary policy affect asset prices?
  - Are there financial stability risks from asset price bubbles?
  - How do risky assets affect households' wealth?
- Competing asset pricing models give different answers

  Campbell and Cochrane (1999); Adam et al. (2017); Myers and De La O (2020)
- Example: Effect of interest rate shock on asset prices Williams (2014)
  - Rational expectations: one-time adjustment of valuations.
  - Extrapolative expectations: belief-driven bubble.

→ **Expectation formation is key!** Brunnermeier et al. (2021)

- Households matter: tight investment mandates and inelasticity

  Koijen and Yogo (2019); Gabaix and Koijen (2021)

This paper

Which mechanism is *causally* shaping households' stock market expectations and *why*?

- Identify causal effects via RCT
- Test leading asset pricing theories jointly

Main findings:

- Causal evidence for extrapolation of returns *and* earnings

  Greenwood and Shleifer (2014); Myers and De La O (2020); Bordalo et al. (2020); Laudenbach et al. (2021)

- Info preference effect: heterogenous mental models

  Fuster et al. (2019); Andre et al. (2019)

- Beliefs *causally* affect portfolios, resolve puzzle

  Giglio et al. (2021)

Asset Pricing and Expectations Campbell and Shiller (1988)

$$p_t/d_t = c + \sum_{j=0}^{\infty} \rho^j \left(\Delta d_{t+1+j} - r_{t+1+j}\right) \tag{1}$$

- **Data:** Higher P/D followed by lower returns.
- **Rational Expectations:** Higher P/D $\rightarrow$ *lower* expected returns.

  Campbell and Cochrane (1999); Bansal and Yaron (2004); Barro (2006)
- **Extrapolative returns:**
  High past returns (high P/D) $\rightarrow$ *high* expected returns.

  Greenwood and Shleifer (2014); Adam et al. (2017)
- **Extrapolative earnings growth:**
  High past earnings growth $\rightarrow$ high expected earnings growth.

  Myers and De La O (2020); Bordalo et al. (2020)

$\rightarrow$ Test predictions in representative survey of 4,000 German households

Information Treatments

(translated, shortened, re-ordered)

- **T1 (Rational Expectations)**
  Current price-earnings ratio of DAX is 23. Long-term average is 15.
  - Prior P/E = 10

  → RE prediction: *downward* revision of expected return
- **T2 (Extrapolative returns)**
  DAX has increased by around 9% over past twelve months.
  - Prior R = 5%

  → Extrapolation: *upward* revision of expected return
- **T3 (Extrapolative earnings)**
  Earnings of DAX companies decreased by 20% over past twelve months.
  - Prior earnings growth = 4%

  → Extrapolation: *downward* revision

  ...
- **T6 (Placebo)**
  Harvest yield of winter rapeseed increased by around 10% in 2019.

Econometric Approach (Baseline)

Coibion et al. 2021

$$E[X]_i^{post} = \alpha + \sum_{k=1}^{K-1} \beta_k T_i^k + \sum_{k=1}^{K-1} \gamma_k T_i^k E[X]_i^{pre} + \delta E[X]_i^{pre} + \mathbf{W_i}\phi + \epsilon_i \quad (2)$$

Example ($\gamma = 0$, $\delta = 1$, $\phi = 0$, $\epsilon_i = 0$):

- Revision control group: $\Delta_c \equiv E[X]_K^{post} - E[X]_K^{pre} = \alpha$
- Revision treatment group: $\Delta_{t,k} \equiv E[X]_{k=1}^{post} - E[X]_{k=1}^{pre} = \alpha + \beta_k$
- Diff-in-diff: $\Delta_{t,k} - \Delta_c = \beta_k$

$\rightarrow$ β_k **measures causal effect of treatment**

$\rightarrow$ $\gamma \neq 0$, $\delta \neq 1$ revisions may depend on prior expectations

$\rightarrow$ $\phi \neq 0$ control for imperfect randomization

Treatment Effects (Baseline)

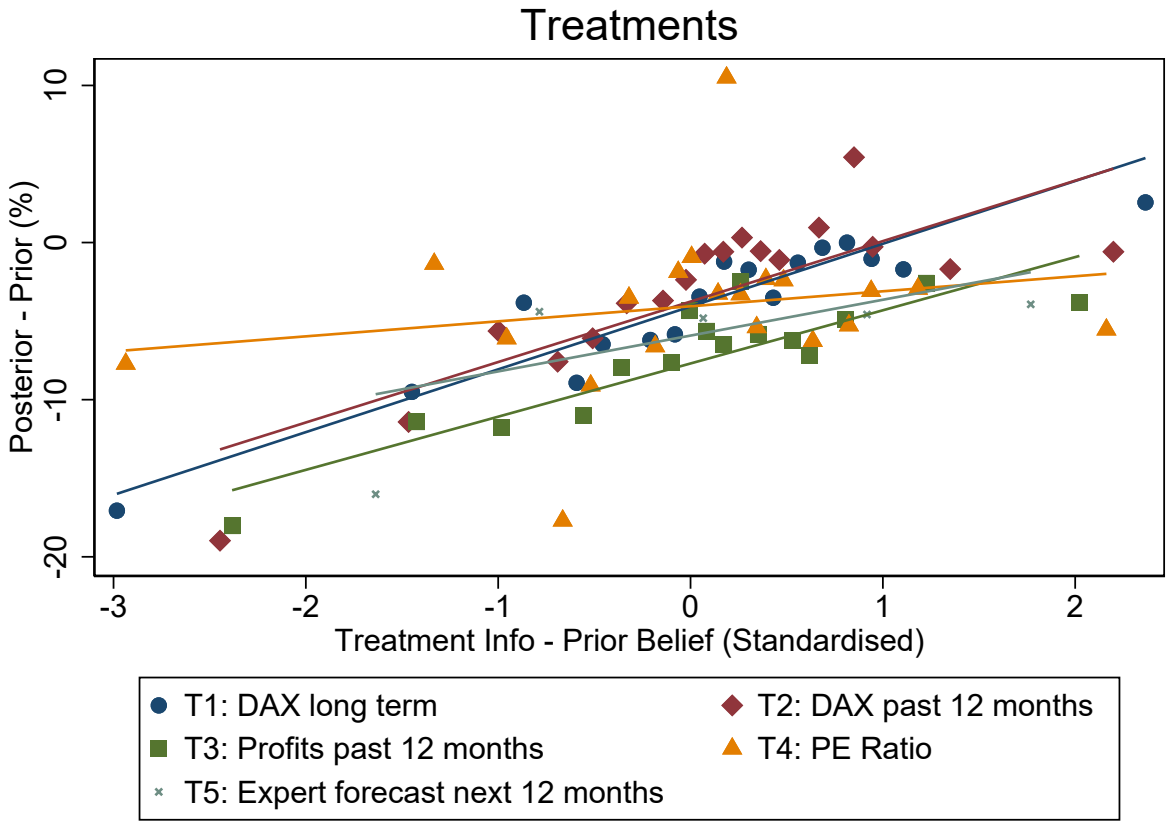
	$E[R_{t+1y}]$
T1 (Rational Expectations)	0.78
	(0.48)
T2 (Extrapolative returns)	1.93***
	(0.44)
T3 (Extrapolative earnings)	-3.19***
	(0.44)
T4 (Expert forecasts)	1.57***
	(0.45)
T5 (Long-term average)	0.40
	(0.41)
N	3,419

→ ***No* response to P/E information**

→ **Extrapolation of returns and earnings growth**

Learning Rates

- Normalize treatment effects by prior perception gaps



→ **Exceptionally low learning rate for P/E information**

→ **Incomplete information *and* non-RE information processing**

Measuring the Information Preference Effect

- Real life: individuals choose information
- Do individuals who prefer an information react *more* or *less* to it?
  - less: might have smaller perception gap
  - more: might process the information differently

$$E[X]_i^{post} = \alpha + \sum_{k=1}^{K-1} \left(\beta_k T_i^k + \psi_k P_i^k + \xi_k T_i^k P_i^k \right) + \dots$$
$$\sum_{j=1}^{J} \left(\sum_{k=1}^{K-1} \gamma_{k,j} T_i^k Z_{i,j} + \delta_j Z_{i,j} \right) + \mathbf{W_i}\phi + \epsilon_i \quad (3)$$

- ξ_k **measures the information preference effect**

$\rightarrow$ ξ_k = Treatment effect if info preferred $-$ treatment effect otherwise

Information Preference Effect (2nd wave)

	$E[R_{1y}]$	$E[R_{5y}]$	$E[\Delta D_{1y}]$	$E[\Delta D_{5y}]$
T1(RE)*P1	-2.81**	-4.86**	-1.75	-2.58
	(1.32)	(2.07)	(2.09)	(2.23)
T2(Extrap. R)*P2	-0.93	-1.84	0.81	-2.71
	(1.21)	(1.66)	(1.68)	(1.86)
T3(Extrap. Earn.)*P3	-3.36**	-3.87*	-5.22***	-6.17***
	(1.62)	(2.26)	(1.97)	(2.19)
N	3183	3183	3128	3128

Individuals who prefer ...

- ... price-earnings ratio information (T1) respond in line with RE.
- ... earnings information in line with learning about fundamentals.

$\Rightarrow$ **Heterogeneity in mental model of the economy affects information acquisition *and* processing** Dominitz and Manski (2011)

Risky Portfolio Share Puzzle

- Test Merton (1969):

$$EquityShare_i^{post} = \alpha + \beta \frac{\widehat{E[R]_i^{post}} - R_f}{Var[R]_i^{post}} + \mathbf{X_i d} + w_i \qquad (4)$$

$\Rightarrow$ Prediction: $\alpha = 0$, $\beta = \frac{1}{\gamma}$ (risk aversion)

- Estimate based on first moments: $\gamma = 50$ Giglio et al. (2021)
- Estimate based on first *and* second moments: $\gamma = 909$ (own estimate)

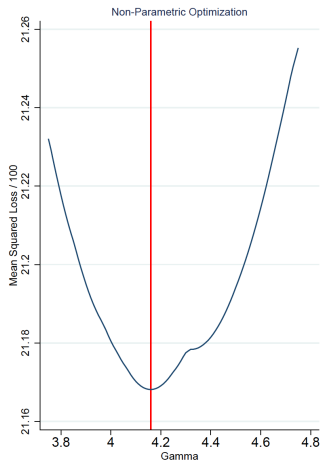
$\Rightarrow$ **Estimated risk aversion, γ, outside plausible range (of 3-10)**

$\Rightarrow$ **Subjective second moments exacerbate puzzle**

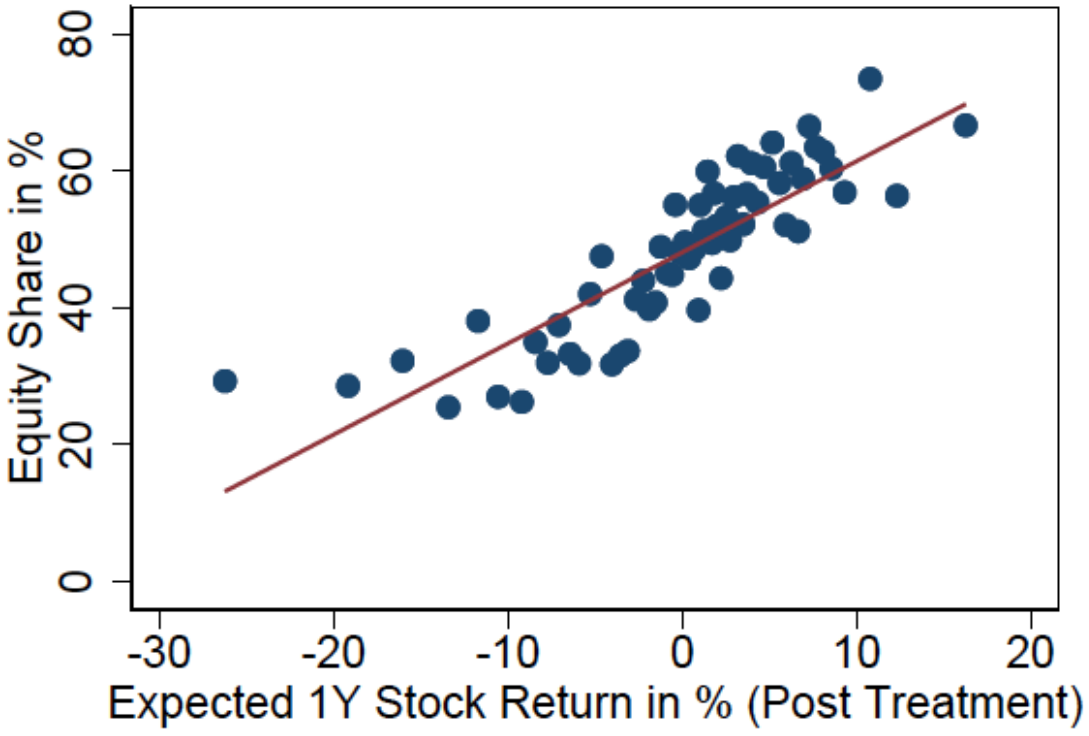
Solving the Puzzle

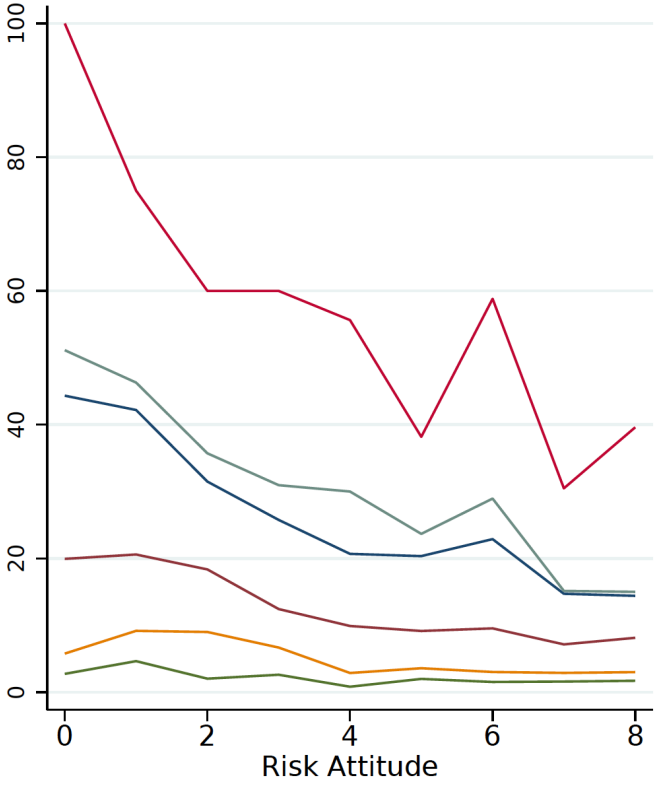
- OLS estimate of γ large because:
  - *Optimal* portfolio share: *unbounded*
  - *Actual* portfolio share: *bounded*
- Impose **leverage constraint**: $EquityShare \leq 100\%$
- Estimate via non-linear least squares (NLLS)
- Result: $\gamma = 4.2$!

$\Rightarrow$ **Imposing leverage constraint and using NLLS solves the puzzle!**



Suggestive Evidence





- Portfolio shares positively correlated with expected returns
- Implied γ smaller for higher willigness-to-take-risks

Conclusion

- Individuals do **not** understand valuations and returns
- Causal evidence for extrapolation of returns *and* earnings

$\rightarrow$ Frictions in information acquisition *and* processing

$\rightarrow$ Heterogeneity matters: mental models

- Conditional on beliefs, households invest rationally

$\rightarrow$ Information interventions to mitigate bubbles and re-distribution (?)

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