Long Term Expectations and Aggregate Fluctuations

Bordalo, Gennaioli, La Porta, O'Brien and Shleifer

Economic and Financial Volatility

- Business Cycle Volatility (Burns and Mitchell 1938)
- Excess Stock Market Volatility (Shiller 1981)
- The Stock Market as a leading Indicator (Merton 1980, Stock and Watson 2023)

- Approach to Business Cycles: Fundamental shocks (e.g. TFP) + RE
  - Problem: does not give excess stock market volatility

- Conventional “fix”: time varying risk premia + RE
  - Problem: hard to measure, and inconsistent with measured expectations of returns

This Paper

- Fundamental shocks + ~~RE~~
  - Data on stock analyst forecasts of *individual* firms' future earnings growth
  - BGLS (2022): LTG overreacts and predict stock returns

- Expected Long Term Earnings Growth (LTG) for S&P 500 firms accounts for:
  - Excess volatility of stock price and volatility in interest rates & credit spreads
  - Boom-bust dynamics in investment and other business-cycle indicators

- Reconcile Shiller and Lucas based on Keynes
  - Long term profit expectations = Animal spirits
  - Volatile long term expectations key to the finance-investment nexus

- Expectations and the Business Cycle (Beaudry and Portier 2006, Lorenzoni 2009, Angeletos et al. 2018-20)
  - Departure from rationality and measured expectations
  - Reconciliation with Shiller and financial volatility

- Investment cycles (Greenwood et al. 1988, Justiniano et al. 2011)
  - Keynes' volatile animal spirits, not on changing price of investment
  - Later show that high current LTG predicts bad MEI shocks in the future

- Departures from RE in macro (Gabaix 2019, Bianchi et al. 2021, L'Huillier et al. 2021, BGST 2020…)
  - Underscore importance of Long Term overreaction
  - Much to do on understanding origins and propagation

Roadmap

1. LTG and Financial Markets Volatility
   - Shiller's excess volatility puzzle
   - Volatility in bond markets and credit spreads

2. LTG and boom-bust real investment cycles

3. LTG, other BC indicators and the "Marginal Efficiency of Investment"

Shiller's Excess Volatility Puzzle

- Under constant required return r, the stock price is:

$$p_t^R = d_t + \frac{k-r}{1-\alpha} + \sum_{s \geq 0} \alpha^s \mathbb{E}_t(g_{t+1+s})$$

- Shiller's idea: d_t and $\mathbb{E}_t(g_{t+1+s})$ vary little.

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- Shiller's idea: d_t and $\mathbb{E}_t(g_{t+1+s})$ vary little.

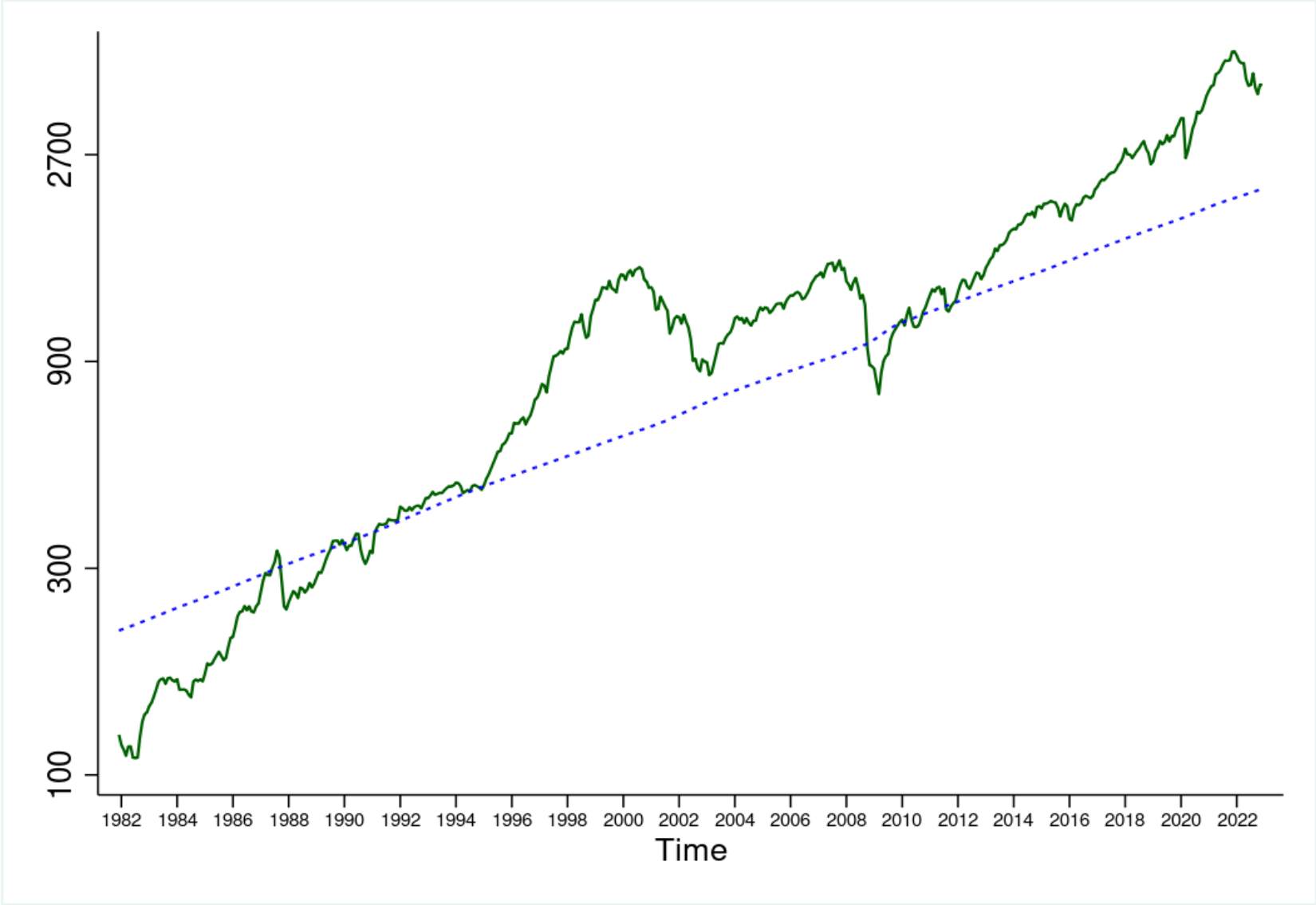
- To quantify, he constructed a "rational price" under perfect foresight of dividends

$$p_t^* = d_t + \frac{1-\alpha^{T-t}}{1-\alpha}(k-r) + \sum_{s=t}^{T} a^{s-t}(d_{s+1} - d_s) + \alpha^{T-t} * (p_{2022}^* - d_{2022}),$$

conventional values (monthly frequency) $\alpha = 0.99$, $k = 0.0138$, $r = 8.75\%$, and $g = 5.7\%$

Excess Volatility during 1981-2022

Green: actual p_t
Blue: rational p_t^*



Expectations Based Price Index

- IBES Expectations of earnings per share for $s = 1,2$ years ahead, and about long term earnings growth (LTG, over the next business cycle):

$$EPS_{t,t+s} = \sum_{i \in S\&P500} \mathbb{E}_t^O[EPS_{it+s}] \frac{Q_{it}}{S_t}, \qquad LTG_t = \sum_{i \in S\&P500} LTG_{it} \left(\frac{P_{it} Q_{it}}{PQ} \right)$$

where S_t is the S&P 500 divisor. LTG available starting from 1981

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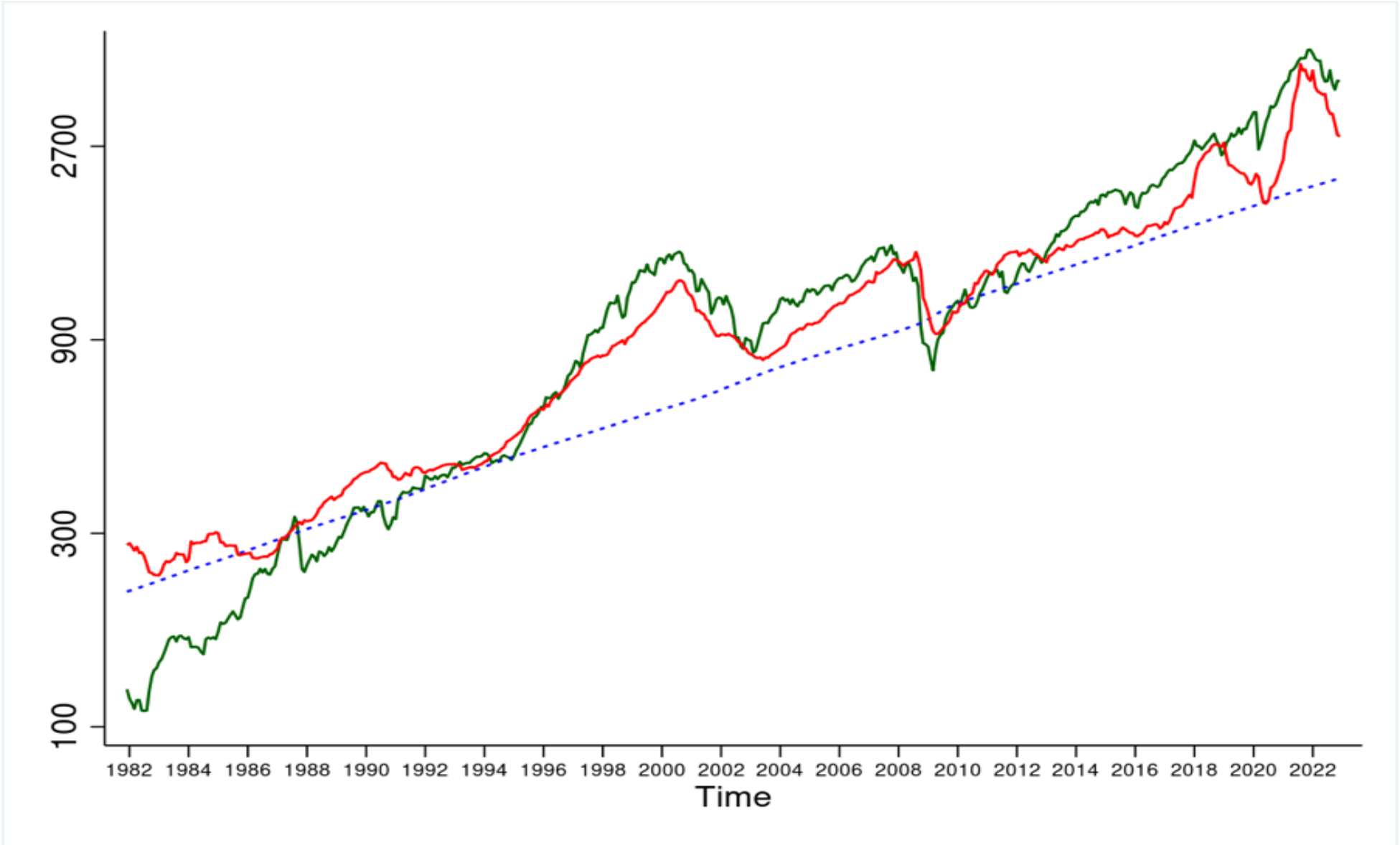
- Earnings Expectations based price index

$$\tilde{p}_t = e_t + \frac{\tilde{k} - r}{1 - \alpha} + \ln\left(\frac{EPS_{t,t+1}}{EPS_t} \right) + \alpha \ln\left(\frac{EPS_{t,t+2}}{EPS_{t,t+1}} \right) + \sum_{s=2}^{10} \alpha^s \, LTG_t + \frac{\alpha^{10}}{1 - \alpha} \, g_*$$

Where $\tilde{k} = 0.0123$ and g_* set to match average price in 1981-2022

red line: $\tilde{p}_t$



Volatile Expectations Account for Shiller

	Earnings Indexes		
	Δp	Δp^*	$\Delta \tilde{p}$
Standard deviation	14.8%	0.7%	14.6%
95% Conf Interval	13.9%-15.9%	0.6%-0.7%	13.7%-15.6%

This table reports the standard deviation and 95th confidence interval of one-year change in: (a) the log of the price of the SP500 index, Δp, (b) the rational benchmark index, Δp^* (equation 3), and (c) the price index based on earnings forecasts (Equation 4), $\Delta \tilde{p}$. The sample period is 12/1982 to 12/2022.

- Non Rationality? Use LTG_t to predict $FE_{t\prime+s} = E_{t\prime}(g_{t\prime+s}) - g_{t\prime+s}, t' \geq t$

Table 2: LTG, Forecast Errors, and Expectations of Stock Returns

	Time Horizon of Dependent Variable (Quarters) B^h Estimates From: $y_{t+h} = B^h LTG_t$										
	0	1	2	3	4	5	6	7	8	9	10
DV: **forecast errors 1Y**$_{t+h}$											
LTG_t	9.99***	12.58***	13.82***	13.80***	13.21***	12.25***	11.15***	9.67***	7.47***	5.26**	3.35
	[2.88]	[2.53]	[2.14]	[2.09]	[2.06]	[2.03]	[2.01]	[2.11]	[2.23]	[2.36]	[2.39]
DV: **forecast errors 2Y**$_{t+h}$											
LTG_t	5.36***	5.58***	5.53***	5.23***	4.18**	3.42	1.96	0.66	-0.36	-1.18	-2.12
	[1.40]	[1.50]	[1.71]	[1.95]	[1.97]	[2.15]	[1.93]	[1.67]	[1.68]	[1.69]	[1.46]
DV: **forecast errors 5Y**$_{t+h}$											
LTG_t	3.69***	3.49***	3.04***	2.38***	1.53*	0.58	-0.33	-1.14	-1.63*	-1.81**	-1.69*
	[0.74]	[0.74]	[0.75]	[0.78]	[0.82]	[0.86]	[0.90]	[0.90]	[0.87]	[0.85]	[0.87]
DV: **expected 1Y sp500 return (cfo)**$_{t+h}$											
LTG_t	0.36	0.61**	0.45	0.43	0.34	0.25	-0.38	-0.75**	-0.61**	-0.19	0.09
	[0.25]	[0.25]	[0.31]	[0.34]	[0.37]	[0.43]	[0.25]	[0.28]	[0.27]	[0.30]	[0.27]

- Optimism => future disappointment
- BGLS (2022) ties to market inefficiency => LTG is a major predictor of stock returns

- LTG can account for stock market volatility despite stable fundamentals. Little, if any, need for time varying risk premia.

- In fact, excessively volatile beliefs are isomorphic to time varying SDF

$$r_{t+1}^{f} = -log\beta - \frac{1}{2}\gamma^2\sigma_g^2 + \gamma\mu g_t + \gamma\omega_t$$

$$\mathbb{E}_t(r_{t+1}) - r_{t+1}^{f} = \gamma\sigma_{ry} - \gamma\frac{\sigma_{ry}}{\sigma_y^2}\cdot\omega_t$$

- <u>But</u> give testable predictions based on the LTG proxy for excess optimism ω_t
- high ω_t comes from good news for risky assets
- and implies systematic future reversal

- We test these predictions using local projections: predict the year on year change of y (1 year and 10 year t-bill, baa spread)

$$y_{t+h} - y_{t+h-4} = \gamma_0 + \gamma_1 \Delta LTG_t + \boldsymbol{\gamma}' \boldsymbol{X} + u_{t+h}$$

- The shock is a one standard deviation increase in LTG. Study predictability of dependent variable for quarters $h = 0, 1, \dots, 10$

- Control for 12 lags of: dependent variable, changes in the policy rate, yearly cpi inflation, S&P500 return

Table 3: Estimate Of $\Delta_4 LTG_t$ On Asset Prices

	B^h Estimates From: $\Delta_4 y_{t+h} = B^h \Delta_4 LTG_t$ Time Horizon (h) of Dependent Variable (Quarters)										
	0	1	2	3	4	5	6	7	8	9	10
	Dependent Variable: Δ_4 tbill $1y_{t+h}$										
$\Delta_4 LTG_t$	0.21*** [0.07]	0.40*** [0.07]	0.44*** [0.09]	0.39*** [0.12]	0.12 [0.13]	-0.19 [0.13]	-0.37*** [0.13]	-0.49*** [0.12]	-0.62*** [0.13]	-0.74*** [0.15]	-0.82*** [0.17]
N	151	151	151	151	151	151	151	151	151	151	151
Adjusted R2	0.85	0.66	0.48	0.25	0.17	0.24	0.33	0.38	0.35	0.30	0.24
	Dependent Variable: Δ_4 tbill $10y_{t+h}$										
$\Delta_4 LTG_t$	0.18** [0.07]	0.35*** [0.08]	0.41*** [0.08]	0.40*** [0.09]	0.16 [0.12]	-0.09 [0.12]	-0.24** [0.10]	-0.32*** [0.11]	-0.32*** [0.12]	-0.40*** [0.12]	-0.48*** [0.13]
N	151	151	151	151	151	151	151	151	151	151	151
Adjusted R2	0.77	0.60	0.49	0.37	0.25	0.27	0.30	0.29	0.24	0.20	0.16
	Dependent Variable: Δ_4 baa credit spread $10y_{t+h}$										
$\Delta_4 LTG_t$	-0.10 [0.07]	-0.13** [0.06]	-0.12* [0.06]	-0.08 [0.07]	0.08 [0.09]	0.19* [0.11]	0.23** [0.10]	0.22** [0.09]	0.19** [0.09]	0.16* [0.09]	0.12 [0.10]
N	151	151	151	151	151	151	151	151	151	151	151
Adjusted R2	0.74	0.55	0.42	0.28	0.19	0.22	0.23	0.18	0.07	-0.03	-0.06

LTG and the Business Cycle

- Link between expectations, finance, and the business cycle: real investment (see also Ma et al. 2016)
- High current optimism about future earnings encourages firms to invest and investors to lend (good “animal spirits”)
- Systematic future disappointment of expectations triggers an aggregate investment reversal (reversal of “animal spirits”)
- Financial and real volatility have a common root: excessively volatile beliefs.
  - Local projection for log change in investment/capital. Same structure of controls.

Tabe 4: Estimate of $\Delta_4 LTG$ on Investment-To-Capital

	Time Horizon of Dependent Variable (Quarters)										
	0	1	2	3	4	5	6	7	8	9	10
	Estimates From: Δ_4 investment-to-capital$_{t+h} = B^h \Delta_4 LTG_t$										
$\Delta_4 LTG_t$	0.70***	1.83***	2.65***	3.21***	2.45***	0.57	-1.27	-2.58***	-2.63***	-1.83***	-0.68
	[0.20]	[0.42]	[0.50]	[0.53]	[0.60]	[0.79]	[0.81]	[0.74]	[0.64]	[0.63]	[0.60]
R2	0.96	0.90	0.83	0.72	0.57	0.41	0.40	0.45	0.48	0.46	0.43
N	150	150	150	150	150	150	150	150	150	150	150

- Sizable effect (a one std dev increase in $\Delta_4 LTG$ is associated with a $2-3\%$ increase in investment growth $3-4$ quarters later, 0.4 std dev of annual investment growth).
- Is the investment reversal due to disappointment of excess optimism? As a proxy for current excess optimism, take the systematic forecast error FE_{t+s} predicted by the *current* LTG *level*

Tabe 4: Estimate of $\Delta_4 LTG$ and $\widehat{FE_t}$ on Investment-To-Capital

	Time Horizon of Dependent Variable (Quarters)										
	0	1	2	3	4	5	6	7	8	9	10
	Estimates From: Δ_4 investment-to-capital$_{t+h} = \beta^h \Delta_4 LTG_t + \delta^h \widehat{FE_t}$ First Stage: $FE_t = \gamma LTG_t \longrightarrow \widehat{FE_t}$										
$\Delta_4 LTG_t$	0.85***	1.67***	2.20***	2.80***	2.47***	1.47*	0.55	-0.24	-0.84	-0.75	-0.24
	[0.31]	[0.49]	[0.64]	[0.86]	[0.89]	[0.88]	[0.84]	[0.76]	[0.69]	[0.73]	[0.82]
$\widehat{FE_t}$	0.13	0.30	0.29	0.07	-0.44	-1.15**	-1.70***	-2.02***	-1.98***	-1.80***	-1.61***
	[0.14]	[0.24]	[0.33]	[0.43]	[0.46]	[0.47]	[0.44]	[0.39]	[0.36]	[0.37]	[0.42]
R2	0.97	0.92	0.84	0.73	0.60	0.47	0.46	0.49	0.52	0.52	0.49
N	138	138	138	138	138	138	138	138	138	138	138

- Reversals accounted by systematic disappointment of over-optimistic beliefs.
- Sizable effect. (A std dev increase in $\widehat{FE_t}$ is associated with a 2% fall in investment growth $7-8$ quarters later, 0.27 std dev of annual investment growth).

- We can perform the analysis at the firm level to control for all aggregate shocks, and for firm level fixed differences in risk, productivity, etc

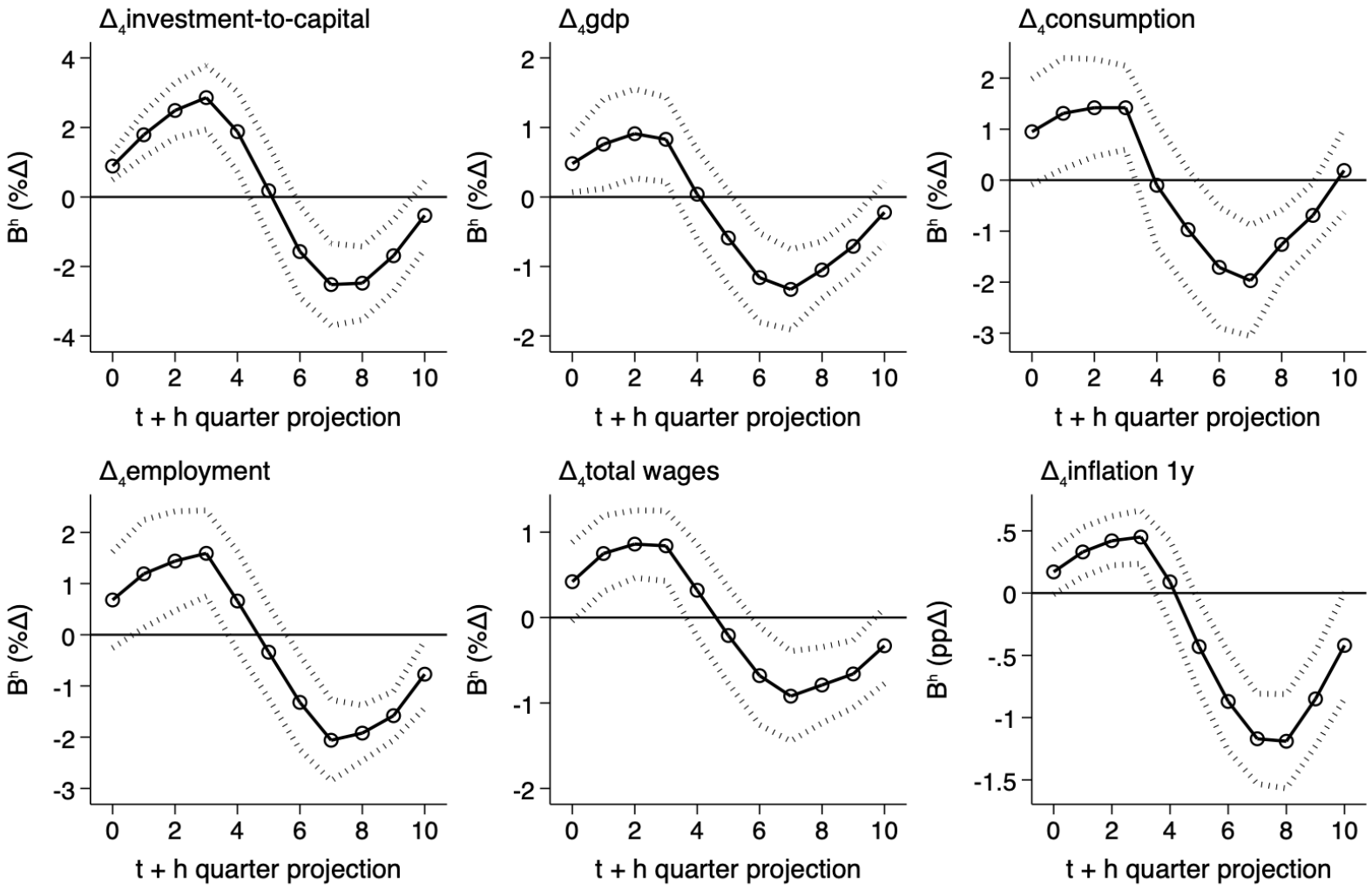
Table 5. LTG and investment at the firm level

	(1)	(2)	(4)	(6)	(8)	(10)
	FE_{it}	$\Delta_4 i_{i,t}$	$\Delta_4 i_{i,t+6}$	$\Delta_4 i_{i,t+12}$	$\Delta_4 i_{i,t+18}$	$\Delta_4 i_{i,t+24}$
$LTG_{i,t}$	0.7770***					
	(0.0477)					
$\Delta LTG_{i,t}$		0.3134***	0.2066***	0.0775*	0.0544***	0.0038
		(0.0582)	(0.0625)	(0.0432)	(0.0183)	(0.0251)
$\widehat{FE}_{i,t}$		-0.102***	-0.1218***	-0.1963***	-0.208***	-0.1514***
		(0.0195)	(0.0323)	(0.0384)	(0.0395)	(0.0375)
Obs	146,151	133,545	132,166	131,122	130,213	129,461
Adj R^2	2.3%	-3.0%	-3.1%	-3.2%	-3%	-3%
Firm Fxd Effect	Y	Y	Y	Y	Y	Y
Time Fxd Effect	Y	Y	Y	Y	Y	Y

Connection to the Broader Cycle and Shocks

- On impact, higher LTG acts like a good shock: financial markets and investment go up
- Eventually, higher LTG predicts systematic disappointment. It embodies a systematic future “bad shock”: financial markets and investment go down
- Similar dynamics in other macro indicators, GDP growth, employment, consumption…
- Systematic disappointment of LTG links to conventional investment (negative) shocks

Local Projections For Other Business Cycle Indicators



- Local projections, same ΔLTG_t shock, same structure of controls

Takeaways

- Consistent with Keynes' hypothesis, long term expectations appear to: i) be excessively volatile, and ii) reconcile excess financial and business cycle volatility

- Basic idea: Markets and the economy are more volatile than fundamentals because overreaction of long term beliefs amplify shocks

  - Tests of this mechanism can use direct measurement of expectations, LTG in particular, and limit the role of "hard to measure" variation in risk premia

  - Future work: transmission mechanism, measurement of long term beliefs for various outcomes.

- Theory of beliefs: where does overreaction come from?

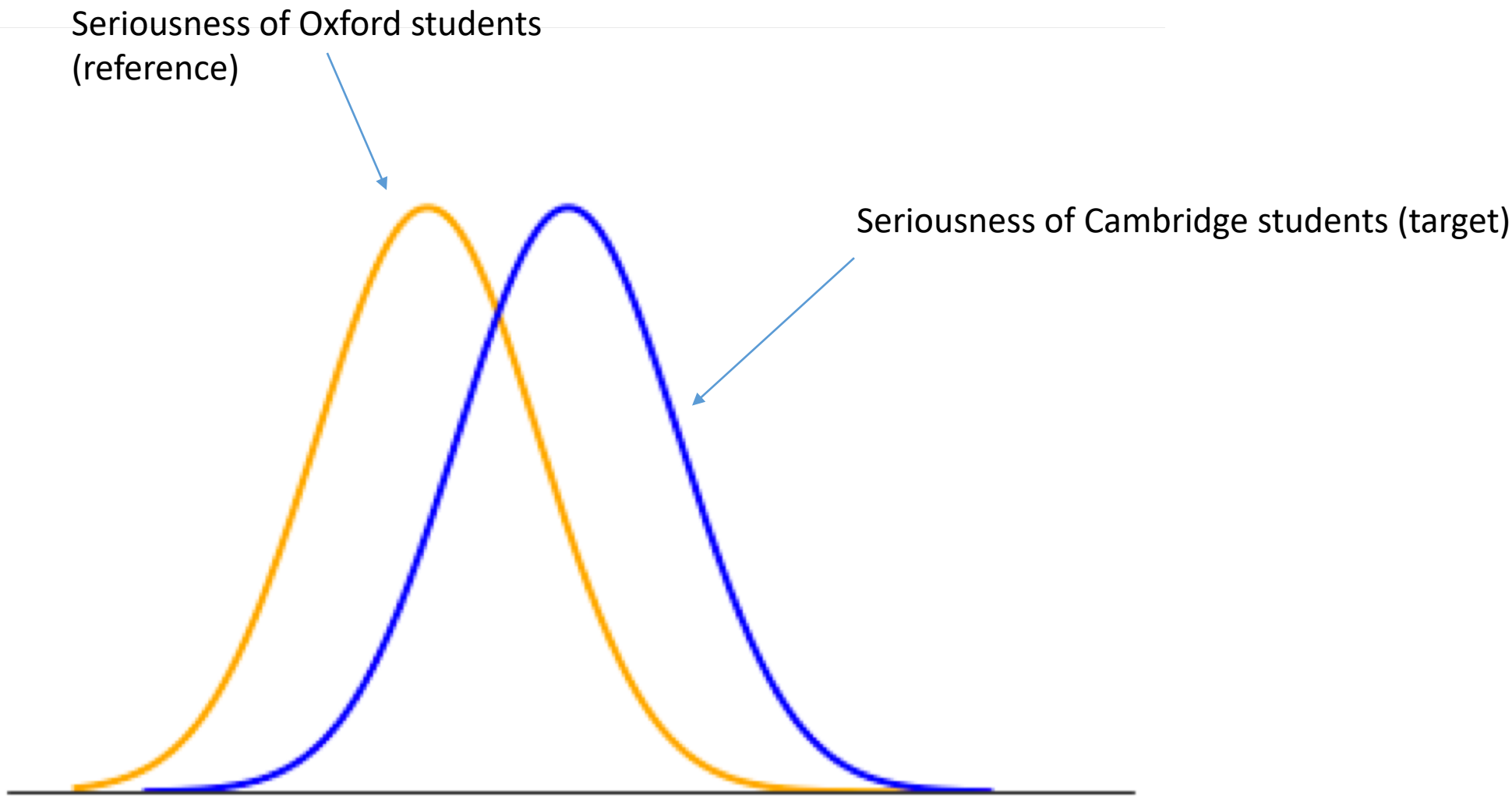
Diagnostic Expectations

- Beliefs formed from biased sampling of the memory database Ω

- Disproportionately sample outcomes ω that are *distinctive* given data $D \subset \Omega$
  - normal earnings growth is likely for many firms, so it is not retrieved after strong growth

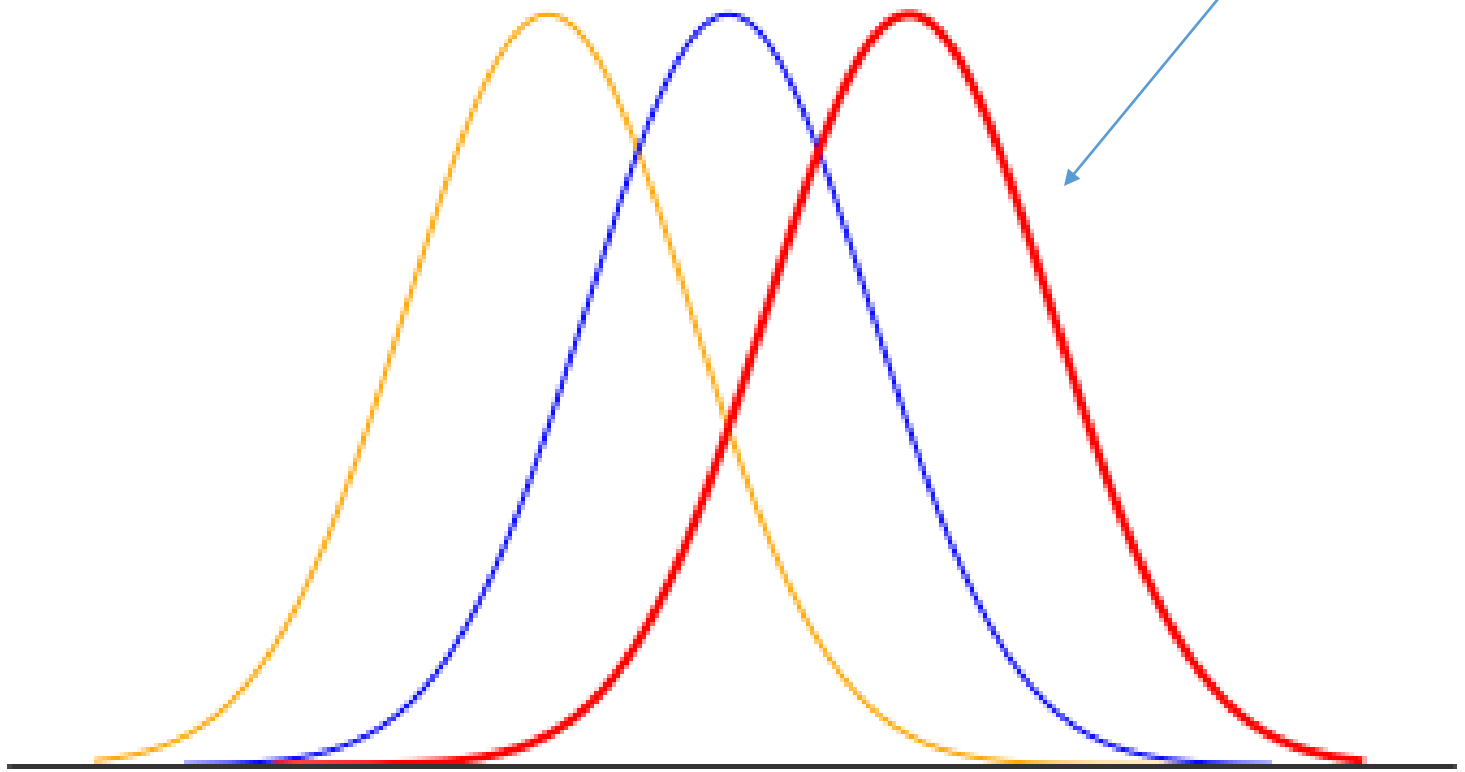
$$f^{DE}(\omega|D) \propto f(\omega|D) \cdot \left[\frac{f(\omega|D)}{f(\omega|-D)}\right]^{\theta}$$

BGLS (2023) show that this model tracks stock market expectations over time.


Seriousness of Oxford students (reference)
Seriousness of Cambridge students (target)

Believed seriousness of Cambridge students

Interference -> overreaction



Beliefs and Memory

- DE was an early model based on intuitions about selective memory. Foundations?
- When thinking about event H, probability of retrieval of experience $\omega \in \Omega$ is (Kahana 2012)

$$r(\omega) = \frac{S(\omega)}{\sum_{\omega' \in \Omega} S(\omega')}$$

Similarity between ω and event H

Interference from
Non Domain Relevant experiences
=> overreaction

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Similarity between ω and event H

Interference from
Non Domain Relevant experiences
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- Retrieved memory is then used to simulate event H according to function $\sigma(\omega)$, also increasing in similarity (Hassabis et al. KT, etc). Belief is:

$$\pi(H) = \sum_{\omega} \sigma(\omega) * r(\omega)$$

Simulation from similar experiences
(both domain relevant and not)

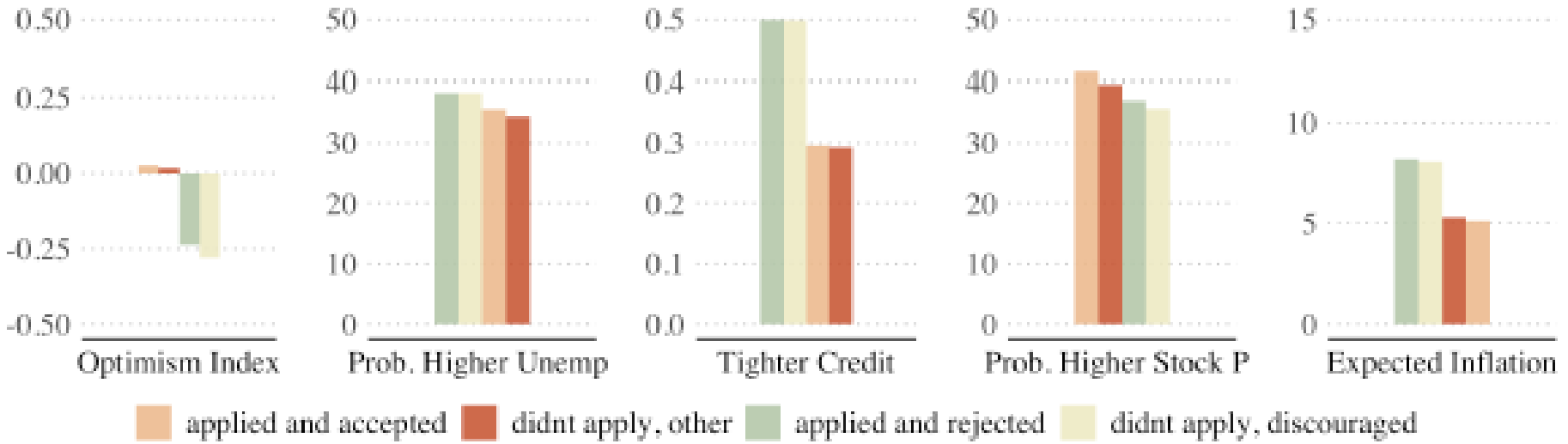
- Unification, new predictions and measurement

Importance of Memory Mechanism

- Experiences do not mechanically affect beliefs. These depend on what it is retrieved and how it is used
  - associative recall, including non-domain specific (NDS) ones, forgetting of relevant ones
- To test this framework, measure:
  - database of experiences
  - similarity $S(\omega)$ between experiences and target event
- One application: beliefs about macro variables
  - Often very heterogeneous. Where does heterogeneity come from?

Credit Market Experiences & Macro Expectations

Figure 1: Average Expectations by Credit Market Experience



- Cenzon (JMP 2023). Many controls, matching sample.
- Effects stronger for more similar variables (i.e. credit), when cues / context is more similar (i.e. recessions), and for younger people (less interference)

Takeaways

- Beliefs exhibit remarkable disagreement and instability
  - they help explain economic choices without assuming exotic utility
  - but instability challenges existing behavioral approaches
- Psychology of memory helps explain how beliefs form and how they change
- Opens many opportunities to measure databases and similarity to study beliefs:
  - sheds light on belief heterogeneity: from both databases and retrieval
  - as well as on how beliefs react to information, and how to change them

- Final exercise: LTG and the “Marginal Efficiency of Investment” (MEI)

- Justiniano, Primiceri and Tambalotti (2011) MEI shock: “productivity with which investment is converted into capital”. This shock account for sizable business cycle volatility and they link it to financial frictions/credit spreads.

- In Keynes’ theory of investment, MEI is shaped by long term expectations and by financial factors. Two questions:

  - How is ΔLTG_t correlated with contemporaneous MEI shocks?

  - Does LTG and its disappointment predict bad MEI shocks in the future?

Table 6: Predicting MEI Shocks with LTG and Credit Spreads

	Time Horizon of Dependent Variable (Quarters)										
	0	1	2	3	4	5	6	7	8	9	10
	Estimates From: mei (J-P-T)$_{t+h}$ = $\Delta_4 LTG_t$ + $\widehat{FE}_t$ + baa credit spread 10y$_t$										
$\Delta_4 LTG_t$	0.19***	0.22***	0.13	0.07	0.06	0.02	0.06	-0.01	-0.03	-0.05	-0.08
	[0.07]	[0.07]	[0.08]	[0.07]	[0.06]	[0.07]	[0.06]	[0.07]	[0.07]	[0.07]	[0.09]
$\widehat{FE}_t$	-0.11**	-0.15***	-0.15***	-0.13***	-0.14***	-0.11**	-0.12***	-0.10**	-0.08*	-0.08*	-0.05
	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]
baa credit spread 10y$_t$	0.03	0.19*	0.14	0.06	0.10	-0.01	0.08	0.00	-0.00	0.01	-0.03
	[0.11]	[0.11]	[0.09]	[0.08]	[0.09]	[0.09]	[0.08]	[0.08]	[0.07]	[0.07]	[0.07]
R2	0.05	0.09	0.07	0.06	0.07	0.06	0.06	0.05	0.04	0.04	0.03
N	95	95	95	95	95	95	95	95	95	95	95

- High optimism predicts bad MEI shocks in the future. Little if any independent predictive power of the credit spread

Survey of Beliefs

- People estimate probability of H = cyberattack in the next 5 years, creating significant losses to the US economy and infrastructure. We measure:
  - **database** of experiences (ID theft, financial troubles, loss of loved one, etc)
  - **perceived similarity**: between each lived experience and cyber attack
- Priming: some participants asked to recall / describe an experience
- Predictions:

1. Lived non-primed experiences affect beliefs based on their similarity to H
2. Some lived experiences are forgotten, so priming them boosts estimate if similar to H (simulation), while it dampens estimates if dissimilar from H (interference)
3. Priming a lived experience interferes with the recall and use of non-primed

Survey of beliefs in the field

experience effects based on similarity →

priming effects based on similarity →

interference between primed and other lived experiences →

	$Prob(cyberattack)$	
$\bar{S}_i(E_i)$, Total Similarity of Lived Experiences	0.19***	0.20***
	(0.028)	(0.028)
$S_i(e_p)$, Similarity of Primed Experience	0.13***	0.19***
	(0.028)	(0.034)
$\bar{S}_i(E_i)\ x\ S_i(e_p)$		-0.059***
		(0.020)
Snow	0.18***	0.18***
	(0.025)	(0.025)
Controls	Y	Y
Observations	1706	1706
Adjusted R-squared	0.107	0.111