

Five Facts about Beliefs and Portfolios

Stefano Giglio
Yale SOM

Matteo Maggiori
Stanford GSB

Johannes Stroebe
NYU Stern

Stephen Utkus
Vanguard

Expectations, Heterogeneity, and Portfolio Choice

- Beliefs play a central role in essentially all intertemporal models of asset prices
- Much to learn about beliefs are formed, and how these beliefs translate into actions.
- **Our Project:** Design and field a new survey of Vanguard retail clients to study quantitative relationship between investors' expectations and their portfolios
 - Establish set of five facts to inform macro-finance/asset pricing theories
 - Document that survey responses are informative about investor behavior
 - Theories need to continue to confront survey evidence
 - Survey data can provide guidance for development of new theories

The GMSU-Vanguard Survey of Expectations Project

- Bi-monthly survey of randomly selected retail and retirement clients
- Invited via email to complete an online survey
- First survey fielded in February 2017, we analyze first 21 waves (to June 2021)
 - Results robust to excluding COVID-19 cash
- Approximately 2,000 responses per wave
- 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 stock returns and GDP growth

Email Invitation to Random Sample of Vanguard Clients



Vanguard would like your input

Dear Jane Doe:

Vanguard is conducting a study to understand how investors are thinking about the future of the stock market, the economy and interest rates.

We are inviting you to provide us with your thoughts by completing a short survey. This survey should take less than ten minutes to complete.

This survey is not a test of your knowledge. Rather, it asks only about your beliefs and expectations. Importantly, it does not ask for any personal financial information.

The results of the survey will be used for research purposes only. This survey is not sales-related in any way. Your responses will be reported in aggregate with other responses. We plan to publish the results in an article or research report on vanguard.com.

To participate in the survey, please click here.

[Take the survey](#)

We'd also like to send you this survey up to six times in the coming year, to see if your beliefs are changing. If you want to be removed from this study, you have the option to click the unsubscribe link below.

If you have any questions about this survey, please call **800-662-2739** and refer to this code: **EXP**.

Thank you for participating, and for sharing your thoughts with Vanguard.

Regards,

Stephen Utkus
Principal

Example: 1-year expected stock market return



What do you expect the return of the US stock market to be **over the next 12 months**?

Note: This expected return is the change in value, in percent, that you expect to receive **over the next 12 months** from investing in a portfolio that holds all stocks listed on the US stock market. It includes both dividends and capital gains/losses.

(Please answer only with a positive or negative numeric value, with at most 1 decimal.)

% over the next 12 months

Next

POWERED BY CONFIRMIT

- Wherever possible: Use framing from existing surveys such as NY Fed SCE

Example: 1-year stock market distribution



In this question we present you with five possible scenarios for US stock market returns **over the next 12 months**:

The US stock market return will be...

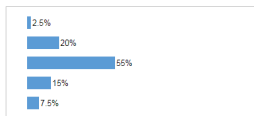
- Scenario 1: **more than 40%** over the next year.
- Scenario 2: **between 30% and 40%** over the next year.
- Scenario 3: **between -10% and 30%** over the next year.
- Scenario 4: **between -30% and -10%** over the next year.
- Scenario 5: **less than -30%** over the next year.

Please let us know how likely you think it is that each scenario will occur.

Please type in the number to indicate the probability, in percent, that you attach to each scenario. The probabilities of the five scenarios have to sum up to 100%. The graphic bar chart on the right updates automatically to reflect your answers.

(Please answer only with a positive numeric value, with at most 1 decimal.)

more than 40%	<input type="text" value="2.5"/>	%
between 30% and 40%	<input type="text" value="20"/>	%
between -10% and 30%	<input type="text" value="55"/>	%
between -30% and -10%	<input type="text" value="15"/>	%
less than -30%	<input type="text" value="7.5"/>	%
<hr/>		
Total	100.0	%



Remaining probability to fill in: 0.0%

Next

Powered by Coursera

Advantages of GMS-Vanguard Investor Expectation Survey

1. Designed questions with aim to inform macro-finance theories
2. Respondents are relatively wealthy and experienced investors
 - More familiar with stock returns and economic growth
→ Take quantitative answers seriously
 - Relevant for macro-finance models
3. Ability to link beliefs to portfolios and trading behavior
 - Quantify the mechanism through which expectations affect aggregate outcomes
4. Observe many repeat respondents
 - Panel dimension: Decompose cross-sectional and time-series variation

Representativeness of Response Sample

- Vanguard clients vs. other investors
 - Second largest asset manager in U.S.: \$6 trillion
 - Cogent Wealth Reports (2018): On average older and richer
 - More likely to follow passive-like strategies & low-fee investment philosophy?
 - BUT: Trading frequency similar to other “large” investment managers
 - Level and variation in beliefs similar to other surveys; also possible to verify other survey patterns
 - Flow-performance sensitivity similar to broader investor population

Representativeness of Response Sample

- Vanguard clients vs. other investors
 - Second largest asset manager in U.S.: \$6 trillion
 - Cogent Wealth Reports (2018): On average older and richer
 - More likely to follow passive-like strategies & low-fee investment philosophy?
 - BUT: Trading frequency similar to other “large” investment managers
 - Level and variation in beliefs similar to other surveys; also possible to verify other survey patterns
 - Flow-performance sensitivity similar to broader investor population
- Selection of respondents within Vanguard
 - Respondents are wealthier than non-respondents (\$513k vs. \$252k)
 - Respondents are older than non-respondents (59.4 years vs. 51.8 years)

Five Facts about Beliefs and Portfolios

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:

- wealth
- investor trading frequency
- investor attention
- investor confidence.

Five Facts about Beliefs and Portfolios

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:

- wealth
- investor trading frequency
- investor attention
- investor confidence.

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.

Five Facts about Beliefs and Portfolios

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.

Five Facts about Beliefs and Portfolios

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.

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

Five Facts about Beliefs and Portfolios

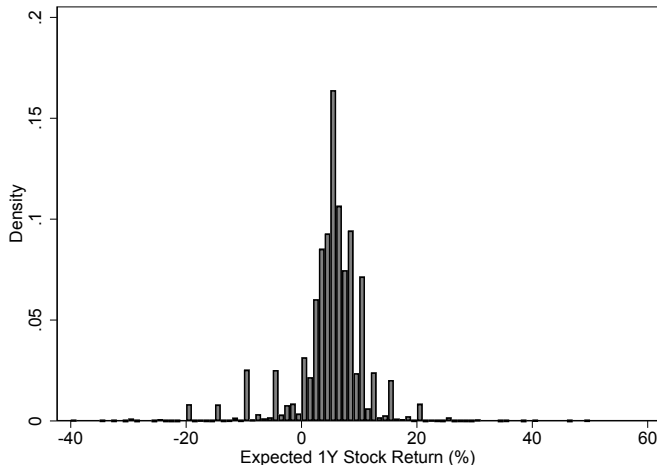
Fact 3. Variation in individual beliefs is well characterized by heterogeneous individual fixed effects. The persistent heterogeneity in individual beliefs is not explained by observable demographic characteristics.

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

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

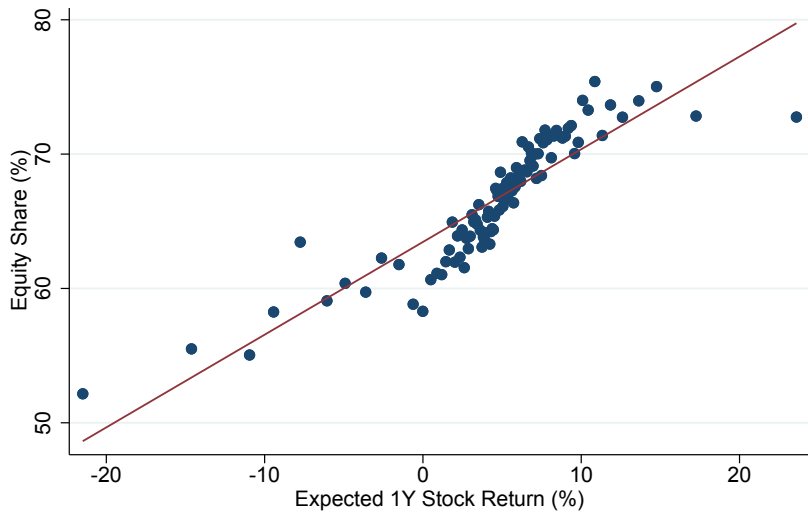
Beliefs vs. Portfolios

Expectations: 1-Year Stock Returns



- Average expected return reasonable, though lower than past equity premium
- Wide dispersion in reported beliefs about stock returns

Expected Stock Returns vs. Equity Share



Expected Stock Returns vs. Equity Share

	Equity Share (%)				
	(1)	(2)	(3)	(4)	(5)
Expected 1Y Stock Return (%)	0.672*** (0.034)	0.690*** (0.034)	1.164*** (0.061)	0.634*** (0.053)	0.818*** (0.042)
Expected 1Y Stock Return (%) x Assets > \$225k				0.114* (0.067)	
Controls	N	Y	Y	Y	Y
Sample			E(Return) 0%-15%		Feb 2017 - Feb 2020
N	44,595	44,565	39,296	44,565	39,859

- Frictionless benchmark: Merton (1969): $\omega_{E,i} = \frac{1}{\gamma} \frac{E_i[R] - R_f}{\text{Var}_i[R]}$
- 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 variable** approach to correct for it
 - Elicit $E_i[R]$ in two different ways
 - ① Direct question about 1-year expected returns
 - ② 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, JPE 2019)

1. Measurement Error

- **Classical measurement error** in survey responses → attenuation bias
- We can use an **instrumental variable** approach to correct for it
 - Elicit $E_i[R]$ in two different ways
 - ① Direct question about 1-year expected returns
 - ② 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, JPE 2019)
- Slope goes from **0.69 to 1.17**
 - Classical ME explains part but not all (or even most) of the 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.”*

2. Frictions

Heterogeneity in the sensitivity lines up with several possible **frictions**

1. Default options in retirement accounts and tax implications
 - DC plans vs. retail accounts vs. tax-advantaged IRAs

2. Frictions

Heterogeneity in the sensitivity lines up with several possible **frictions**

1. Default options in retirement accounts and tax implications

- DC plans vs. retail accounts vs. tax-advantaged IRAs

2. Mental and physical costs of trading

- Monthly turnover
- Monthly Vanguard logins (attention)
- Confidence

→ Along each dimension, sensitivity ranges from **0.7 to 1.7**

2. Frictions

Heterogeneity in the sensitivity lines up with several possible **frictions**

1. Default options in retirement accounts and tax implications

- DC plans vs. retail accounts vs. tax-advantaged IRAs

2. Mental and physical costs of trading

- Monthly turnover
- Monthly Vanguard logins (attention)
- Confidence

→ Along each dimension, sensitivity ranges from **0.7 to 1.7**

→ For an investor with high turnover, high attention, and high confidence, sensitivity is **3.5**

2. Frictions

Heterogeneity in the sensitivity lines up with several possible **frictions**

1. Default options in retirement accounts and tax implications

- DC plans vs. retail accounts vs. tax-advantaged IRAs

2. Mental and physical costs of trading

- Monthly turnover
- Monthly Vanguard logins (attention)
- Confidence

→ Along each dimension, sensitivity ranges from **0.7 to 1.7**

→ For an investor with high turnover, high attention, and high confidence, sensitivity is **3.5**

3. No evidence for 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:

- wealth
- investor trading frequency
- investor attention
- investor confidence.

Beliefs vs. Portfolios: Implications

- High level: Reinforces **usefulness of surveys**
 - Importance of high-quality, large-scale survey data
 - Directly address measurement error & explore heterogeneity
 - Theories can benefit from confronting belief data
- Implications for **rational and behavioral models**
 - Many models are founded on a frictionless transmission of (rational or irrational) beliefs onto demand, then onto prices
 - Empirically, this transmission channel is weak on average, but higher along some dimensions of heterogeneity
 - What are general equilibrium implications: Beliefs \rightarrow Prices?
 - Do we need model adjustments to match these moments 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.

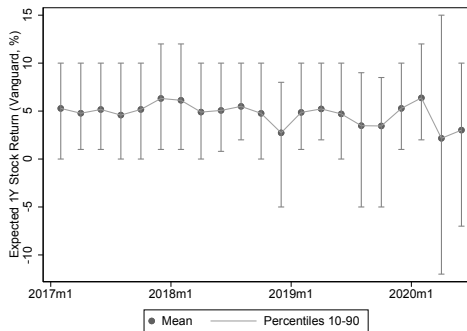
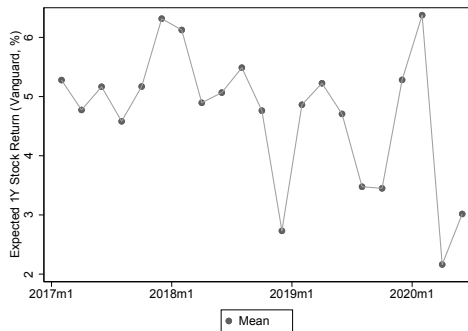
Implications: How to adjust models to better match data?

- Infrequent trading, independent of beliefs (Calvo)

A Variance Decomposition of Beliefs

A Variance Decomposition of Beliefs

- 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



- **Question:** Idiosyncratic or persistent heterogeneity?

A Variance Decomposition for Beliefs

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

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

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

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

A Variance Decomposition for Beliefs

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

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

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

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

	R ² (%) of Panel Regression			N
	Time FE	Individual FE	Time+Individual FE	
Expected 1Y Stock Return (%)	5.0	47.5	51.5	1,960
Expected 10Y Stock Return (% p.a.)	0.5	45.0	45.5	1,964
Probability 1Y Stock Return < -10%	2.7	51.5	53.6	2,011
St.d. Expected 1Y Stock Return (%)	0.5	56.7	57.2	2,011
Confidence (Stock Qs)	1.4	60.6	62.0	1,988
Expected 3Y GDP Growth (% p.a.)	3.8	43.9	46.8	1,968
Expected 10Y GDP Growth (% p.a.)	0.6	39.7	40.2	1,952
Probability p.a. 3Y GDP Growth < 0%	5.1	45.4	49.3	2,010
St.d. Expected p.a. 3Y GDP Growth (%)	1.0	56.5	57.3	2,010
Confidence (GDP Qs)	0.8	62.8	63.8	1,978
Expected 1Y Return of 10Y bond (%)	2.4	38.8	40.7	1,953
Confidence (Bond Qs)	0.4	62.9	63.3	1,969

- We require at least 5 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 AR(1)
 - 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 R^2
 - 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

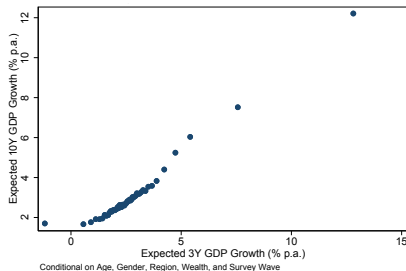
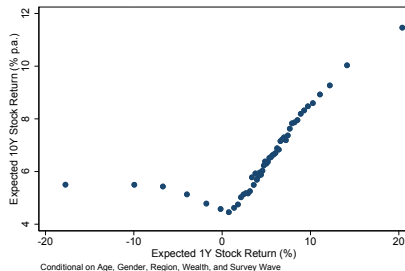
Beliefs On Stocks vs. GDP

- 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

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

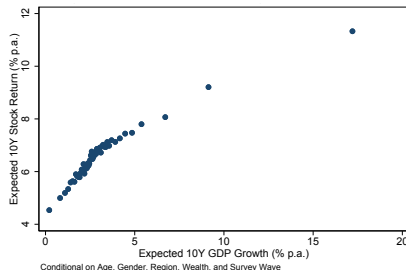
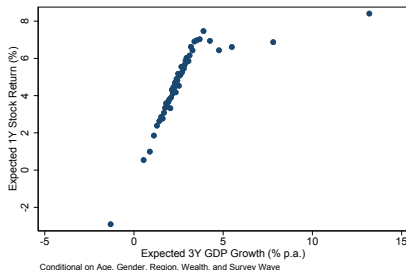
Long-run vs. Short-run Expectations



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:

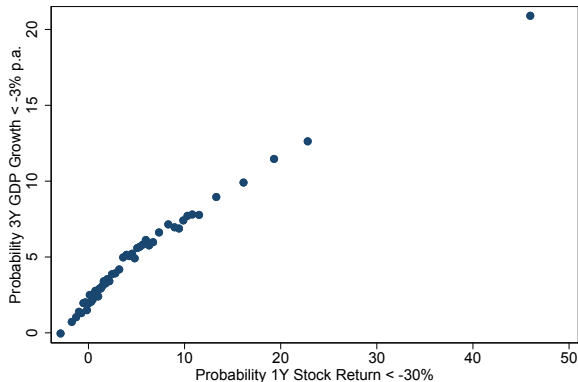
$$pd_t \approx E_{i,t} \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - E_{i,t} \sum_{j=0}^{\infty} \rho^j r_{t+1+j}.$$

- **Time-series:** time variation in stock beliefs can be offset by correlated time variation in expected return beliefs
- Calibrations that match only one side, overstate importance of beliefs

Tail Risk in Stocks and GDP

Tail Risk

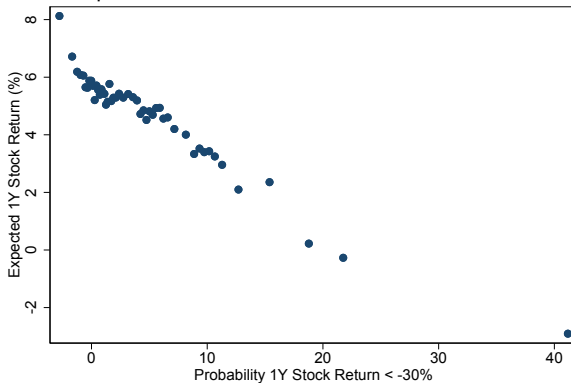
- Focus on the relation between **tail risk** and other beliefs



- In the **rare disasters model**
 - GDP and stock market crashes should be **positively** related

Tail Risk

- Focus on the relation between **tail risk** and other beliefs



Tail Risk

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

Implications:

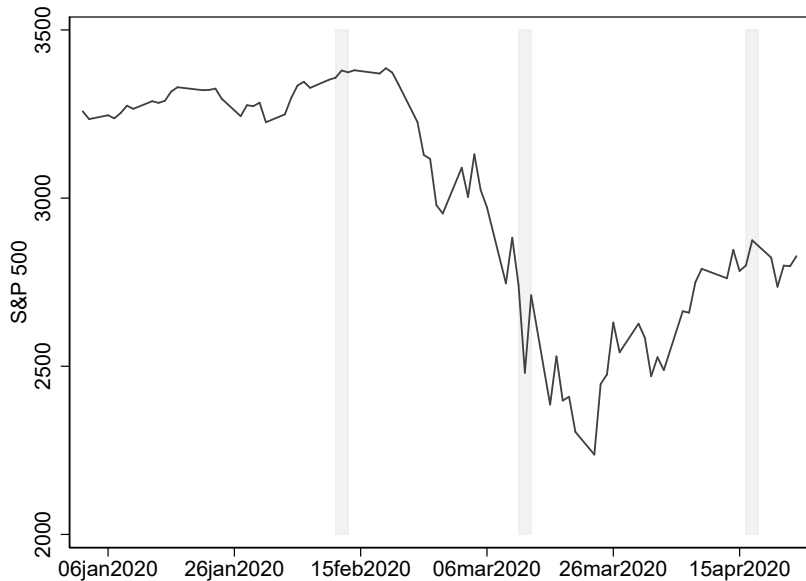
- **Cross-section:** supports models of disagreement about rare disasters, like Chen, Joslin and Tran (2012).
- **Time series:** Representative agent models of time-varying disasters (Gabaix 2012, Wachter 2013) imply that when disaster probability increases, expected returns should *increase* via general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

Conclusion

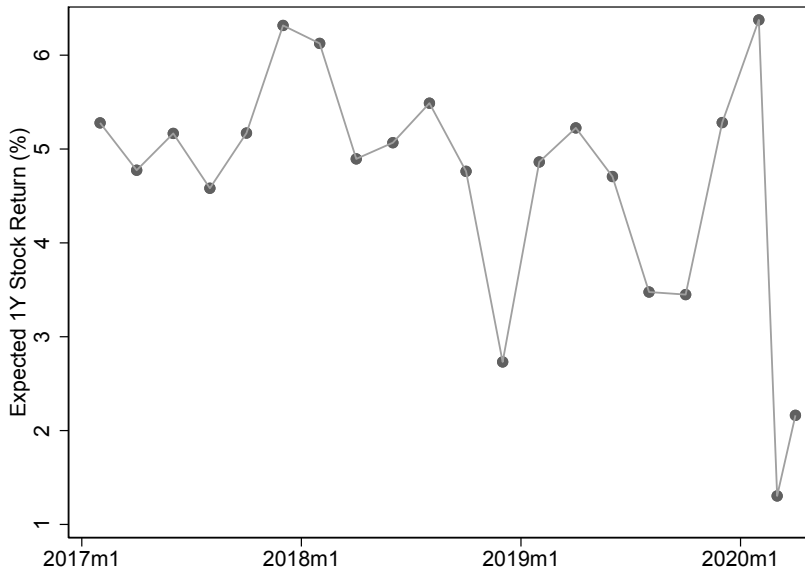
- New large-scale quantitative **survey of investor beliefs**, linked to portfolio data
- Shed direct light on the link between beliefs and economic decisions
- The **5 facts** we distill from this rich data provide new insights about theoretical **mechanisms in macro-finance models**. Four ingredients:
 - 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
 - ④ Overconfidence and “agreeing to disagree”

Inside the Mind of a Stock Market Crash

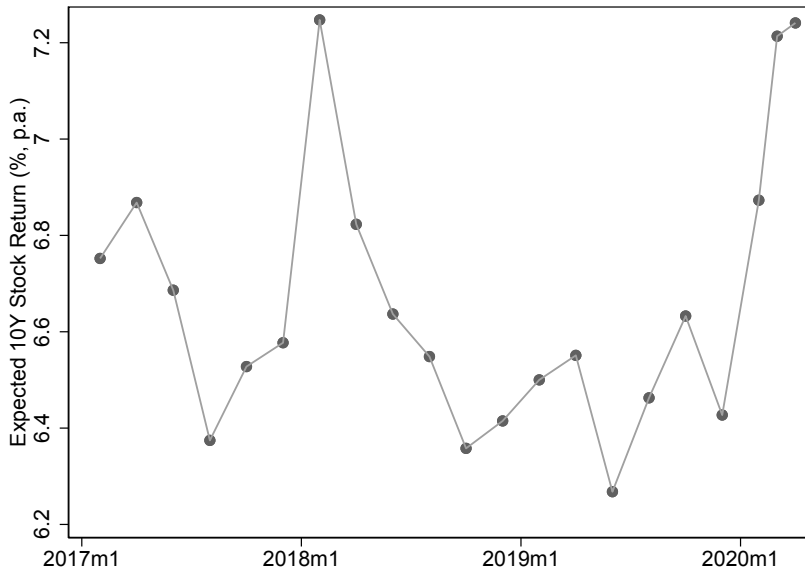
Market Crash and Surveys' Timing



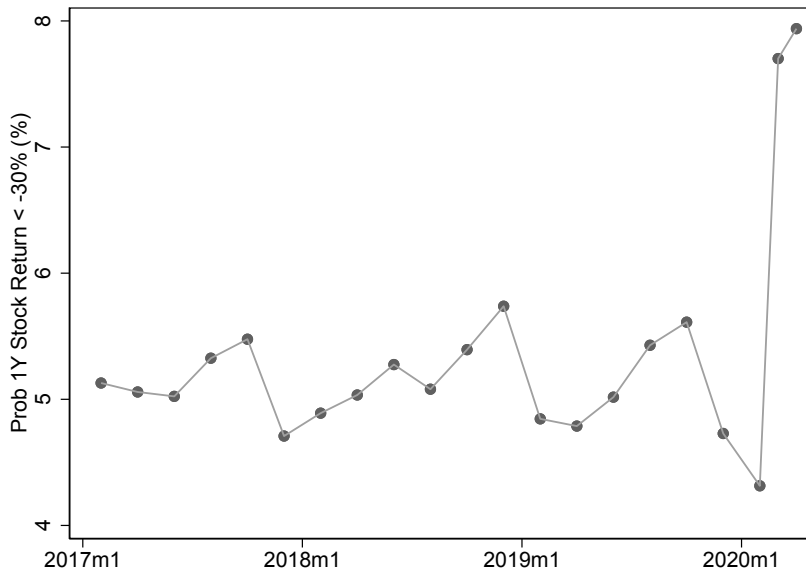
Expected 1-y Stock Returns Went Down After Crash



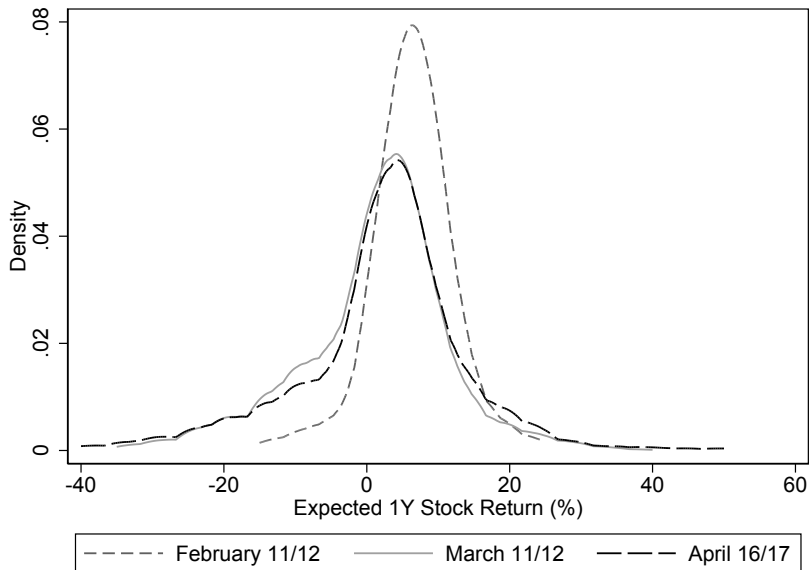
Expected 10-y Stock Returns "Unchanged" After Crash



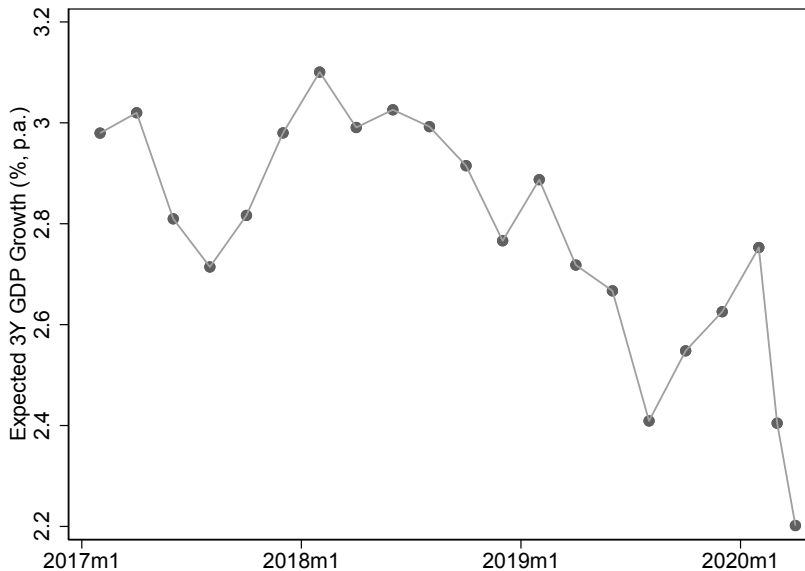
Prob Stock Market Disaster Went Up After Crash



Disagreement About Stock Market Increased After Crash



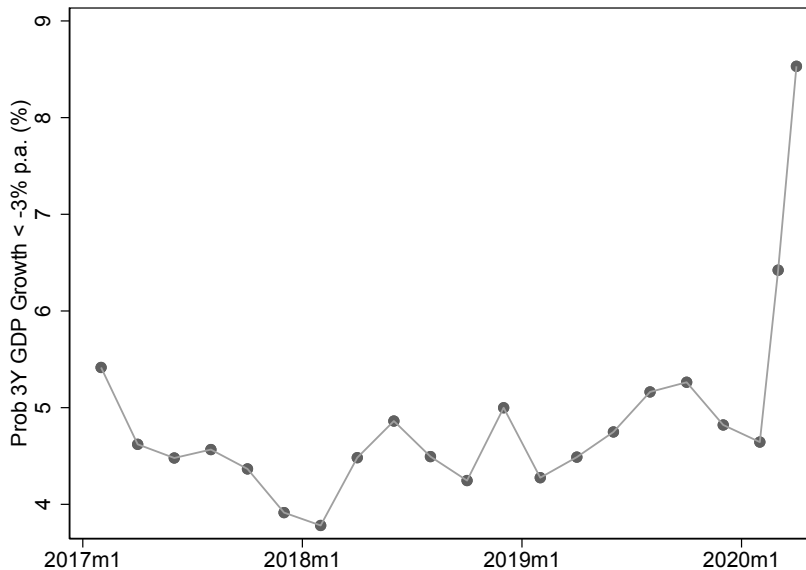
Expected 3-y Real GDP Growth Went Down After Crash



The Magnitude of Growth Expectations

- We observe only moderate fall in growth expectations (from 2.8% per year to **2.2%** per year over next three years)
- Some approximate comparisons in “real time”:
 - IMF forecasted in April approx. -0.7% per year for next 2 years
 - WSJ survey of professional forecasters 0.88% per year for next 3 years
 - Growth after financial crisis over 3 years was 0.3% per year
- All expectations incorporate a quicker recovery than the financial crisis, but disagree on the strength
- Many of these initial forecasts were subsequently revised up

Prob of GDP Disaster Went Up After Crash



Individual Belief Dynamics

- Substantial panel element allows us to track the beliefs of the same people before, during, after the crash
- Sort people into buckets of optimism based on February wave
- Track changes in beliefs in March and April
 - Will focus on Feb → March changes


Individual Belief Dynamics

Expected 1y Stock Ret (Feb)	Change in Expected 1y Stock Returns (Feb - Mar, ppt)					
	Less than -20	Between -20 and -10	Between -10 and -5	Between -5 and 0	Between 0 and 5	Greater than 5
Less than 0%	0%	3%	9%	25%	19%	44%
Between 0% and 5%	9%	18%	11%	35%	18%	10%
Between 5% and 10%	10%	13%	12%	41%	14%	9%
Greater than 10%	4%	29%	29%	24%	5%	8%

← Become more pessimistic Become more optimistic →

Individual Belief Dynamics

Expected 1y Stock Ret (Feb)	Change in Expected 1y Stock Returns (Feb - Mar, ppt)						Share more optimistic
	Less than -20	Between -20 and -10	Between -10 and -5	Between -5 and 0	Between 0 and 5	Greater than 5	
Less than 0%	0%	3%	9%	25%	19%	44%	63%
Between 0% and 5%	9%	18%	11%	35%	18%	10%	27%
Between 5% and 10%	10%	13%	12%	41%	14%	9%	23%
Greater than 10%	4%	29%	29%	24%	5%	8%	13%



Become more pessimistic Become more optimistic

- Most people become more pessimistic
- Ex-ante pessimists only category to increase expectations
- Not driven by mean reversion

Beliefs and Trading

- Track trading of retail clients of Vanguard
- Overall flows from equity & bonds to cash
- Active flows out of equity $< 1\%$ of portfolio shares
 - $\approx 70\%$ of respondents leave portfolio unchanged
 - Small relative to large change in expected returns
 - Largest flows come from initial optimists (who turned most pessimistic)

Summary + Links to Theory

- Empirical paper documenting investor behavior during a crash. What theories can explain it?
- **Dynamics of Beliefs**
 - Investors become pessimistic about the short-term
 - Belief Formation + Extrapolative expectations
 - Increased perceived risk of disaster
 - Rare disaster models
 - \uparrow disagreement + Heterogeneity in belief dynamics
 - Representative agent macro-finance models
- **Dynamics of Trading**
 - Low elasticity. Flows out of equity $< 1\%$, large proportion w/o trade
 - Heterogeneity in trading for optimists and pessimists
 - Important to understand transmission of beliefs into actions