Long Term Expectations and Aggregate Fluctuations

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Abstract

In line with Keynes' intuition, stock market volatility and real economic activity are linked by expectations of long term profits. Using data on analysts' expectations of earnings growth of S&P 500 firms, LTG, we show that current long term optimism is associated with a near term boom in major US financial markets, real investment, and other business cycle indicators. LTG optimism then jointly predicts disappointing earnings growth and a contraction in financial markets and real activity one to two years later. Overreaction of long term profit expectations emerges as a promising mechanism for reconciling Shiller's excess volatility puzzle with the business cycle.

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1 Introduction

The stock market is volatile, as is aggregate economic activity, and the two are connected. At least since Burns and Mitchell (1938), we know that measures of investment and production rise and then fall together across sectors, a phenomenon called the "business cycle". It is also well known that the aggregate stock market is extremely volatile (e.g., LeRoy and Porter 1981; Shiller 1981). Such financial and real volatility are connected: Burns and Mitchell (1938) included the S&P 500 as a leading indicator of GDP growth, and subsequent work confirmed that high stock returns today predict high future aggregate activity (Merton 1980; Stock and Watson 2003; Backus et al. 2009).

What drives these patterns? Decades of research trace business cycles to the rational response of firms and households to persistent "fundamental" shocks to technology, demand, taxes, etc. (Ramey 2016). To illustrate, a positive productivity shock increases current output and rational expectations about future productivity. Households then consume more, firms hire more labour and invest for the future. An aggregate output expansion follows, but then gradually reverts as the productivity shock dies out. In principle, such changes in current and future expected productivity could explain stock market volatility, because stocks are just claims on firms' fluctuating profits. In practice, they do not. Shiller (1981) famously documented an "excess volatility" puzzle: measures of current and rationally expected corporate dividends or earnings are way too stable to account for stock price movements. What drives excess stock price volatility, then? And, going back to the business cycle: does the driver of the excess volatility of stocks also affect real activity?

Conventional macro-finance theory addresses these questions by maintaining rational expectations while allowing for variation in investors' required returns. This ingredient produces financial and real volatility, but its role is hard to test empirically because risk preferences and their variation over time are difficult to measure. In this paper we follow a different route: we keep required returns constant but allow expectations to be non-rational. Key to our strategy is the use of data on stock analysts' consensus expectations of the short and long term earnings growth of S&P

500 firms. One measure turns out to be critical: the analysts' forecast of a firm's long-term earnings growth (LTG), which captures expectations of fundamentals over a three to five years horizon. Our main variable is the consensus LTG forecast, aggregated across firms in the S&P500 index.

In the *General Theory* (1936), Keynes stressed the centrality of expectations of long term profits, also referred to as "animal spirits". Changing business conditions, he argued, could cause large and excessive changes in these expectations. In good times, beliefs about the long term can be too optimistic, causing a boom in asset prices and real investment, and vice-versa in bad times. This mechanism can help reconcile Shiller's excess volatility with the business cycle because beliefs about the long term act as shock amplifiers. Here we use the data on LTG to assess this mechanism.

Specifically, we address three questions. First, can expectations of future earnings growth account for Shiller's excess volatility puzzle, as well as for time variation in other financial predictors of the business cycle such as interest rates and credit spreads? Second, can such expectations, and in particular the unwinding of systematic forecast errors, account for boom-bust dynamics in real investment? Third, do such expectations shed light on other business cycle variables, as well as on standard macroeconomic shocks?

Starting with Shiller's excess volatility puzzle in Section 2, we show that the present value of short and long term expected earnings for S&P 500 firms, computed using a constant required return, fully explains observed stock market variation in our sample, 1980-2022. LTG essentially solves the puzzle, because – unlike rational expectations – analyst expectations are excessively volatile relative to subsequent earnings growth. Two pieces of evidence buttress the role of this departure from rationality. First, high current LTG predicts future disappointment of analyst forecasts of short and long term earnings. Second, it also predicts a short run increase and a longer term decline of survey expectations of stock returns. That is, high LTG serves as a barometer of excess optimism: it points to investors who are too bullish about future profits and expect high future stock returns. The latter fact is in stark contrast with standard theories, in which investors expect low returns in good times.

In Section 3 we show that the explanatory power of LTG reaches beyond the stock market: higher LTG predicts near term increases and long-term declines in short and long-term interest rates, and the reverse pattern for credit spreads. The ability of high LTG to predict a boom bust financial cycle is strong: in our local projections (Jorda 2005) we control for, among other things, 12 quarterly lags of the dependent variable, allowing for a very rich pattern of "fundamental" mean reversion. This evidence offers additional support to the hypothesis that boom-bust dynamics in expectations about the long term act as an important driver of the volatility of key asset prices.

In Section 4, we connect these measures of expectations to real activity. Using local projections again, we show that – consistent with Keynes' view – a one standard deviation increase in LTG fuels an investment boom: growth in the investment to capital ratio is 3% higher than conventional levels in the following year. The boom reverts with a similar magnitude 2 years later. Crucially, the investment reversal is entirely explained by the predictable disappointment of the initially high LTG. This finding is consistent with over-optimism encouraging excessive real investment in the short run and which in turn entails a long run correction.

We then connect LTG to business cycle analysis. We show that in the short term higher LTG behaves like a positive shock: it predicts growth in consumption, employment, and wages. Importantly, though, LTG also predicts a longer-term reversal in these variables. To dig deeper into these boom-bust pattern, we link LTG to shocks that are shown to drive significant investment and business cycle volatility. Building on Greenwood et al. (1998), Justiniano et al. (2011) estimate changes in the "Marginal Efficiency of Investment" (MEI), the ease with which investment goods are transformed into capital, and show that they account for 60 to 85% of US business cycle fluctuations. We find that MEI shocks are positively correlated with contemporaneous LTG changes, confirming that in the short term LTG behaves as a positive shock. At the same time, current LTG predicts reductions in MEI in the future, suggesting that negative shocks in MEI may in part be due to predictable disappointment of optimism. Although we cannot definitely prove that excess volatility in beliefs causes boom bust investment cycles, the robust predictive power of LTG suggests that this possibility must be seriously considered, if not adopted as a working hypothesis.

In sum, LTG emerges as a "miracle" variable, that i) accounts for the volatility of a range of asset prices, from equities to safe and risky bonds, iii) helps explain boom-bust cycles in economic activity through *predictable* disappointment of optimism (as in Minsky), ii) has explanatory power for business cycle variables that is comparable to that of conventional predictors, iv) is directly measurable, and v) has a clear theoretical as well as behavioural foundation.

We contribute to two large literatures. The first is behavioural finance, and in particular recent work combining expectations and asset price data. Earlier work studied expectations of stock returns and found that they are extrapolative, rather than rational (Bacchetta, Mertens, and Wincoop 2009, Greenwood and Shleifer 2014, Amromin and Sharpe 2014, Barberis et al 2015, 2018, Giglio et al 2021). Expectations of risk premia in the bond market also display departures from rationality (Greenwood and Hansen 2013, Piazzesi, Salomao and Schneider 2015, D'Arienzo 2021).

Closer to the current paper, a line of research studies expectations of future fundamentals, and in particular LTG. LaPorta (1996) introduces LTG into finance, and showed that its variation across stocks predicts stock returns. Bordalo, Gennaioli, LaPorta, and Shleifer (BGLS 2019) document the overreaction of firm level LTG and studied its implication for returns using a model of diagnostic expectations. The same authors (BGLS 2022b) focus on the aggregate stock market and show that LTG jointly predicts forecast errors and returns, and that systematic changes in LTG account for the predictive power of the price dividend ratio for returns. Here we show that the same expectations data also resolves Shiller's excess volatility puzzle and link LTG to fluctuations in other asset prices, such as interest rates and credit spreads, and the business cycle more broadly.

The second body of work studies fluctuations in real investment and economic activity, and their drivers. Several papers study the connection between the stock market and firm level investment through the lens of Tobin's Q (Barro 1990, Fazzari, Hubbard, and Petersen 1988, Morck et al 1990, Lamont 1990). They find that stock returns are a better predictor of firm level investment than estimates of Q itself. Gennaioli, Ma, and Shleifer (2016) show that CFO optimism about 12 months ahead profits spurs firm-level investment, and that the explanatory power of measured expectations dwarfs that of stock returns. Compared to this work, here we focus on long term expectations and connect volatility in investment to excess volatility in the stock market. Angeletos, Collard and Dellas (2018, 2020) argue that business cycles reflect variations in demand unrelated to long run TFP. The authors do not use expectations data but conjecture that this shock is due to expectations of aggregate economic activity in the short run (partially because optimism is not long lasting). We show, using expectations data, that systematic overreaction and reversal of measured expectations at the typical business cycle horizon is empirically associated with similar dynamics.

A related body of work connects asset prices and real activity in rational expectations models. In this work, changes in risk aversion – the price of risk (Campbell Cochrane 1999) – or in the quantity of risk (Barro 2009, Bansal, Kiku, and Yaron 2010) – cause time variation in required returns and hence in stock prices. Changing required returns shape the propensity to invest and consume, affecting the real economy (though see Tallarini 2000). Relative to this approach, which relies on hard to measure or counterfactual expected time varying returns, we stress departures from rationality, disciplined using expectations data. Finally, a growing literature in macro relaxes relational expectations by assuming either rational inattention or frictions (Gabaix 2019, Angeletos Huo Sastry 2020, Angeletos Lian 2016, 2022, 2023), or overreaction (Bordalo et al 2021, Bianchi et al 2021, L'Huillier et al 2021, Maxted 2023), or learning from extreme events (Kozlowski, Veldkamp, Venkatesvaran 2019, 2020). Our innovation here is to connect financial markets, which are excessively volatile relative to a clear benchmark, to recurrent economic fluctuations.

I. Shiller's Excess Volatility Puzzle

Campbell and Shiller (1987, 1988) express the price-dividend ratio of a stock with the identity:

$$p_t - d_t = \frac{k}{1-\alpha} + \sum_{s\geq 0} \alpha^s g_{t+1+s} - \sum_{s\geq 0} \alpha^s r_{t+1+s}, \qquad (1)$$

where p_t is the log price at t, d_t is its log dividend, $g_{t+s+1} \equiv d_{t+s+1} - d_{t+s}$ is dividend growth between $t + s$ and $t + s + 1$ and r_{t+s+1} is the realized stock return over the same horizon. k is a constant, and $\alpha = e^{pd}/(1 + e^{pd}) < 1$ depends on the average log price dividend ratio pd.

In Equation (1) variation in the price dividend ratio is due either to variation in expected future dividend growth, captured by the g_{t+1+s} terms, or in required returns, captured by the r_{t+1+s} terms. Under rationality and constant required return r, the stock price is given by:

$$p_t^R = d_t + \frac{k-r}{1-\alpha} + \sum_{s\geq 0} \alpha^s \mathbb{E}_t(g_{t+1+s}), \qquad (2)$$

Price variation comes from changes in the dividend d_t and in expectations of future dividend growth. The intuition for Shiller's puzzle is that, because observed and hence rationally expected dividends are not very volatile, their weighted average on the right-hand side of (2) should be even less volatile, which contrasts with the large observed volatility of the observed stock price p_t.

Shiller constructed a proxy p_t^* for the rational price in Equation (2) using, at each t, subsequent realized dividends and a value for the rational stock price in the last sample period. We replicate the exercise over 1981-2022. Using the terminal realized earnings per share D_{2022}= 66.92, we set the terminal log stock price to $p_{2022}^* = \ln\left(\frac{D_{2022}}{r-g}\right)$. This is the present discounted value of expected future dividends at that time, under the assumption of constant average dividend growth g. We set r = 8.75%, which is the average realized return over the sample period and g = 5.79%, which is also the sample average. One early criticism of Shiller's method was that such terminal price fails to account for rational uncertainty about long-run fundamentals. We return to this point.

Given the terminal price dividend ratio $p_{2022}^{RE} - d_{2022}$, the rational proxy p_t^* at earlier dates is computed backwards, using at each t < 2022 the future realized dividend growth rates:

$$p_t^* = d_t + \frac{1-\alpha^{T-t}}{1-\alpha}(k-r) + \sum_{s=t}^{T} \alpha^{s-t}(d_{s+1} - d_s) + \alpha^{T-t} * (p_{2022}^* - d_{2022}), \qquad (3)$$

where α =0.9981 (at a monthly frequency) and $k = -\log(\alpha) - (1-\alpha)\log\left(\frac{1}{\alpha-1}\right) = 0.0138$. Figure 1 plots the rational proxy p_t^* (blue) against the actual stock price p_t (green). Shiller's puzzle is the fact that p_t^* is virtually a straight line, while the actual stock price p_t displays large boom-bust patterns around it, with periods of sustained over/undervaluation compared to p_t^*.

Most asset pricing research since Shiller (1981) has sought to account for stock price volatility by constructing theories of investor preferences that admit variation in the price and quantity of risk. A few papers have relaxed the assumption of rational expectations of future dividends (see, e.g., DeLong et al (1990), Barsky and DeLong (1993) and Barberis et al. (1998), and more recently BGLS (2019, 2022b). A larger literature has instead focused on extrapolative expected returns (e.g., Barberis et al. 2015, 2018, Hirshleifer, Li, and Yu 2015, building on evidence in Bacchetta, Mertens, and Wincoop 2009 and Greenwood and Shleifer 2014, among others).

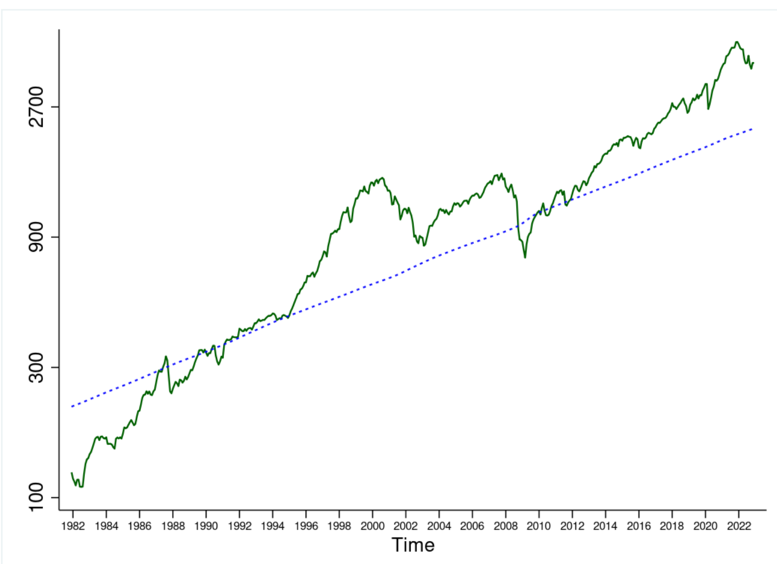


Figure 1: SP500 vs Shiller index p^*

Note: The figure shows the log scale level of the SP500 index (green line) against the log scale rational benchmark (blue line) computed according to equation (3).

Conceptually, the mechanism is intuitive: with non-rational expectations of fundamentals, the terms $\mathbb{E}_t(g_{t+1+s})$ in Equation (2) would be replaced by non-rational expectations $\widetilde{\mathbb{E}}_t(g_{t+1+s})$. As long as these expectations display high volatility, high stock price volatility follows. To assess it quantitatively, we exploit data on analysts' forecasts of future corporate earnings.

II.1 Measured Expectations of Future Fundamentals

We gather monthly data on analyst forecasts for firms in the S&P500 index from the IBES Unadjusted US Summary Statistics file. Forecasts of dividends per share are only available starting from 2002 and for short horizons. To expand temporal coverage and to have longer run forecasts, in our main analysis we construct an earnings-based price proxy that uses analyst forecasts of earnings per share. We perform a robustness exercise using forecasted dividends, see the Appendix.

We focus on median forecasts of a firm's earnings per share (EPS_{it}) and of its long-term earnings growth (LTG_{it}). IBES defines LTG as the "...expected annual increase in operating earnings over the company's next full business cycle. These forecasts refer to a period of between three to five years." LTG_t captures expectations of earnings growth over the business cycle, the other phenomenon of interest here. Data coverage starts on 3/1976 for EPS_{it} and 12/1981 for LTG_{it}. We fill in missing forecasts by linearly interpolating EPS_{it} at horizons ranging from 1 to 5 years (in one-year increments). Beyond the second fiscal year we assume that analysts expect EPS_{it} to grow at the rate LTG_{it} starting with the last non-missing positive EPS forecast.

Survey expectations refer to the individual firms that analysts follow. Following BGLS (2022b), at each t we aggregate the expected earnings per share of S&P 500 firms into indices of one- and two-year ahead expected earnings, $EPS_{t,t+1}$ and $EPS_{t,t+2}$, respectively. We then aggregate the long-term earnings growth expectations into an aggregate index LTG_t. Log earnings growth one or two years ahead are computed based on $EPS_{t,t+s}$.

Both short and long-term growth expectations are highly volatile, as shown in Figure 2. But they capture different kinds of fluctuations. Short-term expectations move mainly due to short-term mean reversion of earnings growth (e.g. short-term growth expectations are highest during the market crash of 2008). LTG instead captures persistent fluctuations in the estimated growth potential. This will be important for connecting stock market and business fluctuations.

One concern with LTG is that analysts may distort their forecasts due to agency. As shown in BGLS (2019), however, this is unlikely to importantly affect the time series variation in forecasts, which is key here. Also, all brokerage houses typically cover S&P 500 firms, so investment banking relationships or analyst sentiment are unlikely to influence the decision to cover firms in the S&P500.[1] Using median forecasts further alleviates these concerns, reducing the impact of outliers.

Another concern is that market expectations may differ from analysts' forecasts in systematic ways. If analyst forecasts are a noisy version of market forecasts, their explanatory power for stock prices would be attenuated. A larger concern is that analysts estimate expected earnings growth using stock prices themselves, while erroneously assuming constant required returns. BGLS (2022b) extensively scrutinize this possibility for their main proxy of expectations, LTG, and find evidence against it. First, revisions in LTG are more reliably explained by past earnings growth than by past stock returns. Second, the predictive power of LTG for both aggregate and firm-level stock returns is robust to including the aggregate and the firm-level price/earnings ratio, respectively, indicating that LTG is not mechanically inferred from prices.

[1] For example, in December of 2018, nineteen analysts followed the median SP500 firm, while four analysts followed the median firm not in SP500. Analysts are also less likely to rate as "buy" firms in the SP500 index.

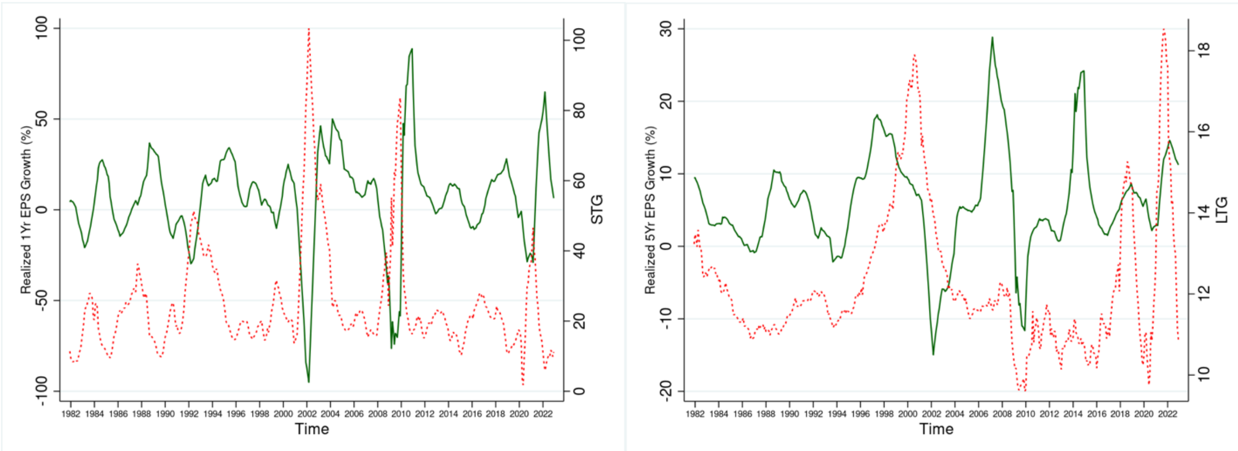


Figure 2: Volatility of Earnings Growth and Expectations

Note: The figure plots 1-year earnings per share growth between t-4 and t against expectations for 4-quarter earnings growth between t and t+4 (STG, left panel) and 5-year earnings per share growth between t-20 and t against expectations for 5-year earnings growth between t and t+20 (LTG, right panel). STG is calculated by value weighting firm level forecasts for expected 1-year eps growth, and LTG by value weighting firm level forecasts for 5-year eps growth.

II.2 The Expectations Based Stock Price Index

We build an expectations-based price index $\tilde{p}_t$ by computing the earnings-based ratio:

$$\tilde{p}_t = e_t + \frac{\tilde{k} - r}{1-\alpha} + \ln\left(\frac{EPS_{t,t+1}}{EPS_t}\right) + \alpha \ln\left(\frac{EPS_{t,t+2}}{EPS_{t,t+1}}\right) + \sum_{s=2}^{10} \alpha^s \, LTG_t + \frac{\alpha^{10}}{1-\alpha}\, g. \qquad (4)$$

α and r are as before, and $\tilde{k} = k + (1-\alpha)\, de = 0.0123$, where de is the average log payout ratio.

The key difference with Shiller's computation is the use of expectations data. We measure expected growth between t and t+2 using forecasted earnings. We use LTG_t to capture expected earnings growth at business cycle frequencies, specifically between t + 3 and t + 10. We employ LTG_t up to 10 years ahead because this is the average duration of a business cycle in our data. To compute the price index, we agnostically set the expected growth rate beyond t + 11 to be g = 3.73%. This is the value at which the average value of index $\tilde{p_t}$ matches the average stock price p_t in the sample.[1] Obviously, then, success in our exercise is not judged by the extent to which average price levels

[1] That is, g is the average of g_t, where the latter solves, at each t, the equation $p_t = e_t + \frac{\tilde{k}-r}{1-\alpha} + \alpha ln\left(\frac{\mathbb{E}_t^0 EPS_{t,t+2}}{\mathbb{E}_t^0 EPS_{t,t+1}}\right) + \sum_{s=2}^{10} \alpha^s \, LTG_t + \frac{\alpha^{10}}{1-\alpha} g_t$. Results are virtually identical if let LTG decay as observed cyclically adjusted earnings.

match but by the extent to which time variation in our index $\widetilde{p_t}$ tracks time variation in p_t. We use nominal earnings, but results are robust when accounting for inflation (see Appendix). Expectations for the very long term may play a significant role in shaping stock prices, but unfortunately, we do not have data about them. Imposing constant expected growth after t+10 reduces out ability to account for the observe stock index, because arguably expectations of the far future also move.

Figure 3 adds to Figure 1 our price index $\tilde{p}$ (red line). This index $\widetilde{p_t}$ is remarkably well aligned with the actual price p_t, especially at low frequencies. In particular, expectations account for the direction of displacement of actual prices from the rational benchmark. When the actual price p_t is above the rational benchmark, p_t^*, so is $\tilde{p}_t$; and conversely when p_t is below the benchmark. The index fails to capture the depressed market in the 80s but does a very good job at capturing the boom-bust cycles associated with the internet bubble of the late 1990s, and the 2008 crisis.

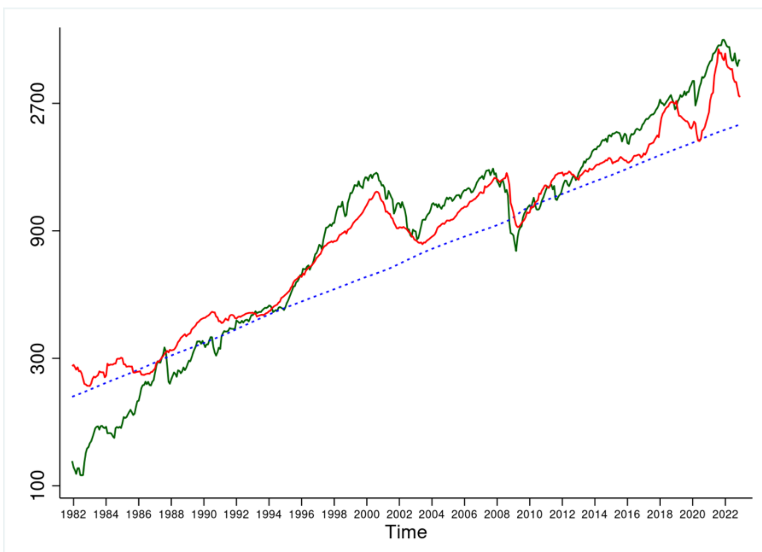


Figure 3: SP500 vs Shiller index p^* and Expectations based index $\tilde{p}$

Note: We plot in log scale the levels of the SP500 index (green line), the rational benchmark index (p^*_t, blue line, equation 3), and the price index based on earnings forecasts ($\widetilde{p_t}$ red line, Equation 4).

To assess more precisely the quantitative ability of beliefs to deliver realistic price volatility, Table 1 reports the standard deviations of one-year changes in our index $\widetilde{p_t}$ and in the actual stock price p_t. For comparison, we also report the standard deviation of the rational price p_t^*. The standard deviation obtained using our index is quantitatively very close to that obtained using the actual price, and much higher than that obtained using the rational benchmark.

Table 1: Volatility of Log Price Changes

	Earnings Index		
	Δp	Δp^{*}	$\Delta\tilde{p}$
variance	15.7%	0.7%	15.3%
Conf. interval	14.7-16.7%	0.6-0.7%	14.4-16.3%

This table reports the standard deviation and 95th confidence interval of one-year change in: (a) the log of the price of the S&P500 index, Δp, (b) the rational benchmark index, Δp^{RE} (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.

Overall, measured earnings expectations go a long way toward solving Shiller's excess volatility puzzle. Excess volatility of measured beliefs parsimoniously accounts for excess volatility in the stock market. This finding lines up with recent evidence that short-term earnings growth expectations help account for variation in the price-dividend ratio (De La O and Myers, 2021).

Is the success of our price index $\tilde{p}$ in accounting for stock price volatility due to the fact that expectations of long term growth are excessively volatile? To address this question we compare the data to the rational expectations benchmark in two ways. First, we use the current level of LTG to predict future errors in expectations of earnings growth. We define forecast errors as current forecast minus future realization, so that a higher value signals current excess optimism. If expectations are rational, then forecast errors should not be predictable based on current LTG, which is in the analyst's information set. Second, we use current LTG to predict current and future expectations of 12 month ahead stock returns, where the latter are measured using CFO and investor surveys. In a rational model with time varying returns, in good times – when LTG optimism is high – investors should require and hence rationally expect low returns.

Table 2 shows the predictability of errors in forecasted growth over one, two, and five years (rows 1, 2, and 3 respectively), and for 12 months ahead expected stock returns (row four). Relative to LTG_t the dependent variables are measured both contemporaneously and into the future, at horizons $t + h$, where $h = 0, \ldots 10$. The results support the view that high LTG captures periods of excess aggregate optimism, in the sense that they systematically predict positive forecast errors and thus future disappointment of earnings growth expectations. Such disappointment persists over time, at least four quarters out, suggesting that LTG is a source of persistent excessive optimism about fundamentals, which eventually reverts. In contrast, expectations about short term growth do not predict forecast errors, once expectations about the long term are controlled for (see Appendix).

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

	Time Horizon (h) of Dependent Variable (Quarters)										
	0	1	2	3	4	5	6	7	8	9	10
	Estimates From: $y_t = LTG_t$										
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]

Note: The estimates measure the impact of a 1 standard deviation change in LTG_t on the dependent variable. Forecast errors $1Y_{t+h}$ are the percentage point difference in 1 year forecasted growth in earnings at time $t + h$ and realized 1 year growth at $+h + 4$ ($STG1_{t+h} - \Delta_4 e_{t+h+4}$). Forecast errors $2Y_{t+h}$ are the percentage point difference in 2 year forecasted growth in earnings and realized 2 year growth at $t + h + 8$, ($STG2_{t+h} - \Delta_8 e_{t+h+8}$). Forecast errors $5Y_{t+h}$ is the percentage point difference in 5 year forecasted growth in earnings at t and realized 5 year earnings growth at $t + h$ + 20, ($LTG_{t+h} - \Delta_{20} e_{t+h+20}$). $Expected\ 1Y\ sp500\ return\ (cfo)_{t+h}$ is the average expectation of 1-year returns on the SP500 of major US CFOs from the Richmond Fed's CFO survey. LTG_t is aggregate market expectation for 5-year earnings per share growth, calculated by value weighting firm level forecasts. All regressions are unconditional, except for when the dependent variable is the expected 1-year SP500 return, in which case we control for 12 lags of the dependent variable. Heteroskedasticity-consistent standard errors reported in parentheses are computed according to Huber-White. Superscripts: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

The fact that high LTG comes with inflated stock prices and future disappointment of growth expectations supports the link between non rational beliefs and excess stock market volatility. BGLS (2022b) already documented, by regressing future LTG forecast errors on current LTG revisions, that LTG overreacts. Here we show, more broadly, that high LTG predicts disappointment at both long and short horizons, and also that such overreaction is persistent. These results will be useful to assess the link between belief disappointment and real investment.

The overreaction of LTG indicates that departures from rationality are much deeper than rational inattention, noise, or overconfidence. These forces act as belief "frictions", which cause a sluggish incorporation of public signals into the consensus belief and hence the macroeconomy. As a result, these frictions are sources of rigidity. By contrast, LTG exhibits strong aggregate overreaction. Periods in which a large number of agents overreact to good news, bringing about large aggregate optimism, and then reversals. In Bordalo et al. (2020) we showed that individual forecasters may overreact, but the contemporaneous presence of information frictions preserves rigidity in the consensus forecast. Periods of upward LTG revisions capture times in which overreaction occurs even at the aggregate level, leading to excess volatility in aggregate beliefs, and predictable boom-bust patterns in expectations and prices (BGLS 2022) and, as we will see, in real variables also.

The evidence expectations of returns also supports a non-rational mechanism. Higher current LTG predicts higher return expectations in the near term, confirming that periods of high LTG exhibit high optimism across the board, and not low required returns as the rational theories postulate. We thus have evidence of i) high levels of LTG being predictably disappointed, ii) excess volatility of expectations, iii) expectations of returns and of fundamentals moving together rather than in opposite directions as rational models would predict. The fourth key piece of evidence in the same direction comes from BGLS (2022b). They show that higher LTG optimism, which is associated with inflated stock prices, predicts lower returns at a horizon of 3 to 5 years. Expectations of short-term earnings growth instead do not predict returns, confirming the importance of long term beliefs. In fact variation in LTG, and its systematic disappointment, accounts for most of the predictability of returns from the aggregate price to dividend ratio, even absent time varying required returns.

LTG thus appears to capture excessively volatile investor beliefs, whose boom-bust dynamics are tightly connected with the key staple of market inefficiency: predictable stock returns.[1] Expectations data tells us that these effects are large, so that variation in required returns may be less necessary than is commonly assumed, if at all.

III. LTG and the Financial Cycle

If LTG captures waves of aggregate optimism, followed by disappointment, then its effects should be reflected in boom bust patterns in other financial markets and the broader economy. We first study how changes in LTG affect changes in interest rates and credit spreads, which have also been used to predict economic activity. We then study the role of changes in LTG on fluctuations in real investment (Section 4) and other business cycle indicators (Section 5). To link LTG to interest rates and spreads, we present a minimal modification of a standard asset pricing model allowing for non-rational beliefs about fundamentals. The model shows how changes in expectations about long term growth can shape time variation of returns in different asset markets, guiding our empirical strategy. Except for time varying belief distortions the model is standard in all respects, so it is not geared to match unconditional phenomena such as the equity premium or the risk free rate puzzles.

An endowment economy follows an AR(1) process for output growth:

[1] Here we focus on expectations of CFOs which are plausibly more sophisticated than the generic market participant. In the Appendix we show that LTG has a similar impact on other measures of expected returns. Moreover, a Granger causality test supports the view that LTG drives expectations of returns, not the reverse.

$$g_{t+1} = \mu g_t + v_{t+1}, \quad (5)$$

Instead, investors use an incorrect model, in which output growth follows

$$\tilde{g}_{t+1} = \mu g_t + \omega_t + v_{t+1}, \quad (6)$$

where ω_t summarizes the time-varying belief distortions. When $\omega_t > 0$ beliefs are excessively optimistic about future growth. The belief distortion ω_t – which we refer to as optimism at t – is persistent, and compounds reactions to present and past news v_{t-s}:

$$\omega_t = \rho \omega_{t-1} + \theta v_t. \quad (7)$$

When $\theta > 0$ beliefs overreact: in Equation (6) the current news v_t causes beliefs about growth to shift by $(\mu + \theta)v_t$, which is larger in magnitude than the rational μv_t. If $\theta < 0$ beliefs underreact. If $\theta = 0$, expectations are rational. Equation (7) captures the two key features of LTG_t: its persistence and boom-bust dynamics, with periods of sustained over-optimism followed by disappointment. BGLS (2022b) show that when $\theta > 0$, Equations (6) and (7) are a special case of the diagnostic expectations model, in which overreaction to past shocks exhibits a geometric decay, the "distant memory" specification studied in Ilut et al. (2023).

The representative consumer has CARA utility with risk aversion parameter γ. Asset prices are set according to the representative consumer's first order condition:

$$\widetilde{\mathbb{E}}_t\left[R_{t+1} B g_{t+1}^{-\gamma}\right] = 1. \quad (8)$$

where $B < 1$ is the rate of time preference, g_{t+1} is real consumption growth (equal to the exogenous output growth in this endowment economy), and $R_{t+1}$is the realized asset return. The equilibrium return equalizes the consumer's current and future expected marginal utility of consumption. The key difference with a standard model is that in (8) the expectation is taken with respect to the possibly non-rational beliefs in Equation (6).

In the rational expectations model, time variation in returns is entirely shaped by the intertemporal rate of substitution, $g_{t+1}^{-\gamma}$, also called the stochastic discount factor. It determines how much extra return must be delivered to the consumer at $t + 1$ to compensate it for a unitary reduction in consumption at t. When consumption growth g_{t+1} is expected to be higher, the consumer is more affluent in the future compared to the present. This implies that he desires to consume more today, which pushes required asset returns up. Because actual consumption is fairly stable, this theory is a poor description of time variation in asset returns, which goes back to Shiller's excess volatility puzzle for stocks. The conventional approach to this problem has been to modify consumer preferences in ways that enhance the volatility in the marginal rate of substitution.

Consider instead what happens when, consistent with survey expectations, we relax the assumption of belief rationality. By exploiting Equation (7), we can rewrite Equation (8) as:

$$\mathbb{E}_t\left[R_{t+1}Bg_{t+1}^{-\gamma}M(g_{t+1},g_t,\omega_t)\right]=1. \tag{9}$$

The pricing equation under non-rational beliefs can be written as the rational pricing equation in which the new term $M(g_{t+1},g_t,\omega_t)$ captures the investor's belief distortions, which replaces nonstandard preferences in shaping the time variation of equilibrium returns. These are however not observationally equivalent: shifts in beliefs can be disciplined using the expectations data.

Assuming as is commonly done joint lognormality of returns and fundamentals, Equation (9) pins down the equilibrium risk-free rate and risk premium. These are given by:

$$r_{t+1}^f=-logB-\frac{1}{2}\gamma^2\sigma_g^2+\gamma(\mu g_t+\omega_t) \tag{10}$$

and

$$\mathbb{E}_t(r_{t+1})-r_{t+1}^f=\left(\gamma-\frac{\omega_t}{\sigma_y^2}\right)\sigma_{ry}, \tag{11}$$

respectively, where σ_g^2 is the unconditional variance of consumption growth and σ_{ry} is the covariance between the asset return and consumption.

As in standard models, the risk free rate decreases in patience B, in the volatility of consumption growth σ_g^2 due to precautionary saving, and in the rationally expected consumption growth μg_t. The new term is ω_t: during times of excessive optimism about future growth, the consumer is reluctant to save (he may actually want to borrow against future income). The risk-free rate is then higher. Equation (10) yields two predictions connecting LTG and real interest rates. Higher optimism ω_t, proxied by upward revisions of LTG_t, should be associated with: i) a higher current interest rate r^f_{t+1} , and ii) reversal of interest rates r^f_{t+s} in the future. Interest rate reversals are in part due to fundamental mean reversion in output growth (due to $\mu < 1$) but they can also be due to the disappointment of excess optimism ω_t in the future, since $\rho < 1$. This term is responsible for the excess volatility that a rational fundamentals-based approach cannot account for.

The risk premium in Equation (11) increases in risk aversion γ, which is also standard. The well-known challenge is that according to conventional estimates γ is low and time variation in σ_{ry} is minor, so the rational model cannot deliver meaningfully time-varying excess returns. The departure from rationality in (11) can instead produce significant variation in risk premia, and this variation should be predictable using expectations data. In particular, when the consumer becomes more optimistic about future growth, the risk premium is persistently low. This yields two predictions about the time variation in returns, which mirror those for interest rates. Higher current optimism about future fundamentals, captured by upward revisions of LTG, should be associated with: i) higher contemporaneous realized excess returns on risky assets, a "good news" effect, and ii) low average realized excess return $\mathbb{E}_t(r_{t+s}) - r^f_{t+s}$ on the same assets in the future. This reversal, which creates return predictability, is due entirely to the deflation of overly optimistic beliefs. BGLS (2022b) document this predictability for stock returns. Here we exploit it for credit spread dynamics: the contemporaneous "good news" effect entails low spreads in the near term, while the systematic future disappointment in risky bond returns (due for instance to higher than expected defaults) predicts a future increase in the spread.

In sum, upward revisions in LTG_t should be associated with higher contemporaneous interest rates and lower credit spreads, but also *predict* lower future interest rates and higher spreads. The dynamics of interest rates can be due both to fundamental mean reversion and to belief disappointment, those of spreads can only reflect disappointment of expectations.

We test these predictions by studying the association between the quarterly change in LTG_t and three contemporaneous and future outcomes: the one and the ten years interest rate, and the Baa credit spread. We perform quarterly local projections (Jorda, 2005) using as independent "shock" the yearly LTG_t change and using as outcomes the year-on-year changes in the variables above. We start from the contemporaneous correlation between the shock and each outcome, h = 0, and then predict the outcome variable for future quarters h = 1, ….10.

Following standard practice, we control for twelve lags of the dependent variable. Among other things, this allows us to account for a rich pattern of fundamental mean reversion. We also control for twelve lags in yearly changes in the policy rate, 12 lags of yearly cpi inflation, and twelve lags of the yearly log change in the SP 500 index. These controls assuage concerns that our LTG shock may capture fundamental mean reversion, the monetary policy response, and the potentially time varying required return embodied in stock valuations, resulting in a demanding exercise.

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										
	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***	0.40***	0.44***	0.39***	0.12	-0.19	-0.37***	-0.49***	-0.62***	-0.74***	-0.82***
	[0.07]	[0.07]	[0.09]	[0.12]	[0.13]	[0.13]	[0.13]	[0.12]	[0.13]	[0.15]	[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**	0.35***	0.41***	0.40***	0.16	-0.09	-0.24**	-0.32***	-0.32***	-0.40***	-0.48***
	[0.07]	[0.08]	[0.08]	[0.09]	[0.12]	[0.12]	[0.10]	[0.11]	[0.12]	[0.12]	[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	-0.13**	-0.12*	-0.08	0.08	0.19*	0.23**	0.22**	0.19**	0.16*	0.12
	[0.07]	[0.06]	[0.06]	[0.07]	[0.09]	[0.11]	[0.10]	[0.09]	[0.09]	[0.09]	[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

Note: the estimates measure the impact of a 1 standard deviation change in $\Delta_4 LTG_t$ on the dependent variables. The set of controls include 12 lags of changes in the dependent variable, 12 lags of changes in the policy interest rate, 12 lags of yearly cpi inflation, and 12 lags of the yearly SP500 return. Δ_4 tbill $1y_{t+h}$ is the 4-quarter percentage point change in the Federal Reserve's 1 year treasury bond (DGS1). Δ_4 tbill $10y_{t+h}$ is the 4-quarter percentage point change in the Federal Reserve's 10 year treasury bond (DGS10). Δ_4 baa credit spread $10y_{t+h}$ is the 4-quarter percentage point change in the percentage point change in the yield spread between Moody's 10y BAA bond (BAA) and the US 10-year Treasury Bond (DGS10). $\Delta_4 LTG_t$ is the 4-quarter percentage point change in aggregate market expectation for 5-year earnings per share growth, calculated by value weighting firm level forecasts. Heteroskedasticity-consistent standard errors reported in parentheses are computed according to Huber-White. Superscripts: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

Table 3 reports the estimated coefficients. Consistent with Equation (10), an increase in optimism is associated with contemporaneously higher short and long term interest rates (panels A and B). This is followed by positive predictability at short horizons h = 1,2,3 (which is at least in part mechanical due to overlapping quarters). After a period of stability, six quarters ahead interest rates revert and decline. This may be due to reversal of optimism about future earnings which, again consistent with (10), reduces demand for funds by consumers and firms, reducing real interest rates.

The evolution of risk premia helps detect the role of systematic forecast errors.[1] Consider Panel three, which reports results for the Baa spread. Growing optimism about future earnings growth, due for instance to high recent growth, is associated with lower contemporaneous spreads, as captured by the negative coefficient at $h = 0$. Between three and six quarters ahead the credit spread stabilizes. Consistent with belief overreaction, though, the credit spread eventually reverts:

[1] To help disentangle the roles of mean reversion and wrong expectations in driving the reduction in interest rates, in the Appendix we add as a regressor the predictable component of the forecast error of LTG, computed in Table 2. We find that predictable disappointment is associated with a contemporaneous drop in interest rates. We also adopt this methodology in our analysis of business cycle variables in Sections 4 and 5.

starting from quarter 5 the coefficient turns positive, indicating a predictable tightening of credit markets. In the model, this tightening reflects systematically disappointing future "news".

After the 2008 financial crisis, a large body of work uses the credit spread as a barometer for financial and real activity. Its reductions are associated with expansion of output and investment, its predictable tightening to economic and financial reversals (Lopez-Salido et al., 2017, Krishnamurthy and Muir 2017). Greenwood and Hanson (2013) show that low credit spreads predict negative excess returns on risky bonds, consistent with excess optimism at these times. Our findings offer direct evidence of this channel and underscore the importance of beliefs about long term earnings growth.

IV. LTG and Boom-Bust Investment Cycles

The explanatory power of LTG for boom bust financial dynamics is consistent with Keynes' view that expectations of long term profits are an important source of volatility in financial markets. Keynes connected the same expectations, which he called animal spirits, to real activity, and in particular to firms' desire to invest. Following this insight, we next assess whether financial and business cycle volatility can be reconciled by studying the connection between LTG and real investment, both in the aggregate and at the firm level. Relative to Gennaioli et al. (2016), who document the link between CFOs' short term expectations of earnings growth and investment, we focus on long term expectations, connecting investment cycles to excess financial volatility.

Table 4: Estimate Of $\Delta_4 LTG$ and $\widehat{FELTG}$ 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 = $\Delta_4 LTG_t$										
$\Delta_4 LTG_t$	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

Estimates from:
Δ_4 investment-to-capital = $\Delta_4 LTG_t + \widehat{FE}_t$

First Stage: $FE_t = LTG_t \rightarrow \widehat{FE}_t$

$\Delta_4 LTG_t$	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

Note: The estimates measure the impact of a 1 standard deviation change in $\Delta_4 LTG_t$ and $\widehat{FE}_t$ on the 4-quarter log growth in investment-to-capital, Δ_4 investment-to-capital. The set of controls include 12 lags of dependent variable, 12 lags of 4-quarter percentage point changes in the policy interest rate, 12 lags of yearly cpi inflation, and 12 lags of the log 4-quarter SP500 return. $\Delta_4$investment-to-capital is the 4-quarter log change in the ratio of non-residential investment (PNFI) to the previous year's cost of capital (K1NTOTL1ES000). $\Delta_4 LTG_t$ is the 4-quarter percentage point change in aggregate market expectation for 5-year earnings per share growth, calculated by value weighting firm level forecasts. FE_t is defined as the difference between (a) aggregate market expectation for 5-year earnings per share growth, LTG_t, and (b) the average annual growth in aggregate earnings per share between quarter t and $t+20$, $\Delta_{20} e_{t+20}/5$. $\widehat{FE}_t$ are fitted values from the regression of FE_t on LTG_t. Heteroskedasticity-consistent asymptotic standard errors reported in parentheses are computed according to Huber-White. Superscripts: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

As in the previous section, we estimate local projections for aggregate year-on-year change in investment, controlling for 12 lags of the dependent variable, of yearly changes in the policy interest rate, of cpi inflation, and of the yearly S&P500 return. Our main shock is again the yearly change in LTG. The results are reported in Table 4, first row. A one standard deviation increase in LTG is associated with a contemporaneous increase in investment that persists until four quarters later, peaking at a 3% increase in the investment to capital ratio, which corresponds to roughly 0.4 standard deviations of year on year investment growth (7.4%). Investment stabilizes for two quarters and then declines by a similar amount. This behaviour is consistent with a mechanism in which excess optimism about long-term earnings growth fuels a short run investment boom, which then reverts into a bust when beliefs are disappointed and adjust downward.

One important question is whether the long run investment decline estimated in Table 4 is connected to the disappointment of optimistic expectations (again, this decline is unlikely to be due to fundamental mean reversion given the 12 investment lags in Table 4). We add to the specification of Panel 1 the predictable component of LTG forecast errors estimated in Table 2, row 3. The idea here is to check whether times of high excess optimism, in the sense that current LTG is so high that it predictably leads to large future disappointment, predicts future investment busts. The estimation results in Panel 3 support this mechanism. Excess LTG optimism, captured by predictable disappointment, accounts for the totality of the future reversal in aggregate investment. Controlling for predictable disappointment, the current LTG shock exerts a much more benign effect: it stimulates investment in the near term, just like a good fundamental shock.[1]

Figure 4 takes this analysis one step further to show that overoptimism at time t, measured by predictable forecast errors, is associated with investment that is *cumulatively* lower than its initial level. That is, reversals go beyond correcting for initially high investment in a mean reverting way. Instead, they predictably lead to investment 3 to 5 years ahead that is lower than if no shock to optimism had occurred at time t. This is consistent with the possibility that excessive optimism at t may lead to excessive investment over the first year, in turn entailing: i) disappointment in expectations going forward, as well as ii) a cut back of "inefficient" investment in the subsequent years (assessing the inefficiency of this contraction is however beyond the scope of this paper).

[1] In the Appendix, we add expectations of short term growth to panel B. Such expectations negatively predict investment one year ahead and have no longer term predictive power. A Granger causality test further suggests that this association is due to higher recent investment driving higher short term growth expectations and a drop in subsequent investment.

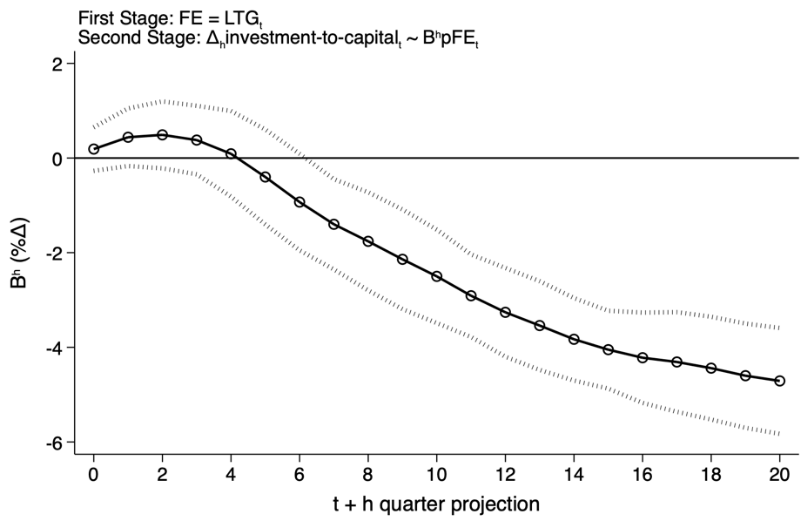


Figure 4: Impulse Response of Cumulative Investment-To-Capital To Over-Optimism
Note: The graph shows the estimated impulse response of investment-to-capital to $\widehat{FE}_t$ using local projections (Jorda, 2005). The y-axis shows δ^h estimates from the regression: Δ_h investment-to-capital$_{t+h}$ = $\delta^h \widehat{FE}_t$. The dependent variable in the regression is the log cumulative change in investment-to-capital between quarter $t-1$ and quarter $t+h$ on the x-axis. FE_t is defined as the difference between (a) aggregate market expectation for 5-year earnings per share growth, LTG_t, and (b) the average annual growth in aggregate earnings per share between quarter$t$ and $t+20$, $\Delta_{20}e_{t+20}/5$. $\widehat{FE}_t$ are fitted values from the regression of FE_t on LTG_t. The set of controls include 12 lags of yearly log changes in investment-to-capital, 12 lags of percentage point changes in the policy interest rate, 12 lags of yearly cpi inflation, and 12 lags of yearly log SP500 returns. 95% confidence interval shown, computed according to Huber-White.

Once concern in the analysis is that the connection between LTG and investment dynamics may be contaminated by a few large aggregate fundamental shocks such as the collapse of the dotcom Bubble or the Great Recession. To assess robustness, we estimate the specifications of Table 4 at the firm level. In this specification, the shock is the change in firm-level LTG and the proxy for over-optimism is the future forecast error of the firm's earnings growth predicted from the current firm-level LTG. Crucially, in this regression we can introduce time dummies, which control for any aggregate shock, including those potentially affecting required returns. We also add firm fixed effects, which additionally control for firm level differences in average profitability and risk.

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[a]					
	(0.0477)					
$\Delta LTG_{i,t}$		0.3134[a]	0.2066[a]	0.0775[c]	0.0544[a]	0.0038
		(0.0582)	(0.0625)	(0.0432)	(0.0183)	(0.0251)
Predicted (1)		-0.1021[a]	-0.1218[a]	-0.1963[a]	-0.2081[a]	-0.1514[a]
		(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

Note: We present firm-level regressions for all US firms in the IBES sample. We define firm-level forecast errors as the difference between (a) the expected long term growth in firm *i*'s earnings, $LTG_{i,t}$, and (b) the average annual growth in firm *i*'s earnings per share between quarters t and $t+20$, $\Delta_{20}e_{i,t+20}/5$. $\Delta_4 i_{i,t+h}$is the growth rate in firm *i*'s investment between quarters $t+h-4$ and $t+h$. We define firm *i*'s investment $i_{i,t}$ as the log of $\Delta_4 K_{i,t+h}/K_{i,t+h-4}$, where firm *i*'s capital stock $K_{i,t}$ includes physical, intangible and knowledge capital following the methodology of Peters and Taylor (2017). In column [1] we perform an OLS regression of the error in forecasting the firm's five-year earnings growth on $LTG_{i,t}$. In columns [2]-[6] we perform an OLS regression of $\Delta_4 i_{i,t+h}$on (a) the forecast errors fitted in column [1] and (b) the one year revision of the forecast of firm *i*'s long-term earnings growth, $\Delta_4 LTG_{i,t}$. Regressions include time- and firm-fixed effects, which we do not report. The sample period is 1982:4-2018:1. We report Driscoll–Kraay standard errors with autocorrelation of up to 60 lags. Superscripts: [a] significant at the 1% level, [b] significant at the 5% level, and [c] significant at the 10% level.

Column 1 shows that, just like at the aggregate level, high firm level LTG predicts future disappointment in earnings growth. High LTG is thus a proxy for firm level excess optimism about the long term. Columns (2)-(6) show that, as in the aggregate investment regressions, an upward LTG revision at the firm level is associated with high year-on-year investment in the near term, but going forward there is also a large and predictable investment decline.[1]

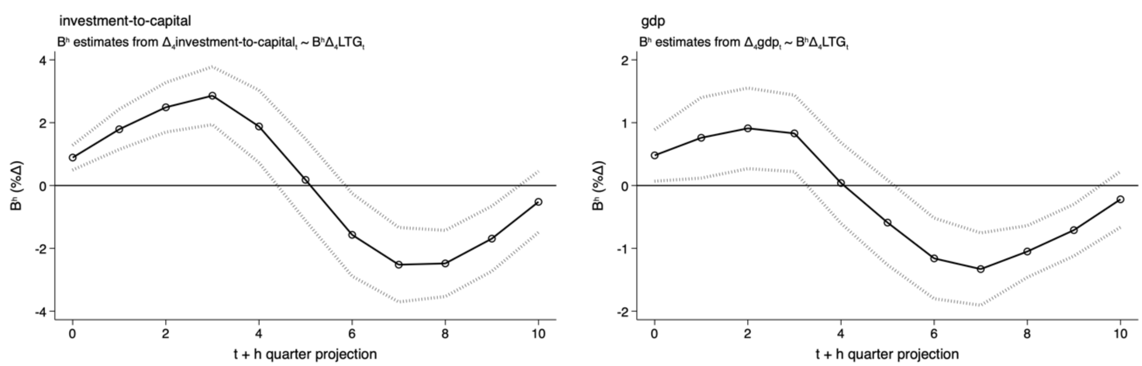
This section delivers a simple yet important message. Expectations of long term growth can reconcile excess financial volatility with volatility in real investment. This is possible because these expectations are excessively volatile, and hence display optimism and predictable disappointment that can jointly account for boom bust patterns in financial markets and real investment.

[1] The investment reversal in Table 5 is consistent with Bordalo, Gennaioli, Shleifer, and Terry (2021), who show, at the firm level, that excess optimism about short term growth is associated with predictably higher firm-level credit spreads and lower investment. They stress shifts in credit supply. Here we focus on long term expectations, not on credit, which may play a role in the effects we document.

V. LTG and the Business Cycle

We extend our analysis in two ways. First, we show that the predictability of LTG forecasts for booms and busts in economic activity extends from investment to other major business cycle indicators. Second, as a first step in examining the mechanism, we show that changes in LTG help predict current, as well as future, shocks that are conventionally considered drivers of investment.

Figure 5 shows the impulse response of investment to a one standard deviation upward LTG revision, using local projections (as given in Table 4, panel 1 for investment). The other panels show the corresponding analysis for year on year growth in gdp, aggregate consumption, employment, wages and inflation. The pattern is clear. In the short run, an upward LTG revision acts as a “good shock”: it boosts all these variables. A one standard deviation increase in LTG is associated with a 0.35 std increase for gdp growth, a 0.43 std increase for consumption, a 0.67 std increase for employment growth, a 0.30 std increase for wages, as well as a 0.35pp increase for inflation, over the course of the first year. These magnitudes are remarkable given that the impulse response already controls for many current and lagged variables.



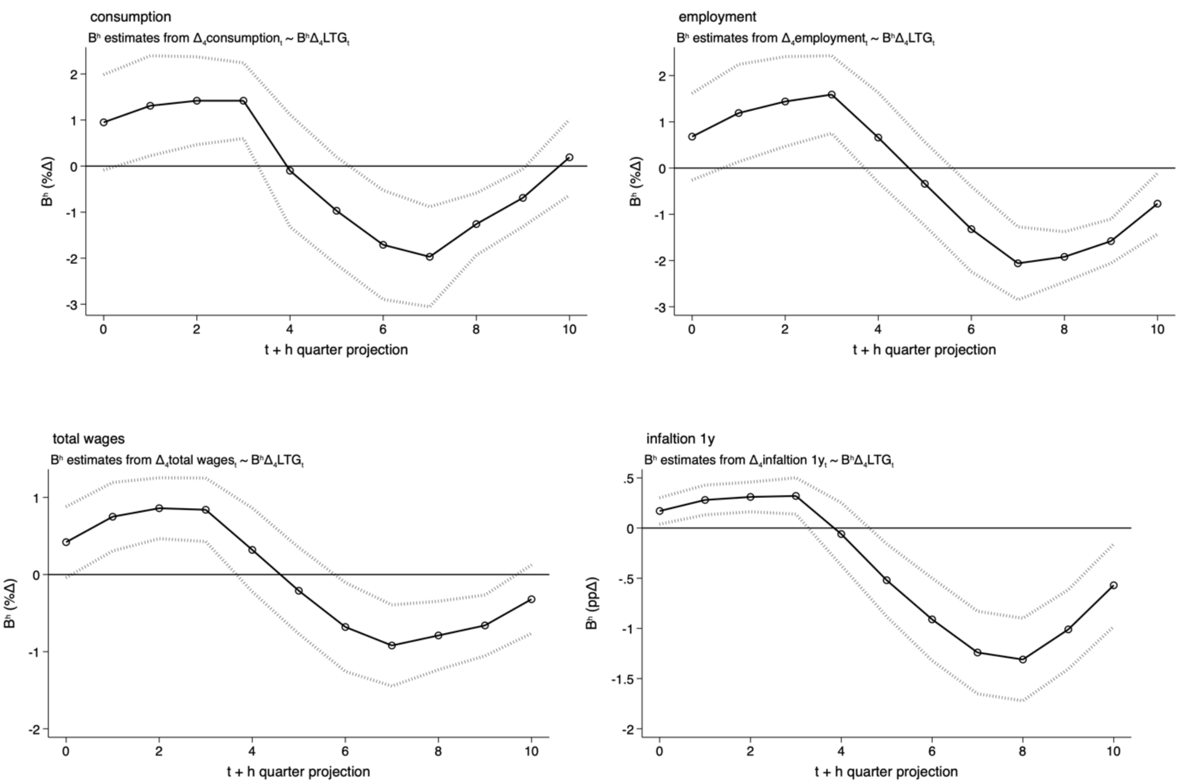


Figure 5. Impulse Projections of Business Cycle Variables

Note: The figure shows the impulse response of business cycle variables to the 4-quarter percentage point change in aggregate market expectation for 5-year earnings per share growth, $\Delta_4 LTG_t$, using the local projections (Jorda, 2005) method. Δ_4 investment-to-capital is the 4-quarter log change in the ratio of non-residential investment (PNFI) to the previous year's cost of capital (K1NTOTL1ES000). $\Delta_4 gdp$ is the 4-quarter log change in gdp (GDP). $\Delta_4 consumption$ is the 4-quarter log change in consumption (PCE). $\Delta_4 employment$ is the 4-quarter log change in total employment (CE16OV). $\Delta_4 total\ wages$ is the 4-quarter log change in total wage and salary disbursements (A576RC1). $\Delta_4 inflation$ is the 4-quarter percentage point change in yearly cpi inflation (CPIAUCSL). The set of controls include 12 lags of dependent variable, 12 lags of 4-quarter percentage point changes in the policy interest rate, 12 lags of yearly cpi inflation, and 12 lags of the log 4-quarter SP500 return. 95% confidence interval shown, computed with Huber-White standard errors.

The impulse response however show that, in the long run, a current increase in LTG is associated with reversals. These magnitude of these reversals is similar to that of the initial boom. These boom-bust dynamics mimic those of real investment and financial markets, confirming that expectations of long term growth can reconcile financial and real volatility.

To support this interpretation, and assess endogeneity concerns about the contemporaneous link between increased optimism and good times (e.g. stronger GDP growth), we perform a Granger causality test for each variable and LTG. The results are reported in the Appendix. We find that, in a Granger sense, LTG causes investment, gdp growth, consumption, employment, wages and inflation, while the reverse is almost never the case, especially at four and eight quarter lags. While this evidence is not conclusive, it indicates that LTG does not mechanically adjust to the past. It instead reflects beliefs about the future that are not yet incorporated into economic variables.

We conclude by connecting LTG to standard macroeconomic shocks, drivers of investment and the business cycle. It is beyond the scope of our paper to perform an extensive analysis of shocks, and in particular to study the propagation mechanism behind Figure 5. As a first step in this direction, we ask: what is the correlation between LTG and contemporaneous macroeconomic shocks typically associated with investment? And, can LTG help predict future realizations of these shocks? If beliefs amplify macroeconomic volatility, we would expect that current optimism is associated with good recent shocks. At the same time, since the volatility of expectations is excessive and current optimism predicts future disappointment, optimism may help predict bad shocks in the future.

We focus our analysis on shocks to the "Marginal Efficiency of Investment" (MEI). Justiniano et al. (2011) estimate this shock using a canonical DSGE model, and find that it accounts for 60 to 85% of US post-war fluctuations in GDP growth, hours and investment. Besides its high explanatory power, this shock directly connects to the mechanism we have in mind. In the Appendix we consider also investment specific and news shocks, which have also been associated with investment.

Keynes coined the term Marginal Efficiency of Investment to describe firms' propensity to invest and saw it as driven by two factors: the ease of credit and "the state of long-term expectations" or "animal spirits". In Keynes' view fluctuations in MEI played a key role in the finance and investment-business cycle nexus. Justiniano et al. (2011) formalize MEI as the productivity with which investment goods are transformed into capital. Remarkably, they show that MEI is high during times in which ease of financing is high, as measured by low credit spreads.

Here we connect shocks to MEI to its second component, long term expectations, LTG. Note that, due to its explanatory power for financial markets, LTG may also subsume part of the credit channel. That is, changes in LTG can affect MEI by directly increasing entrepreneurs' desire to invest (the demand for credit) but also indirectly, by increasing lenders' optimism (the supply of credit). To assess whether this is the case, we perform three exercises: i) we correlate the MEI shocks and LTG shocks, ii) we predict future MEI shocks using current LTG over-optimism (i.e. predictable future disappointment), and iii) we run a horse race between LTG and credit spreads in accounting for the variation in MEI.

Our first finding is that the revision of LTG over the past four quarters is positively correlated with the contemporaneous MEI shock: a one standard deviation increase in the former is associated with a 0.12 standard deviation increase in the latter. This basic correlation corroborates the idea that MEI could at least in part capture improvements in the state of long term expectations.

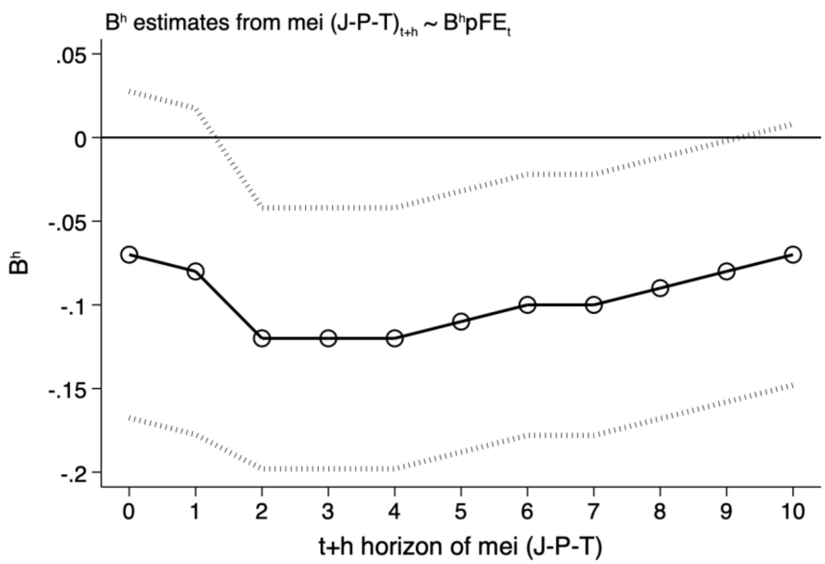


Figure 6. Impulse response of MEI shocks to FE

Note: The figure shows that impulse response to shocks to the mean efficiency of investment (MEI) to $\widehat{FE}_t$ using raw correlations. FE_t is defined as the difference between (a) aggregate market expectation for 5-year earnings per share growth, LTG_t, and (b) the average annual growth in aggregate earnings per share between quarter t and $t+20$, $\Delta_{20}e_{t+20}/5$. $\widehat{FE}_t$ are fitted values from the regression of FE_t on LTG_t. Mean Efficiency of Investment is the rate at which investment goods are converted into capital goods, taken from Justiniano et. al (2011). 95% confidence interval shown, computed according to Huber-White.

We next use our index of current excess optimism, the predictable LTG forecast errors estimated in Table 2 row 3, to predict *future* values of the MEI shock at different horizons. Figure 6 reports the univariate regressions of the shock on predictable forecast errors. High excess LTG optimism today predicts bad MEI shocks in the future. This finding is intriguing because MEI shocks are by construction unpredictable based on the variables included in the DSGE model by Justiniano et al (2011). Perhaps their model fails to capture excess volatility of expectations and their subsequent systematic disappointment, here proxied by LTG, and so feeds it into the estimated MEI.

We conclude by running a horse race, in which the LTG shocks, our measure of excess optimism given by the predicted forecast errors, and the credit spread are jointly used to predict contemporaneous and future MEI shocks. The results are in Table 6.

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)$_{t+h}$ = $\Delta_4 LTG_t$ + $baaspread_{t+h}$ + FE'_t No Controls										
$\Delta_4 LTG_t$	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]
baa credit spread 10y	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]
$\widehat{FE}_t$	-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]
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

Note: The estimates measure the impact of a 1 standard deviation change in $\Delta_4 LTG_t$ and $\widehat{FE}_t$ on mei_{t+h}. The regressions are unconditional (no controls). $\Delta_4 LTG_t$ is the 4-quarter percentage point change in aggregate market expectation for 5-year earnings per share growth, calculated by value weighting firm level forecasts. FE_t is defined as the difference between (a) aggregate market expectation for 5-year earnings per share growth, LTG_t, and (b) the average annual growth in earnings per share between quarter t and $t+20$, $\Delta_{20} e_t - e_{t+20}/5$. $\widehat{FE}_t$ are fitted values from the regression of FE_t on LGT_t. baa credit spread$_{t+h}$ is the yield spread between Moody's 10y BAA bond (BAA) and the US 10-year Treasury Bond (DGS10). Heteroskedasticity-consistent asymptotic standard errors reported in parentheses are computed according to Huber-White. Superscripts: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

As in our previous analysis, upward LTG revisions appear as good shocks: they positively correlate with MEI in the short term. However, high LTG optimism is associated with bad MEI shocks in the future, consistent with the possibility that MEI may in part capture excess volatility created by overreaction and systematic reversals. Conditional on long term expectations, the credit spread loses its contemporaneous explanatory power for MEI. This evidence further bolsters the possibility that long-term expectations may lie at the core of the nexus between financial and real activity, acting as a driver of excess volatility in both domains.

In sum, measured expectations of long term growth offer the promise of reconciling excess volatility in financial markets and predictable returns with the volatility of investment and the business cycle that is at the same time parsimonious, and consistent with standard macroeconomic shocks. The key new aspect is the role of overreacting long term expectations as shock amplifiers.

VI. Conclusion

Using analyst expectations of long-term earnings growth for individual US listed firms, we provide some evidence that the well-known connection between financial markets and the macroeconomy may be due to the influence of non-rational expectations on both. In line with Keynes' intuition, long term expectations exhibit excess volatility, which in turn correlates with movements of stock prices and returns, interest rates, credit spreads, as well as with the cyclical behaviour of investment and other real quantities. Belief overreaction arises as an important ingredient that appears both qualitatively and quantitatively helpful to understanding volatility, particularly predictable long-term reversals. Several approaches have tried to account for these facts by changing investor preferences in ways that are hard to measure or test. We underscore the promise of a simple, measurable, and realistic ingredient: overreacting expectations as shock amplifiers.

The analysis presented here only scratches the surface of a daunting task: integrating survey data and realistic models of expectation formation in macroeconomic analysis. One challenge is to explore how, through choices of different agents, non-rational expectations affect the propagation mechanism. Doing so calls for developing theoretical macroeconomic models with overreacting beliefs in which the precise consequences of these links can be assessed. There are several recent attempts in this direction (Bordalo et al., 2021, Bianchi et al., 2021; Maxted, 2020; L'Huillier et al., 2021; Ilut and Schneider, 2014; Angeletos et al., 2020), but much remains to be done, for instance in understanding the role of beliefs for consumer demand, labor markets, or price setting.

The second open issue is to measure and study the formation of expectations about the long term. The accumulated evidence shows that expectations about fundamentals are important. But expectations about many other outcomes may play important roles. Examples include perceptions of risks (including financial, political or climate risks), beliefs about returns to investment (including on savings and on human capital) and also second order expectations about other investors. The latter expectations were also discussed by Keynes in the General Theory. They have been studied under rationality, but new models of expectations open new avenues. Bordalo, Gennaioli, Kwon, and Shleifer (2021) show how diagnostic expectations about others may help account for asset price bubbles, Bastianello and Fontanier (2022) consider wrong beliefs about the information used by others. Systematically measuring a rich set of expectations (and testing for their departures from rationality) will help understand the propagation of shocks through the economy.

Finally, there is much still to learn about the formation of expectations. The overreaction in LTG appears delayed and persistent. The sluggish adjustment may come from information frictions, as discussed in Bordalo, Gennaioli, Ma, and Shleifer (2020) and Bordalo, Gennaioli, Kwon, and Shleifer (2021). But what drives overreaction and why is it more prevalent in expectations about the long term? Keynes (1936) argued that because the long term is so uncertain and hard to imagine, these expectations are likely to be shaped by current events which are easily accessible. This view is consistent with research in Psychology, which shows more broadly that beliefs about the future are largely formed from experiences retrieved from memory on the basis of prominent cues (Bordalo, Conlon, Gennaioli, Kwon, and Shleifer 2022). Thus, good times bring strong growth to mind, and keep risks out of mind. This effect is stronger for longer term expectations, where most anything can happen or be believed, since imagining the near term is naturally strongly anchored to the present.

The psychology of memory and attention can offer important insights in this enterprise. For instance, even irrelevant personal experiences may matter when forming beliefs about aggregate conditions, because these experiences are salient in a person's mind and can help her imagine an uncertain future. In this respect, the memory-based theories of beliefs can jointly shed light on the large observed belief heterogeneity, and connect it to systematic biases such as under or over reaction of consensus expectations to specific shocks. The introduction of realistic departures from rationality in macroeconomics is not like opening Pandora's box where "anything can happen". It is part of a long quest in the search for better micro-foundations, deeper "parameters", and the ability to incorporate as well as explain a larger body of data.

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