Five Facts about Beliefs and Portfolios

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Motivation

- Frontier of Macro-Finance: Using survey data to understand belief formation and link between beliefs and asset prices
 - *Critique:* We don't know what survey-elicited beliefs correspond to, and whether individuals' behavior aligns with those beliefs

• Often missing: Data that links economic decisions and survey expectations for the same individuals

Motivation

- Frontier of Macro-Finance: Using survey data to understand belief formation and link between beliefs and asset prices
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 - Often missing: Data that links economic decisions and survey expectations for the same individuals
- **Our Project:** Study quantitative relationship between *retail* investors' expectations and their portfolio decisions
 - Collaborate with Vanguard to build a new survey of investor expectations and analyze it jointly with administrative data on investor behavior
 - Document that survey responses are informative about investor behavior

 $\rightarrow~$ Theories need to continue to confront this evidence

• Establish set of five facts to inform macro-finance/asset pricing theories

The GMSU-Vanguard Survey

- Bi-monthly survey of randomly selected retail and retirement clients
- Invited via email to complete online survey, 2,000 responses per wave
- First survey fielded in February 2017, will analyze first 15 waves
- End of presentation: Update through Covid-19 crash
- Elicit quantitative beliefs:
 - *Stock returns*: 1-year expectation, 10-year expectation, 5-point distribution of 1-year return
 - *GDP growth*: 3-year expectation, 10-year expectation, 5-point distribution of 3-year growth
 - Confidence in beliefs about each block

Representativeness of Response Sample

- Vanguard clients vs. other investors
 - Second largest asset manager in U.S.: \approx \$6 trillion
 - More likely to follow passive-like strategies and believe in low-fee investment philosophy
 - BUT: Trading frequency similar to other "large" investment managers

- Level and variation in beliefs similar to other surveys
- Flow-performance sensitivity similar to broader investor population

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- Selection of respondents within Vanguard
 - Respondents are wealthier than non-respondents (\$513k vs. \$252k)
 - Relevant for macro-finance models
 - Respondents are older than non-respondents (59.4 years vs. 51.8 years)

Beliefs vs. Portfolios

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Expectations: 1-Year Stock Returns



Average expected return reasonable, though lower than past equity returns

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• Wide dispersion in reported beliefs about stock returns

Expected Stock Returns vs. Equity Share



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Expected Stock Returns vs. Equity Share

	Equity Share (%)			
	(1)	(2)	(4)	
Expected 1Y Stock Return (%)	0.776*** (0.046)	0.816*** (0.046)	0.646*** (0.094)	
Expected 1Y Stock Return (%) x Assets > \$100ł			0.243*** (0.106)	
Controls	Ν	Y	Y	
N	30,991	30,975	30,975	

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- Frictionless benchmark: Merton (1969): $\omega_{E,i} = \frac{1}{\gamma} \frac{E_i[R] R_f}{Var_i[R]}$
- Standard $\gamma = 4 \rightarrow \beta \approx 6.25$
- Significant but low sensitivity Explanations?

1. Measurement Error

- Classical measurement error in survey responses → attenuation bias
- We can use an instrumental variables approach to correct for it
 - Elicit *E_i*[*R*] in two different ways
 - Direct question about 1-year expected returns
 - Implied mean from the distribution \Rightarrow IV
 - **Most powerful:** Use each of the two variables as IV for the other (ORIV approach proposed by Gillen, Snowberg and Yariv, 2019)
- Slope goes from 0.78 to 1.4
 - · Classical ME explains part but not all (or most) of low sensitivity
 - Note: "If measurement error is positively correlated across elicitations, then instrumented coefficients will still be biased downwards, although less so than without instrumenting."

Heterogeneity in the sensitivity lines up with several possible frictions

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- 1. Tax implications
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- 2. Mental and physical costs of trading
 - Monthly turnover
 - Monthly Vanguard logins (attention)
 - Confidence
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- **3.** No evidence on other possible explanations: Heterogeneous risk aversion, labor income risk, assets outside Vanguard

Beliefs vs. Portfolios: Fact 1

Fact 1. Portfolio shares vary with investors' beliefs, but less than predicted by frictionless asset pricing models. The sensitivity of equity shares to the expected stock market returns is higher in tax-advantaged accounts, and increasing in:

- investor trading frequency
- investor attention
- investor confidence.

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Implications:

- Reinforces usefulness of surveys
- Rational & behavioral models: Beliefs $\xrightarrow{\text{Frictionless}}$ demand & prices
 - Empirically, this transmission channel is weak on average
 - Can model adjustments (e.g., infrequent trading) match prices quantitatively?

Trading

Trading analysis

By looking at trading, we can decompose into the **extensive margin** and the **intensive margin** channels

- Extensive margin: do beliefs predict the incidence of trading?
- Intensive margin: do beliefs predict the magnitude of trading, conditional on trading?

Fact 2. While belief changes have little to no explanatory power for predicting when trading occurs, they explain both the direction and magnitude of trading conditional on a trade occurring.

Implications: How to adjust models to better match data?

• Infrequent trading, independent of beliefs (Calvo) ... also need adjustment costs?

A Variance Decomposition of Beliefs

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A Variance Decomposition of Beliefs

- We now dig deeper into the heterogeneity by studying the cross-section of beliefs
- Note: Substantial amount of time-series belief variation
- But: Cross-sectional variation swamps time-series variation
 - Patterns similar through Covid-19 crash of March 2020.



• Question: Idiosyncratic or persistent heterogeneity?

A Variance Decomposition for Beliefs

• Three models, with time and/or individual fixed effects

$$B_{i,t} = \chi_t + \epsilon_{1,i,t}$$

$$B_{i,t} = \phi_i + \epsilon_{2,i,t}$$

$$B_{i,t} = \phi_{3,i} + \chi_{3,t} + \epsilon_{3,i,t}$$

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	R ² (%) of Panel Regression			
	Time FE	Individual FE	Time + Individual FE	N
Expected 1Y Stock Return (%)	2.4	58.8	60.8	3,400
Expected 10Y Stock Return (% p.a.)	0.5	46.8	47.3	3,379
Probability 1Y Stock Return < -10%	0.4	56.6	57.0	3,465
St.d. Expected 1Y Stock Return (%)	0.3	59.7	60.0	3,465
Confidence (Stock Qs)	0.2	64.8	64.8	3,440
Expected 3Y GDP Growth (% p.a.)	0.9	53.7	54.4	3,407
Expected 10Y GDP Growth (% p.a.)	0.3	46.7	46.9	3,388
Probability p.a. 3Y GDP Growth < 0%	0.3	53.8	54.0	3,453
St.d. Expected p.a. 3Y GDP Growth (%)	0.7	59.5	60.1	3,453
Confidence (GDP Qs)	0.1	66.5	66.6	3,432
Expected 1Y Return of 10Y bond (%)	1.8	51.0	52.3	3,376
Confidence (Bond Qs)	0.1	66.2	66.4	3,394

• We require at least 3 responses, robust to requiring more

A Variance Decomposition for Beliefs

- Panel variation well characterized by persistent across-individual heterogeneity
 - · Hard to separate individual fixed effects vs. highly persistent beliefs
 - Often very similar implications for theory
- Consistent with what we find in the RAND American Life Panel
 - Other major survey with substantial panel component
 - True over many years of data and responses (50 responses)
- Individual fixed effects are not well explained by demographic variation
 - Consistent with literature exploring beliefs in the cross-section: Statistically significant relationships, but low R²
 - Here: Conclude that this is not driven by measurement error in beliefs, since measurement error averages out in fixed effects

Variance Decomposition for Beliefs

Fact 3. Variation in individual beliefs is well characterized by heterogeneous individual fixed effects. The persistent heterogeneity in individual beliefs is not explained by observable demographic characteristics.

Implications:

- Models based on time variation in average beliefs
 - All action comes from time series; silent on the cross-section
 - Enrich to account for cross-sectional patterns
- Models with constant differences in beliefs
 - E.g., Geanakoplos (2009)
 - Action comes from wealth redistribution optimists/pessimists
 - Requires that the heterogeneity is reflected in portfolios (Facts 1 and 2)

Beliefs On Stocks vs. GDP

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Beliefs On Stocks vs. GDP

- So far we have focused on heterogeneity in beliefs about one object at a time (e.g., expected 1 year returns)
- Now relate beliefs about different objects
- Note: all patterns hold in the time series and in the cross-section



Expectations about Stocks vs. GDP

Beliefs On Stocks vs. GDP

Fact 4. Higher expected cash flows are associated with higher expected returns, both within and across individuals.

Implications:

 Correlation between expected returns and cash flows is informative for models. Consider the C-S decomposition:

$$pd_t \approx E_{i,t} \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - E_{i,t} \sum_{j=0}^{\infty} \rho^j r_{t+1+j}.$$

- **Time-series**: time variation in cash-flow expectations can be offset by correlated time variation in expected returns
- Papers that match only one type of survey evidence (either returns or cash-flows) overstate the impact on prices

Rare Disaster Beliefs and Expected Returns

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Tail Risk

• Focus on the relation between tail risk and other beliefs



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Tail Risk

Fact 5. Higher expectations of stock market disasters are associated with lower expected stock market returns, both across and within individuals.

Implications:

- **Cross-section**: Supports models of disagreement about rare disasters, like Chen, Joslin and Tan (2012).
- **Time series**: models of time-varying disasters (Gabaix 2012, Wachter 2013) imply that when disaster probability increases, expected returns should *increase* via general equilibrium effects

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Individuals' data says the opposite

Conclusion

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Conclusion

- New large-scale quantitative **survey of investor beliefs**, linked to portfolio data
- Shed direct light on the link between beliefs and economic decisions
- The **5** facts we distill from this rich data provide new insights about theoretical mechanisms in macro-finance models. Four ingredients:
 - **1** Large, persistent heterogeneity in beliefs about returns and cash flows

- 2 Heterogeneity in belief-to-portfolio pass-through; muted on average
- **3** Infrequent trading and portfolio adjustment costs
- Overconfidence and "agreeing to disagree"
- New and exciting research area

Inside the Mind of a Stock Market Crash

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Market Crash and Surveys' Timing



Expected 1-y Stock Returns Went Down After Crash



- Expected disaster probability also increased
- Most people become more pessimistic; ex-ante pessimists only category to increase expectations

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Long-run expected stock returns unaffected

Disagreement About Stock Market Increased After Crash



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Expected 3-y Real GDP Growth Went Down After Crash



Relatively modest decline in expected 3-year annualized GDP growth.

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Active Trading by Level of Optimism: Cond. on Trading

