Expectations and Investment[1]

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Abstract

Using micro data from Duke University quarterly survey of Chief Financial Officers, we show that corporate investment plans as well as actual investment are well explained by CFOs' expectations of earnings growth. The information in expectations data is not subsumed by traditional variables, such as Tobin's Q or discount rates. We also show that errors in CFO expectations of earnings growth are predictable from past earnings and other data, pointing to extrapolative structure of expectations and suggesting that expectations may not be rational. This evidence, like earlier findings in finance, points to the usefulness of data on actual expectations for understanding economic behavior.

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1. Introduction

One of the basic principles of economics in general, and macroeconomics in particular, is that expectations influence decisions. In line with this principle, the use of survey-based expectations data has been the mainstay of macroeconomic analysis since the 1940s, analyzing variables such as railroad shippers' forecasts. NBER published several volumes on data of this kind, such as *The Quality and Economic Significance of Anticipation Data* (1960), showing that forecasts are helpful in understanding real decisions by firms, such as investment and production.

The use of expectations data took a nosedive following the Rational Expectations Revolution. First, under rational expectations, the model itself dictates what expectations rational agents should hold to be consistent with the model (Muth, 1961), so anticipations data are redundant. Second, economists became skeptical about the quality of expectations data; in fact this skepticism predates rational expectations (Manski, 2004). According to Prescott (1977), "Like utility, expectations are not observed, and surveys cannot be used to test the rational expectations hypothesis" (underlining his). In finance, as in macroeconomics, the Efficient Markets Hypothesis implies that expectations of asset returns are predicted by the model (Campbell and Cochrane, 1999; Lettau and Ludvigson, 2001), so expectations data are not commonly used.

In our view, the marginalization of research on survey expectations deprives economists of extremely valuable information. Whether or not survey expectations predict behavior is an empirical question. Moreover, the rational expectations assumption should not be taken for granted, but rather confronted with actual expectations data, imperfect as they are. Today, we have theoretical models that do not rely on the rational expectations assumption and make testable predictions, as well as expectations data to compare alternative models. Indeed, Manski (2004) argues forcefully and convincingly that expectations data are necessary to distinguish alternative models in economics.

As an illustration, take the case of finance, where data on expectations of asset returns have been rejected as uninformative (e.g., Cochrane, 2011). Yet there is mounting evidence that

expectations are highly consistent across different surveys of different types of investors, that they have a fairly clear extrapolative structure, that they predict investor behavior, and that they are useful in predicting returns (e.g., Greenwood and Shleifer, 2014). Most important, expectations of returns obtained from surveys are negatively correlated with measures of expected returns obtained from rational expectations models. The trouble seems to be with conventional rational expectations models of asset prices, not with expectations data.

The message we take from this discussion is that expectations data can be used to address two questions: 1) do expectations affect behavior? and 2) are expectations rational? The questions are related. If expectations do not affect behavior, it matters little whether they are rational or not. If however expectations do affect behavior, the question of their rationality becomes quite relevant, since it allows us to consider alternative models of belief formation underlying economic decisions.

In this paper, we try to answer these questions for the case of corporate investment. We use new data assembled by Campbell Harvey and John Graham from Duke University to examine expectations formed by Chief Financial Officers of large U.S. corporations and their relationship to investment plans and actual investment of these firms. To be more specific, the Duke data are based on quarterly surveys of CFOs which, among other things, collect information on earnings growth expectations and investment plans. We match these data with Compustat to get information on actual investment and other accounting variables. We also consider earnings forecasts made by Wall Street financial analysts regarding individual firms, which happen to be highly correlated with CFO forecasts.

To organize our discussion, we present a simple Q-theory based model of investment, but one relying on actual expectations rather than stock market data. We then conduct a number of empirical tests suggested by the model of the relationship between earnings growth expectations and planned investment growth, both in the aggregate and firm-level data. The results suggest that expectations are statistically and substantively important predictor of both planned and actual investment; they seem to have explanatory power beyond traditional variables such as Tobin's Q, discount rates,

measures of financial constraints or uncertainty. We then conduct a number of empirical tests on the rationality of expectations. Although these tests face a number of difficulties, our evidence suggests that expectations do not appear to be rational in the sense that—both in the aggregate and at the level of the individual firms—errors are consistently predictable from highly relevant publicly available information, such as past profitability. Some evidence points to the extrapolative structure of earnings expectations, similar to the evidence from finance.

Our paper is related to several very large strands of research. Most clearly, it is related to a large literature on determinants of investment, such as Barro (1990), Hayashi (1982), Fazzari, Hubbard, and Petersen (1988), Lamont (2000), and many others. Four papers are particularly closely related to our work. Cummins, Hassett and Oliner (2006) replace the traditional market-based Tobin's Q used in investment equations by Q computed using analyst expectations data, and find that the fit of the equation is much better. Guiso, Pistaferri, and Suryanarayanan (2006) use direct expectations data on Italian firms to study the relationship between expectations, investment plans, and actual investment. Arif and Lee (2014) use accounting data to show that high aggregate investment precedes earnings disappointments, and argue that fluctuations in investor sentiment account for the evidence. Finally, Greenwood and Hanson (2015) study specifically the shipping industry, and find evidence of boom-bust cycles driven by volatile (and incorrect) expectations and investment that follows them.

Our paper is also related to research on expectations in macroeconomics. A large literature studies inflation expectations and their rationality (e.g. Figlewski and Wachtel, 1981; Zarnowitz, 1985; Keane and Runkle, 1990; Ang, Bakaert, and Wei, 2007; Monti, 2010; Del Negro and Eusepi, 2011; Coibion and Gorodnichenko, 2012, forthcoming; Smets, Warne, and Wouters, 2014). Souleles (2004) finds that consumer expectations are biased and inefficient, yet are strong predictors of household spending. Some research suggests that analyst expectations of corporate profits are rational at very short horizons (Keane and Runkle, 1998), although the overwhelming majority of studies reject rationality of analyst forecasts (De Bondt and Thaler, 1990; Abarbanell, 1991; La

Porta, 1996; Liu and Su, 2005; Hribar and McInnis, 2012). There is also a literature on expectations shocks in macroeconomics, which generally maintains the assumption of rational expectations (Lorenzoni, 2009; Angeletos and La'O, 2009; Levchenko and Pandalai-Nayar, 2015).

Perhaps most closely related to our work is research in behavioral finance, where biases in expectations have been examined for many years (e.g., Cutler, Poterba, and Summers, 1990; DeLong et al. 1990). Some of the recent papers include Amronin and Sharpe (2009), Bacchetta, Mertens and Wincoop (2009), Hirshleifer and Yu (2012), and Greenwood and Shleifer (2014), to which we return later. Several of these papers find that investor expectations are extrapolative. In the bond market, Piazzesi, Salomao, and Schneider (2013) use data on interest rate forecasts and also find substantial deviations from rationality. Vissing-Jorgensen (2003) and Fuster et al. (2011) are two recent Macro Annual papers that also address expectations formation and rationality.

In the next section, we briefly summarize some of the evidence on the relationship between investor expectations and asset prices, and address some of the criticisms of expectations data. Section 3 describes our data. Section 4 presents a simple Q-theory model of expectations and investment that organizes our empirical work. Section 5 follows with the basic empirical results on expectations and investment. Section 6 examines the structure of expectations. Section 7 concludes with a brief discussion of implications of the evidence for macroeconomics.

2. Recent Research on Expectations and Asset Prices in Finance

Before turning to our main results on investment, we briefly summarize recent research on expectations and stock market returns, which illustrates the usefulness of expectations data. In recent models with time-varying expected returns (e.g., Campbell and Cochrane, 1999; Lettau and Ludvigson, 2001), expected returns (ER) are given by required returns, which in turn depend on consumption: investors require higher returns when consumption is low (relative to some benchmark), and lower returns when consumption is high. This research does not generally use data on expectations. Rather, it adopts a rational expectations approach in which ERs are determined by

the model itself, so ER is inferred from the joint distribution of consumption and realized returns.

As discussed in the introduction, recent work has started to use actual expectations data. For our purposes, the most relevant paper is Greenwood and Shleifer (2014). They use data on expectations of returns from six different surveys of investors, including a Gallup survey, investor newsletters, and the survey of CFOs of large corporations that we use in the current paper. The paper reports four main findings relevant to our analysis, which we summarize in Tables 1 and 2.

First, expectations of aggregate stock returns are highly correlated across investor surveys, despite the fact that different datasets survey different investors and ask somewhat different questions (see Table 1). These measured expectations are also highly positively correlated with equity mutual fund inflows. Survey expectations are thus hardly misleading or uninformative: why would they otherwise be strongly correlated across groups, across questions, and with fund flows?

Second, return expectations appear to be extrapolative: they are high after a period of high market returns, and low after a period of low market returns (see Table 1 and Figure 1).

Third, and critically, expectations of returns are strongly negatively correlated with model-based measures of ER (see again Table 1). Put simply, when investors expect returns to be high, models predict that the ER is low. A plausible interpretation of this finding is that model-based ER does not actually capture expectations.

Fourth, when expectations of returns are high, and ER is low, actual returns going forward are low (see Table 2). To us, this piece of evidence points to the interpretation, dating back to Campbell and Shiller (1987, 1988), that high market valuations and consumption reflect overvaluation and excessive investor optimism (as directly measured by expectations), and portend reversion going forward. Model-based ER, in other words, does not measure expectations, but rather proxies for overvaluation.

We draw two lessons from this analysis. At the most basic level, the research indicates that direct survey estimates of expectations are useful: they have a well-defined structure across different surveys, and they predict fund flows as well as future returns. Second, to the extent that the

conclusion that survey measures of expectations actually measure expectations is accepted, the evidence points against rational expectations models of stock market valuation. Actual expectations are strongly negatively related to the measures of expected returns that these models generate. In the remainder of this paper, we consider some related findings with respect to corporate investment.

3. Data for Studying Expectations and Investment

Our empirical analysis of corporate investment draws on two main categories of data: 1) data on expectations, primarily of future profitability, and 2) data on firm financials and investment activities. We focus on non-financial firms in the United States. We collect data both at the aggregate and at the firm level, and all data are available at quarterly frequencies. Appendix B provides a list of the main variables, including their construction and the time range for which each variable is available.

3.1 Expectations Data

We have data on the expectations of two groups of people: CFOs and equity analysts. We first describe these data and then show that expectations of CFOs and equity analysts are highly correlated.

A. CFO Expectations

Our data on CFO expectations come from the Duke/CFO Magazine Business Outlook Survey led by John Graham and Campbell Harvey, which is launched in July 1996 and takes place on a quarterly basis. Each quarter, the survey asks CFOs their views about the US economy and corporate policies, as well as their expectations of future firm performance and operational plans.[2] Starting in 1998, the CFO survey consistently asks respondents their expectations of the *future twelve month growth* of key corporate variables, including earnings, capital spending, and employment, among others. The original question is presented to the CFOs as follows:

[2] Graham and Harvey (2011) provide a detailed description of the survey. Historical questionnaires are available at http://www.cfosurvey.org.

Relative to the previous 12 months, what will be your company's PERCENTAGE CHANGE during the next 12 months? (e.g., +3%, -2%, etc.) [Leave blank if not applicable]

Earnings: _____; Cash on balance sheet: _____; Capital spending: _____;

Prices of your product: _____; Number of domestic full-time employees: _____; Wage: _____...

(Selected items are listed as examples. For a complete listing, please refer to original questionnaires posted on the CFO survey's website.)

We use CFOs' answers on earnings growth over the next twelve months as the main proxy for CFO expectations of future profitability. As the survey does not ask for expectations beyond the next twelve months, we will explain in Section 4 how we interpret and extract information from earnings expectations over the next twelve months.

We then use CFOs' answers on capital spending growth in the next twelve months as a proxy for firms' current investment plans. In the empirical analysis, we investigate how investment plans relate to expectations of future profitability. We adopt this approach in light of well documented lags between decisions to invest and actual investment spending (Lamont, 2000). With lags in investment implementation, current expectations about future profitability may not translate into capital expenditures instantly. Instead, they will affect current investment plans, and show up in actual investment spending with some delay. As a result, it can be more straightforward to detect the impact of earnings expectations by looking at investment plans. We discuss this issue in more detail in Sections 4 and 5.

Our analyses use both aggregate time series and firm-level panel data. Aggregate variables are revenue-weighted averages of firm-level responses, and they are published on the CFO survey's website. While the survey does not require CFOs to identify themselves, some respondents voluntarily disclose this information. It is then possible to match a fraction of the firm-level responses with data from CRSP and Compustat to perform firm-level tests. For example, Ben-David, Graham, and Harvey (2013) use matched firm-level data to study how managerial miscalibration affects corporate financial policies. Because there are privacy restrictions associated with these data,

Graham and Harvey helped us implement firm-level analysis using a subsample of their matched dataset. The firm-level data we use has 1,133 firm-year observations, spanning from 2005Q1 to 2012Q4.[3] We exclude firms that have negative earnings in the past twelve months because in that case earnings growth is not well-defined. We also winsorize outliers at the 1% level.

B. Analyst Expectations

We obtain data on equity analysts' expectations of future firm performance from the IBES dataset. Beginning in the 1980s, IBES collects analyst forecasts of quarterly earnings per share (EPS) for the next one to up to twelve quarters. We take consensus EPS forecasts (i.e. average forecast for a given firm-quarter in the future) and compute forecasts of total earnings by multiplying the number of shares outstanding. To compare the results with those using CFO expectations, we compute analyst expectations of future twelve months earnings growth. We calculate aggregate analyst expectations of future twelve months earnings growth by summing up expected future earnings of all firms in the next four quarters and then divide by the sum of earnings of all firms in the past four quarters. We calculate firm-level analyst expectations of future earnings growth by taking the forecast of total firm earnings in the next four quarters, and then dividing by total earnings in the past four quarters. We exclude firms that have negative earnings in the past twelve months when calculating expected future earnings growth.

The sample with analyst expectations covers both a longer time span and a larger set of firms. We set the start date of the aggregate time series and firm panel to be 1985Q1 because some of the quarterly Compustat data items we use only become systematically available around 1985 and because aggregate analyst forecasts have some outliers before 1985. We set the end of the sample to be 2012Q4 so we can match expectations to realized next twelve month earnings growth with accounting data ending in 2013Q4. In total, we have 145,281 firm-level observations of expected earnings growth over the next twelve months, and we winsorize outliers at the 5% level.

C. Correlation between CFO and Analyst Expectations

[3] The number of observations in our firm-level regressions can be smaller because some respondents do not answer all questions.

The expectations of CFOs and analysts with respect to next twelve month earnings growth are highly correlated. Figure 2 shows aggregate time series of expected next twelve month earnings growth from the CFO survey and from analyst forecasts. The raw correlation of these two series is 0.65. At the firm level, the raw correlation between CFO and analyst expectations of next twelve month earnings growth is 0.4 if we demean by firm, and 0.3 if we demean by both firm and time. The high correlation between expectations of CFOs and analysts indicate that expectations data are consistent and meaningful, and expectations of both groups incorporate information about general business outlook shared by managers and the market.

3.2 Firm Financials Data

We collect aggregate data on firm assets and investment from the Flow of Funds (Table F.102 and Table B.102) and the National Income and Product Accounts, and firm-level data from Compustat. A key variable in our analysis is realized earnings, which we use to assess the accuracy of earnings expectations of CFOs and analysts. While Compustat mainly records Generally Accepted Accounting Principles (GAAP) earnings, managers and analysts often use so-called "pro forma earnings" (also called "Street earnings") which adjust for certain non-recurring items (Bradshaw and Sloan, 2002; Bhattacharya, Black, Christensen, Larsen, 2003). To make sure we use the same measure of earnings as CFOs and analysts, we collect realized earnings from IBES Actuals files, which closely track earnings as reported by companies in their earnings announcements. These are the numbers that analyst forecasts aim to match and the earnings metric that managers tend to use the most.[4] For simplicity, in the rest of the paper we will refer to IBES actual earnings as "earnings", and GAAP earnings as "net income".

Table 3 presents summary statistics of firms for which we have firm-level CFO expectations (Panel A) and analyst expectations (Panel B), as well as all non-financial firms in Compustat (Panel C). For comparability, the statistics in Panel B and Panel C are generated based on the time period

[4] We performed detailed checks and verified that IBES actuals earnings indeed appear to be closest to forecasts by managers and analysts, in terms of accounting treatment, magnitude, variance, and variation over time.

for which we have firm-level CFO expectations (i.e. from 2005 through 2012). We can see that firms with analyst expectations are mostly larger than the median Compustat firm, and firms with CFO expectations are generally even larger. Firms with CFO and analyst expectations also appear to be more profitable than firms in the full Compustat sample in terms of net income, but otherwise very similar in terms of sales, investment, book-to-market, and Q.

4. Expectations and Firm Investment: Empirical Specifications

We motivate our empirical specification with a basic Q-theory model. A firm is run by a risk neutral owner who discounts the future by factor $\beta < 1$,[5] and the firm's horizon is infinite. In the model, we interpret each period t to be twelve months. We later discuss how we adapt this annual timing structure to our quarterly survey data. The firm's output in period t is obtained by combining capital and labor using a constant returns to scale production function $A_t^{1-\eta} K_t^{\alpha} L_t^{\eta}$. At the beginning of period t, the owner hires labor L_t at wage w and makes decisions about investment during the year I_t. Investment takes one year to implement, so $\mathrm{K_{t+1}} = (1-\delta)\mathrm{K_t} + I_t$, where δ is capital depreciation rate. The firm's optimal policy in year t maximizes the expected present value of earnings:

$$max_{\{I_s, L_s\}_{s \geq t}} \mathbb{E}_t \left\{ \sum\nolimits_{s \geq t} \beta^{s-t} \left[A_s^{1-\eta} K_s^{\alpha} L_s^{\eta} - wL_s - C(I_s, K_s) \right] \right\}$$

subject to $K_{s+1} = (1-\delta)K_s + I_s$. We assume the commonly used quadratic investment costs:

$$C(I_s, K_s) - I_s = \frac{b}{2}\left(\frac{I_s}{K_s} - a\right)^2 K_s,$$

which allow for convex adjustment costs ($b > 0$) and displays constant returns to scale.

In the optimization problem above, the operator $\mathbb{E}_t(.)$ denotes the owner's expectations conditional on his information at the beginning of year t, computed according to his possibly distorted beliefs. We allow for departures from rational expectations, but restrict to beliefs that

[5] The assumption of risk neutrality and constant discount rate is for simplicity of exposition. The framework can be extended to incorporate time varying discount rates. In our empirical analysis in Section 4.2 and Section 4.3, we will explicitly consider time varying discount rates in our log-linearized Q theory framework, and the specification is the same as those derived by Lettau and Ludvigson (2002).

preserve the law of iterated expectations. By standard arguments, Appendix A shows that the firm's optimal investment chosen at the beginning of year t is described by:

$$\frac{I_t}{K_t} = \left(a - \frac{1}{b}\right) + \frac{\beta}{b}\frac{\mathbb{E}_t\left[\sum_{s\geq t+1}\beta^{s-(t+1)}\Pi_s\right]}{K_{t+1}}. \quad (1)$$

where $\Pi_s = A_s^{1-\eta}K_s^{\alpha}L_s^{\eta} - wL_s - C(I_s, K_s)$ denotes the firm's earnings in year s. Equation (1) corresponds to a generic Q-theory equation with quadratic adjustment costs, which takes the form $I_t/K_t = \eta + \gamma Q_t$.

To estimate Equation (1), ideally we would like to know expectations of earnings in all future periods. This is unfortunately not feasible in practice. For instance, CFOs only report expectations of earnings growth in the next twelve months. Formally, in the CFO survey we only have information about $\mathbb{E}_t(\Pi_t)$, namely expectations at the beginning of year t about earnings Π_t in the following twelve months (which are not yet known, so the expectations are well-defined). With respect to investment, we have information on: i) planned investment over the next twelve months, and ii) actual capital spending in each quarter. We denote investment plans for the next twelve months as I_t^p, which captures the plan made at the beginning of the year about investment in the upcoming year.

Given implementation lags in the investment process, it may be most straightforward to test how expectations at a given point in time affect firms' investment plans.[6] Accordingly, we approximate Equation (1) by

$$\frac{I_t^p}{K_t} \approx \theta_0 + \theta_1 \frac{\mathbb{E}_t(\Pi_t)}{K_t} \quad (2)$$

This approximation is reliable if expectations about the level of future earnings display significant persistence, namely $\mathbb{E}_t(\Pi_t)/K_t$ is not too far from $\mathbb{E}_t(\Pi_{t+1})/K_{t+1}$ and more generally for earnings further away in the future. We find this assumption to be plausible based on information in

[6] Plans are particularly helpful in the context of our data, where we observe forward looking expectations once a quarter rather than once a year. With lags in investment implementation, it is unlikely that expectations in a given quarter will be immediately reflected in capital spending in the same quarter, or even fully incorporated into capital spending in the next quarter. In comparison, investment plans would be more responsive to contemporaneous expectations. When managers become more optimistic, they would revise their plans upward. As plans get implemented over time, the impact on actual capital expenditures can show up with some delay. For this reason, it is more straightforward to start testing the impact of expectations by looking at investment plans.

the data. Empirically earnings over asset are relatively persistent, and moreover, we verify that they are perceived to be very persistent drawing on evidence from analyst forecasts. The IBES dataset provides analysts' forecasts of future earnings for up to twelve quarters. With firm level forecasts, we find $\mathbb{E}_t(\Pi_{i,t+1})/K_{i,t+1} = 0.83\mathbb{E}_t(\Pi_{i,t})/K_{i,t} + \eta_i + \varepsilon_{i,t}$ and $\mathbb{E}_t(\Pi_{i,t+2})/K_{i,t+1} = 0.73\mathbb{E}_t(\Pi_{i,t})/K_{i,t} + \eta_i + \varepsilon_{i,t}$. Aggregate persistence implied by analyst forecasts is similar. In addition, lagged profitability is not significant if included in these regressions and neither does it affect coefficients on $\mathbb{E}_t(\Pi_{i,t})/K_{i,t}$. These results suggest that next one year expectations incorporate a significant amount of information about medium to long term expectations. We showed in Section 3 that CFO and analyst expectations are highly correlated, and it is probable that their beliefs share common structures.

Given this corroborating evidence, it appears that within the limitations of our data, Equation (2) is a reasonable approximation of Equation (1). For the purpose of our empirical analysis, it is convenient to log-linearize Equation (2) and express it in growth rates, since all variables in the CFO survey are in terms of percentage change in the next twelve months relative to the past twelve months. By expressing Equation (2) in growth rates we can directly employ these variables, without using them to reconstruct levels. If we denote logs by lowercase variables, then derivations in Appendix A show that our equation for investment plans can be approximated as:

$$\underbrace{i_t^p - i_{t-1}}_{\substack{\text{planned investment growth} \\ \text{in next 12m}}} \approx \mu_1 \underbrace{[\mathbb{E}_t(\pi_t) - \pi_{t-1}]}_{\substack{\text{expectation of earnings growth} \\ \text{in the next 12m}}} + (1-\mu_1)(k_t - k_{t-1}) \qquad (3)$$

where μ_0, μ_1 are log-linearization constants ($\mu_1 > 0$). The left hand side term is planned investment growth in the next twelve months, which is available from the CFO survey. The first term on the right hand side of Equation (3) is expectations of earnings growth in the next twelve months, which we also observe directly in the data. This specification is very similar to previous studies of investment growth such as Barro (1990), Lamont (2000), and many others.

The intuition of Equation (3) is as follows: When firms think that earnings will increase by a lot in the next twelve months, they also tend to believe that future earnings will be higher for a

sustained period of time. As a result, they would want to invest more, which leads to an immediate increase in planned investment. In Equation (3) we need to control for the change in capital stock because both investment and profitability are affected by the size of capital stock. We can also arrive at a specification very similar to (3) in a simpler setting with time to build but without adjustment costs.[7] Empirically we use Equation (3) to map a basic investment model to testable predictions in our dataset. We instead refrain from testing the parameter restrictions on the right hand side coefficients that would be implied by a strict adherence to the approximated Q equation.

While investment plans are a convenient starting point to detect the impact of expectations, for Equation (2) to be informative about how expectations influence investment, it must also be the case that plans are closely related to realizations. In Section 5.3, we show that investment plans are highly correlated with actual capital spending over the planned period. In other words, a significant fraction of capital spending over the next few quarters appears to be determined by ex ante investment plans, consistent with previous findings by Lamont (2000). To the extent that there is a close correspondence between investment plans and realized investment over the planned period, it would also be of interest to test how current expectations translate into actual capital spending in the next twelve months. This additional test allows us to further assess whether expectations have a substantial impact on actual investment activities. We present results from these tests in Section 5.3.

5. Expectations and Investment

In this section, we test the relationship between investment decisions and earnings expectations. We focus on CFO expectations, and provide supplementary results using expectations of equity

[7] One might also consider an alternative approximation of Equation (1) of the following form $I_{t-1}/K_{t-1} \approx \hat{\theta}_0 + \hat{\theta}_1 \mathbb{E}_t(\Pi_t)/K_t$ where I_{t-1} denotes realized investment in the past twelve months, and $\mathbb{E}_t(\Pi_t)$, as before, is current expectations of earnings in the next twelve months. This approximation is reasonable under two conditions. As in the case of Equation (2), it should be that expectations over future earnings are stable. Moreover, it has to be that respondents received little information and barely updated their beliefs in the past twelve months, so that current expectations about next twelve month earnings, namely $\mathbb{E}_t(\Pi_t)$, is close to expectations four quarters ago about earnings over the same period, namely $\mathbb{E}_{t-1}(\Pi_t)$. We find this approximation to be less tenable for several reasons. First, from time to time new information arrives over a twelve month period that has a significant impact on people's beliefs. (This can happen even if earnings processes are highly persistent, for example, if it is a random walk.) Second, given implementation lags in real world investment activities, actual capital spending over a twelve month period tends to be particularly influenced by decisions made at the beginning of the period. As a result, realized capital spending in year $t-1$, I_{t-1}, may not be well explained by expectations at the end of year $t-1$. In light of these observations, we use the approximation in Equation (2) in the rest of our analysis.

analysts. We begin by studying investment plans. In Section 5.1 we consider the role of expectations at the aggregate level, and in Section 5.2 we consider the role of expectations at the firm level. Then, in Section 5.3 we evaluate the relationship between plans and realized investment, and document the link between expectations and actual capital spending.

5.1 Expectations and Investment Plans: Aggregate Evidence

Figure 3 visually represents the association between aggregate CFO expectations and aggregate investment. Panel A plots CFOs' expectations of next twelve month earnings growth, along with planned investment growth in the next twelve months. Panel B adds to Panel A actual aggregate investment growth in the next twelve months. We see that there is a strong comovement between earnings expectations and investment plans, and between investment plans and actual capital spending. At the very least, expectations data do not appear to be uninformative noise.

We then estimate versions of Equation (3) using quarterly regressions:

$$\Delta\widehat{\mathrm{CAPX}}_{q_t} = \alpha + \beta \mathrm{E}^{\mathrm{CFO}}_{q_t}[\Delta\mathrm{Earnings}] + \lambda \mathrm{X}_{q_t} + \epsilon_{q_t}$$

where $\Delta\widehat{\mathrm{CAPX}}_{q_t}$ is planned investment growth in the next twelve months reported in quarter q_t, $\mathrm{E}^{\mathrm{CFO}}_{q_t}[\Delta\mathrm{Earnings}]$ is CFO expectations of next twelve month earnings growth reported in quarter q_t. X_{q_t} includes past change in capital stock as shown in Equation (3), as well as a set of additional controls we discuss below. We use Newey-West standard errors with twelve lags.

Table (4) columns (1) and (2) report our baseline results. We find that CFOs' earnings expectations have significant explanatory power for firms' investment plans, both statistically and economically. A one standard deviation increase in earnings growth expectations is associated with a 0.8 standard deviation increase in planned investment growth.[8] Put differently, a one percentage point increase in CFO expectations is accompanied by a 0.6 percentage point increase in planned investment growth.[9] Quantitatively, CFO expectations have major explanatory power for aggregate

[8] At the aggregate level, during the period where we have CFO expectations data, the standard deviation of planned investment growth is about 0.05, and the standard deviation of earnings growth expectations is 0.07. 0.07*0.6/0.05=0.8.

[9] Due to lags in investment implementation it is also possible that, at a given quarter, part of the capital spending that firms expect to make in the next twelve months are determined by decisions made, for example, in the last quarter, and therefore affected by

investment.

In interpreting these results, three issues arise. First, how do CFO expectations relate to traditional proxies of Tobin's Q? Do data on managers' expectations contain information beyond market price-based measures of Q? Second, is the role of expectations robust to controlling for alternative theories of corporate investment? Third, and finally, could the correlation between expectations and investment reflect a reverse causality problem, whereby investment affects expectations of future earnings rather than the other way around? In the following, we address these issues by augmenting our baseline regressions.

Some variables may affect investment but are likely to do so only through their influence on expectations, such as information relevant for predicting future product demand. In principle, a large part of expectations are formed, perfectly or imperfectly, based on observable information, instead of being exogenous innovations. Thus a flexible enough function of observable information should be able to approximate expectations. The focus of our present analysis, however, is to test the extent to which expectations as a whole, as measured by our data, affect firms' investment decisions. It is not to analyze the role of expectational shocks, or the part of expectations not explained by observables. For this reason, we do not pursue an investigation of whether our expectations variables can or cannot be driven out by a full set of factors that are used to explain expectations. Instead, we emphasize controls that represent alternative determinants of investment (such as discount rates, financial constraints, etc.).

5.1.1. CFO Expectations and Market-based Proxies for Tobin's Q

We begin with a comparison of CFO expectations and traditional proxies of Tobin's Q. This exercise helps us assess whether expectations data contain additional information relative to standard market-based Q measures. In Table 4 column (3), we include the empirical proxy of Q. In

expectations then. In aggregate data, we can include lagged expectations, in which case current expectations and past expectations with two lags are significant, and jointly highly significant. Unfortunately, it is difficult to include lagged expectations in firm level tests, since we do not always observe individual firms continuously. Therefore, in the baseline specifications we include only current expectations.

line with previous research, the explanatory power of equity Q is very weak. It is well known that equity Q is very persistent and does not line up well with fluctuations in investment activities. In our context, to explain investment growth, the direct theoretical counterpart is not Q in levels, but the log change in Q. Barro (1990) shows changes in Q are almost equivalent to stock returns. He finds that changes in Q from the beginning of year $t-1$ to the beginning of year t is highly correlated with investment growth in year t, and stock returns from the beginning of year $t-1$ to the beginning of year t perform incrementally better. In column (4), we include past twelve month stock returns. The coefficient on this variable is positive and statistically significant, as predicted by theory. The coefficient on CFO expectations remains large and highly significant.[10] The views of CFOs appear to contain a substantial amount of additional information for investment plans not captured by equity Q.

Recent work by Philippon (2009) finds that a proxy of Q obtained from bond yields is also highly correlated with investment activities. Philippon's bond Q series end in 2007, which is five years before the end of our sample. However, bond Q is highly correlated with credit spread. For example, the correlation between change in bond Q and change in credit spread over four quarters is 0.84. Thus in column (5) we include changes in credit spread in the past four quarters in lieu of bond Q. In addition, credit spread can be relevant as a control also because it may reflect credit availability and financial constraints. The coefficient on this variable is negative and significant—consistent with theory—but CFO expectations retain significant explanatory power beyond it.

Overall, then, CFO expectations explain investment plans beyond market based Q proxies, statistically and economically. Indeed, CFOs may possess information that markets participants either do not possess or process imperfectly. To the extent that managers' and markets' views differ, it is natural that managers' beliefs have a major impact on investment decisions. As we show in Section 5.3, this result also extends to actual capital spending.

[10] As illustrated in Section 4, proxies of Q are supposed to represent the Q model precisely, whereas survey data can only represent it approximately. Thus it may not be surprising that Q proxies remain significant in regressions that include survey expectations.

5.1.2. CFO Expectations and Alternative Theories of Investment

We now test the role of expectations against alternative theories of investment. We introduce a set of variables motivated by these theories, which are the key controls in our analysis.

Time-varying discount rates

A prominent idea in traditional finance holds that variations in required returns, or discount rates, are central to explaining investment in both financial and real assets. Lamont (2000) postulates that firm investments rise and fall in response to changes in discount rates so that high investment growth is associated with low future stock returns. Lettau and Ludvigson (2002) argue that time varying risk premia, as proxied for by the consumption-wealth ratio (known as *cay*), can forecast future investment growth. In Table 4 columns (6) to (8), we control for three common measures of discount rates: log dividend yield, *cay*, and the surplus consumption ratio as constructed by Campbell and Cochrane (1999). *cay* is somewhat significant, surplus consumption is not, and dividend yield tends to enter with the wrong sign. The explanatory power of CFO expectations is unaffected.

We can also control for risk premia implied by long run risks models, as constructed by Bansal, Kiku, Shaliastovich, and Yaron (2014). Unfortunately their series is annual, which leaves us with few observations. We interpolate the series to quarterly frequencies in multiple ways and find it tends to enter with the wrong sign. Taken together, none of these variables compare in their explanatory power to CFO expectations, and their inclusion does not have much of an influence on the coefficient on expectations.

Because proxies for discount rates are generally quite persistent, their coefficients can suffer from Stambaugh (1999) biases. In our case, Stambaugh bias will tend to attenuate the coefficients on discount rates toward zero or make them have the wrong sign.[11] In Appendix C Table C6, we

[11] Stambaugh bias arises when predictor variables are relatively persistent, and innovations in predictor variables and outcome variables are correlated. In theory, investment should be high when discount rates are low. Thus we would expect a negative coefficient on discount rates. To the extent that investment and discount rates are negatively correlated, Stambaugh bias will be upward, pushing the coefficient on discount rates closer to or above zero.

report Stambaugh bias adjusted results, using a multivariate version of the bootstrap method in Baker, Taliaferro, and Wurgler (2006). The bias adjusted results are very similar.

Financing Constraints

A well-known empirical result, dating back to Fazzari, Hubbard, and Petersen (1988), is that investment is positively correlated with recent firm cash flows. The leading interpretation is that firms are often financially constrained, so they would invest more when high cash flows increase internal resources. In column (9), we control for cash flows in the past twelve months.[12] We can include cash flow variables either in levels or in changes, and results are similar: The coefficient on expectations barely changes, and the coefficient on past cash flows tends to be insignificant. This result confirms earlier findings by Cummins et al. (2006) that unveil the fragility of financial constraint variables once earnings expectations are taken into account.

Economic Uncertainty

A blooming literature studies the impact of uncertainty on economic activities when investment is irreversible or has fixed adjustment costs (Leahy and Whited, 1996; Parigi and Guiso, 1999; Bloom, Bond, and Van Reenen, 2007; Bloom, 2009, among others). During periods of high uncertainty, the theory goes, managers do not want to exercise the option of investing: they prefer to wait for better times and information. It is legitimate to ask whether our measure of CFO expectations is important when we include proxies for uncertainty in our regression.

In Table 4 column (10), we include stock price volatility as a standard uncertainty proxy following Leahy and Whited (1996) and Bloom, Bond, and Van Reenen (2007), together with economic policy uncertainty as measured by Baker, Bloom, and Davis (2013). We can use these variables in levels or in past twelve month changes. In either case, these uncertainty proxies have only weak explanatory power, and the coefficient on CFO earnings expectations remains highly

[12] Here we use past net income rather than pro forma earnings to be conservative, since the actual internal resources that firms gain from cash flows need to deduct most of the extraordinary items. Results using either form of profit metric to control for past cash flows are very similar.

significant.

In Table 4 columns (11) and (12), we additionally control for past GDP growth and past investment growth. In the last column, we include multiple controls together. The statistical and economic significance of CFO expectations variable remains largely intact.

Overall, these tests illustrate that CFO earnings expectations have significant explanatory power which is not accounted for by variables capturing alternative theories, such as time varying discount rates, financial constraints, and uncertainty. As we show below, similar results hold when we connect expectations to actual capital spending. Our results suggest that expectations data provide substantive information about fluctuations in aggregate investment, and changes in expectations can be central to understanding investment activities.

5.1.3. Reverse Causality

One possible concern is our baseline results could be affected by reverse causality. Specifically, if a firm plans to invest a lot in the next twelve months, managers might also expect earnings to increase as investment leads to more output and sales. This mechanism seems unlikely to be driving our results. First, investment in the next twelve months generally does not translate into output and sales immediately. Second, even if it does, investment is an incremental addition to the capital stock. It is unlikely that a one percent increase in investment (which increases the firm's capital stock by much less than one percent) can instantly lead to a one percent or more increase in firm earnings, as would be required to match the magnitude of coefficients in the data.

We further address the reverse causality concern in supplementary tests, drawing on another question in the CFO survey, which asks respondents to rate their optimism about the US economy on a scale from 0 to 100 (with 0 being the least optimistic and 100 the most optimistic). In Appendix C Table C1, we show that CFOs' optimism about the US economy is significantly positively correlated with investment. It is hard to argue that firms' investment plans will mechanically cause CFOs to be more optimistic about the *US economy*. Instead, this result is very

much in line with previous findings that firms' expectations and sentiments appear to be a key driver of investment activities.

In Appendix C Table C2, we present the same set of tests using analyst expectations. We find analyst expectations are also significantly correlated with investment plans, although not surprisingly the magnitude of the relationship is smaller; the coefficients on analyst expectations are generally about one half of the size of the coefficients on CFO expectations. The evidence suggests that expectations elicited from different sources are consistent, and there are general views shared by managers and the market that play an important role in shaping aggregate investment dynamics.

5.2 Expectations and Investment Decisions: Firm Level Evidence

In Table 5, we repeat our analysis at the firm level. As before, we start with CFO data. We estimate

$$\Delta\widehat{\mathrm{CAPX}}_{\mathrm{i,q}_t} = \alpha + \zeta_i + \beta \mathrm{E}^*_{i,\mathrm{q}_t}[\Delta\mathrm{Earnings}_i] + \lambda \mathrm{X}_{\mathrm{i,q}_t} + \epsilon_{\mathrm{i,q}_t}$$

We report baseline results with firm fixed effects. Results are very similar without fixed effects, or with dynamic panel estimators.[13] Table 5 shows that at the firm level, CFO expectations continue to have substantial explanatory power for investment decisions. The response of a firm's investment plans to CFO expectations is similar in magnitude to the relationship unveiled in the aggregate analysis of Table 4: When CFOs expect earnings growth to increase by one percentage point, planned investment growth increases by 0.4 percentage points on average. We then compare CFO expectations with firm level Q and past twelve month firm stock returns. We use the book-to-market ratio as a proxy for firm level required returns, and all other firm level controls directly correspond to their aggregate counterparts in Table 4. After including these controls, alone or together, CFO expectations remain statistically and economically significant. We also examine results adding time

[13] To the extent that strict exogeneity may not be satisfied, fixed effect estimators may be biased in finite sample. In our context, it will bias the coefficient on earnings expectations downwards. Regressions without fixed effects and those using dynamic panel methods show that the bias does not appear to be very important. Given that we do not always continuously observe individual firms in the CFO sample, it is difficult to take first differences and use lagged instruments. Instead, for dynamic panel estimations we apply the forward orthogonal deviations (FOD) transformation as in Arellano and Bover (1995).

fixed effects and the findings are similar.

In Appendix C Table C3 we replicate the firm-level analysis with analyst expectations. The results show that analyst expectations about a firm's earnings growth can also explain investment plans. As before, the size of the coefficients on analyst expectations is about one half of that on CFO expectations. While CFO expectations play a more dominant role, business outlook shared by managers and specialist analysts is nonetheless informative about investment decisions.

5.3 From Plans to Realized Investment

A premise for our analysis in Sections 5.1 and 5.2 is that investment plans are key determinants of actual capital spending. With lags in investment implementation, expectations in a given quarter may not translate into realized investment instantly, so changes in plans can help us pinpoint the impact of expectations, and plans will turn into capital expenditures over a period of time. In this section, we evaluate this proposition empirically. In Figure 3 Panel B it is evident that, at the aggregate level, plans and realized investment over the planned period are closely related. The raw correlation between the two series is 0.78.[14] Figure 3 Panel B also shows that realized investment is highly correlated with investment plans fitted on CFO expectations. Expectations appear to be a key driver not only of investment plans, but also of actual capital spending.

In Table 6 and Table 7, we present a full set of results using CFO earnings expectations in a given quarter to forecast actual investment growth in the next twelve months, both at the aggregate and at the firm level. We find that expectations, and CFO expectations in particular, have substantial forecasting power for realized next twelve month investment. Both in aggregate and at the firm level, a one percentage point increase in CFO earnings growth expectations predicts a 0.6 percentage point increase in actual investment growth in the next twelve months. The performance of past stock returns and changes in credit spread has some improvements, but expectations data retain significant power; they are very informative about realized capital spending both alone and in

[14] Figure 2 uses aggregate investment as measured by private non-residential fixed investment from NIPA. We can alternatively use capital expenditures data from Flow of Funds or Compustat, and results are very similar.

the presence of a list of important controls.

Taken together, evidence in this section shows that expectations data are highly relevant for understanding corporate investment. They are not simply noise, but contain considerable information for explaining investment activities beyond a host of traditional variables.

6. Are Expectations Rational?

Given that expectations appear to shape investment, it is critical to understand their determinants. We now take a first step in analyzing the structure of CFO and analyst expectations about future earnings growth. In particular, we check whether expectations of managers and market participants are consistent with rational benchmarks, or are systematically biased in predictable ways.

The simplest test of rational expectations is to run a regression with realized future earnings growth on the left hand side and ex ante expectations on the right hand side. In our context, such tests take the form:

$$\underbrace{\Delta Earnings_i}_{\substack{\text{realized next 12m} \\ \text{earnings growth}}} = \alpha + \beta \underbrace{\mathrm{E}^*_{i,\mathrm{q}_t}[\Delta Earnings_i]}_{\substack{\text{expected next 12m} \\ \text{earnings growth}}} + \omega_{i,t+1}$$

where i is a firm index, $\Delta Earnings_i$ denotes realized earnings growth in the next twelve months, $\mathrm{E}^*_{i,\mathrm{q}_t}[\Delta Earnings_i]$ denotes expectations of next twelve month earnings growth reported in quarter q_t. The test can be augmented by including on the right hand side a set of variables that are within time t information set.

Rational expectations postulate that $\alpha = 0$ and $\beta = 1$ (and a zero coefficient on any other variable in time t information set). Using both CFO and analyst expectations, we find β to be significantly lower than one, and a list of variables known at time t enter significantly. This finding, however, does not necessarily mean that expectations are excessively volatile relative to outcomes. It could be that expectations are measured with error, which would cause a downward bias in β.

An alternative approach is to study the predictability of ex-post expectational errors. If expectations are rational, forecast errors should be orthogonal to all information available at the time when the forecast is made, and forecast errors should be unpredictable. If, on the other hand, expectations are systematically biased, then ex post errors would be predictable using information available ex-ante. In this case, the structure of error predictability could help us understand potential sources of excessive optimism and pessimism.

To take a first look, consider Figure 4. Panel A shows errors in aggregate CFO expectations about next twelve month earnings growth against past year corporate profitability. Panel B shows the same series using analysts' expectations data.[15] The figures show a striking pattern: expectational errors appear to be systematic and recurring. In particular, they are consistent with the presence of excessive optimism in good times and excessive pessimism in bad times: future realized earnings growth systematically falls short of expectations when past earnings are high, and exceeds expectations when past earnings are low.[16]

To statistically corroborate the patterns in Figure 4, we present regressions of expectational errors on past profitability. Column (1) of Table 8 Panel A reports the results using CFO data. Column (1) of Table 9 Panel A reports the results using analyst data. In both cases, high past year profitability is correlated with over-optimism, while low past year profitability is correlated with over-pessimism.[17] The magnitude of the bias appears large. For instance, a one standard deviation increase in past profitability is associated with a 0.6 standard deviation increase in the magnitude of CFOs' expectational errors.[18] Figure 5 further illustrates these results with scatter plots of expectational errors against past profitability. It shows that the bias is present throughout the sample

[15] The errors are computed as aggregate realized next twelve month earnings growth – aggregate CFO (analyst) expectations of next twelve month earnings growth. As we cannot identify the full set of firms that answer the CFO survey in each quarter, this sample may differ from the full sample with which we use to compute aggregate realized earnings growth. For robustness, to make sure that aggregate earnings growth patterns are representative, we alternatively compute aggregate earnings growth by taking the mean or median earnings growth in each quarter. We find this makes very little difference, and we get consistent empirical results in all cases.

[16] Note that earnings in quarter t are typically announced several weeks into quarter $t+1$, thus we use earnings from quarter $t-5$ through $t-2$ to compute past year profitability, so as to ensure that all information in the predictor variable is strictly in the information set of CFOs and analysts when they make forecasts in quarter t.

[17] To address concerns that past year profitability is relatively persistent (though it is much less persistent than variables like discount rate proxies), we present bootstrap bias adjusted results in Appendix C Table C7. We find very similar results.

[18] During the period where we have CFO expectations, the standard deviation of past year earnings/asset is 0.88, and the standard deviation of expectational errors is 0.13. 0.88*0.09/0.13=0.6.

period, and not driven by a single outlier event.

Column (2) in Panel A of Tables 8 and 9 correlate expectational errors with past GDP growth to check whether over-optimism and over-pessimism are predictable by aggregate economic performance. We also find higher past GDP growth is associated with over-optimism, and vice versa (although the statistical significance on past GDP growth is a bit lower).[19]

One way to interpret these results is that expectations depart from rationality in the direction of being extrapolative: when CFOs or analysts observe good or bad earnings realization, they think that similar realization persists into the future and fail to correct for mean reversion. To illustrate, we separately examine, and then compare, how actual future earnings growth and expected future earnings growth correlate with past year profitability. When past year earnings over asset increase by one percentage point, actual earnings growth in the next twelve month on average slows down by 0.12. However, CFOs only expect next twelve month earnings growth to slow down by about 0.03. The difference between the true and perceived reversion corresponds to the coefficient of -0.09 in Panel A column (1).

We find very similar results at the micro level. In Table 8 Panel B we examine expectational errors of individual CFOs. We use past year firm profitability and GDP growth as main predictors of expectational errors. Consistent with previous evidence at the aggregate level, expectational errors of individual CFOs are also strongly correlated with firm profitability and general economic conditions, in a way that appears to be extrapolative. At the firm level, as past year earnings over asset increase by one percentage point, next twelve month earnings growth tends to slow down by 0.06, whereas CFOs only expect it to slow down by 0.01 on average. This results in a difference of -0.05, as shown by Panel B column (1).

Note that profitability is likely to be heterogeneous across firms, and the normal level of earnings over asset can be quite different for established firms than for young firms, and for firms in different industries (this can be of particular concern when we turn to the analyst sample, which is

[19] To be conservative, past twelve month GDP growth also ends at quarter t-2 because GDP is reported with a lag,

much more heterogeneous than the CFO survey sample). To account for firm-specific average profitability, we include firm fixed effects. In the setting of error predictability regressions, strict exogeneity required by traditional fixed effect estimators may not be satisfied. Under the null of rational expectations, only sequential exogeneity will be satisfied. We perform robustness checks using dynamic panel estimators as in Arellano and Bover (1995),[20] and results are very similar. For standard errors in firm level tests, we always cluster by firm and we double cluster by both firm and time whenever the length of the panel makes it appropriate to do so.

In columns (5) and (6) of Table 8 Panel B, we report results adding time fixed effects, which helps us assess the extent to which expectational errors load on the idiosyncratic component of firm profitability. By teasing out aggregate shocks, time fixed effects may also attenuate issues in rational expectations tests when the panel is relatively short (this can be a concern with the CFO panel, which spans seven years and 28 quarters, and is less of a concern with the analyst panel, which covers 28 years and 112 quarters).[21] We find that CFOs seem to significantly extrapolate the idiosyncratic component of past profitability. Together, results in Table 8 show that the extrapolative structure of CFO expectations appears pervasive. Past year economic conditions, and both the aggregate and the idiosyncratic component of firm profitability, are all correlated with CFOs' expectational errors.

In Table 9, we perform the same set of tests as in Table 8 using analyst expectations. The results are similar: Analysts also tend to over-estimate next twelve month earnings growth when past year firm profitability is high and when past year economic conditions are favorable, and under-estimate future earnings growth when the past year is rough.

At first glance, the patterns in CFO and analyst expectations are quite consistent with extrapolative biases observed in financial markets. As shown by Greenwood and Shleifer (2014), many market participants—including individual and institutional investors as well as CFOs

[20] The forward orthogonal deviations (FOD) transformation studied by Arellano and Bover (1995) is most helpful as our CFO panel contains gaps.

[21] One possible concern is that time fixed effects may not completely tease out aggregate shocks if different firms are affected differently by an aggregate shock. For this to affect our results, it has to be that firms which happen to have a profitable past year are hit harder by an adverse aggregate shock, and vice versa. We do not find very compelling evidence for this concern.

surveyed by Graham and Harvey—tend to extrapolate stock price trends formed in the past year. They generally think that past year's trend would continue, whereas in reality it tends to revert. As explained in Section 2 and shown in Figure 1, investors tend to become significantly more optimistic about stock market performance in the next twelve months when market returns in the past year are high, and vice versa (Figure 1 Panel A). Corporate CFOs are equally extrapolative in their expectations about next twelve month market returns (Figure 1 Panel B). Piazzesi, Salomao, and Schneider (2013) also find that bond market investors tend to perceive interest rate trends to be more persistent than they are.

While our evidence is consistent with extrapolation in earnings expectations, there can certainly be other reasons which contribute to apparent deviations from rationality. In the following, we address a set of possible concerns.

Alternative Explanations of Deviations from Rationality

One potential concern is that CFOs or analysts may have asymmetric loss functions that cause them to report expectations which deviate from their objective views. For instance, analysts may want to please management and release upward biased forecasts (Lim, 2001). Reputational or other "publicity" considerations are not likely to be at play in the case of CFOs, as individual responses in the CFO survey are never published. From this perspective, CFOs should not have much incentive to bias their responses for signaling purposes.

The main challenge for explanations with asymmetric loss functions is to account for the time varying nature of expectational errors. Commonly used specifications of asymmetric loss functions (such as the LINEX function, and the Lin-Lin function under certain assumptions) generally yield optimal forecasts that are linear in objective expectations and conditional variance of the forecast variable. Given that conditional volatility of earnings tends to be higher in bad times, for asymmetric loss functions to generate more "pessimism" in bad times and more "optimism" in good times, it has to be the case that over-predicting is more costly than under-predicting. In this case,

however, we would expect reported expectations to be consistently biased downwards (with the magnitude increasing in the size of the conditional variance), which is not the case for either CFOs or analysts.[22]

While we do not find compelling reasons why asymmetric loss functions can drive our results, we nevertheless perform a set of robustness checks. In Table 8 and Table 9 we control for various proxies of volatility, including the VIX index and recent stock price volatility. We find that the volatility terms do not enter significantly, and our main results are unchanged. This evidence suggests that it is the level of past earnings that affects systematic forecast errors, whereas uncertainty plays a minor role.

Another possible concern is that CFOs might be reporting expectations not under physical probabilities, but under certain types of risk neutral probabilities. Note that reporting expectations of future earnings growth is distinctively different from pricing, or calculation of expected returns of an asset. In the context of pricing, future cash flows may be discounted using a stochastic discount factor, or correspondingly, weighted by risk neutral probabilities. In the context of forecasting future earnings growth, it is not very plausible that any *discounting* is present and that there is an associated stochastic discount factor from optimizing theories.[23] It is possible that certain scenarios might be more salient in people's minds that lead to distorted probability weighting, but this explanation would fall into the category of cognitive biases (Bordalo et al. 2012).

Finally, recent research also points to other frictions that can affect expectations formation, including information rigidities (Mankiw and Reis, 2002) and inattention (Sims 2003, 2010). While these frictions are likely to be important in many economic settings, they may not be natural explanations for the extrapolative errors in CFOs' and analysts' earnings expectations. Although

[22] One might also consider alternative scenarios where CFOs and analysts have time varying loss functions. For this to explain our results, it has to be that people prefer to under-predict in bad times and to over-predict in good times. We do not find compelling reasons why it is optimal to follow this strategy.

[23] In addition, to the extent that high earnings are associated with low SDF (i.e. in general earnings are high in good states), earnings growth under risk neutral probabilities (which is always a well-defined mathematical object, though its economic interpretation may be unclear) will be consistently lower than earnings growth under physical probabilities. We find no evidence that either CFOs or analysts appear to be persistently pessimistic.

there is some possibility that managers and analysts do not pay full attention to information such as GDP growth, it is not quite plausible that past firm earnings are not in their information set, or that such information just slips their minds. After all, earnings are quite important for firms, as well as to management compensation. Similarly, analysts, who are designated to forecast future earnings and whose performance is judged in part by the accuracy of their forecasts, are also unlikely to be oblivious to firm earnings.

Overall, our evidence points to systematic extrapolative biases in CFO and analyst expectations. While we may not be able to definitively rule out that some combinations of limited sample span, measurement error, and more complicated versions of informational frictions and loss functions could contribute to some these results, extrapolation stands out as the most natural and parsimonious explanation. The findings also echo accumulating evidence in finance that extrapolation arises in many settings, and appears to be a common psychological tendency in expectations formation.

7. **Summary and Implications**

Our analysis of data on earnings expectations and investment yields two basic conclusions. First, expectations data appear to be extremely helpful in understanding corporate investment plans and actual investment, more so than some traditional measures of determinants of investment. Second, several empirical tests appear to reject the rational expectations benchmark, pointing to the extrapolative nature of expectations.

At a minimum, the evidence endorses Manski's (2004) call for collecting and using expectations data to evaluate economic theories. Our project would not have been possible without Campbell Harvey and John Graham's CFO data. But as is often the case with a preliminary analysis and with limited data, there are many questions that we cannot address with the limited data we have.

An important challenge raised by this analysis, as well as by previous work, is to construct

plausible models of expectations. In macroeconomics, in particular, such models have to come to grips with some version of the Lucas critique, which was applied initially precisely to Cagan's and other models of adaptive expectations. In our view, market participants might be backward looking and extrapolative to some extent, but surely they also have some ideas of how the economy evolves that are forward-looking. Developing models along these lines is an open problem. Our own approach has been to use psychological models of expectations that incorporate both forward and backward looking elements (e.g., Bordalo et al. 2013; Gennaioli et al. 2015), but this research is still some way from being ready for a macroeconomic model.

The larger question of course is whether expectations have a significant role to play in macroeconomic modeling. A recent literature in macroeconomics considers expectations "shocks", and discusses the extent to which they can contribute to economic fluctuations (Beaudry and Portier, 2004; Angeletos and La'O, 2009; Lorenzoni, 2009; Barsky and Sims, 2012; Angeletos and La'O, 2013; Levchenko and Pandalai-Nayar, 2015). Our perspective is quite different; the evidence suggests that expectations have a fairly precise extrapolative structure, and do not just vibrate randomly. They are not noise; there is a systematic pattern of errors. Moreover, we believe – and our evidence seems supportive of this belief – that market participants make common expectational errors. Here we show that these errors are common to analysts and CFOs; we suspect the beliefs of policy makers are highly correlated with those of market participants. It seems to us that, as a consequence, plausible models would consider common errors among many economic agents, which therefore would have potential aggregate effects.

The final question is whether such errors can account for some part of macroeconomic fluctuations, such as aggregate overbuilding in important sectors like the housing market, or prolonged recessions with a lack of corporate investment and hiring. Our data have limitations for quantifying how the erroneous component of expectations affects investment, since the rational level of investment is not observable, but has to be inferred from making additional assumptions about the decision makers' environment and information, which requires extra discretion. It is a

further step still that a common error translates into aggregate investment distortions. We leave this to future work.

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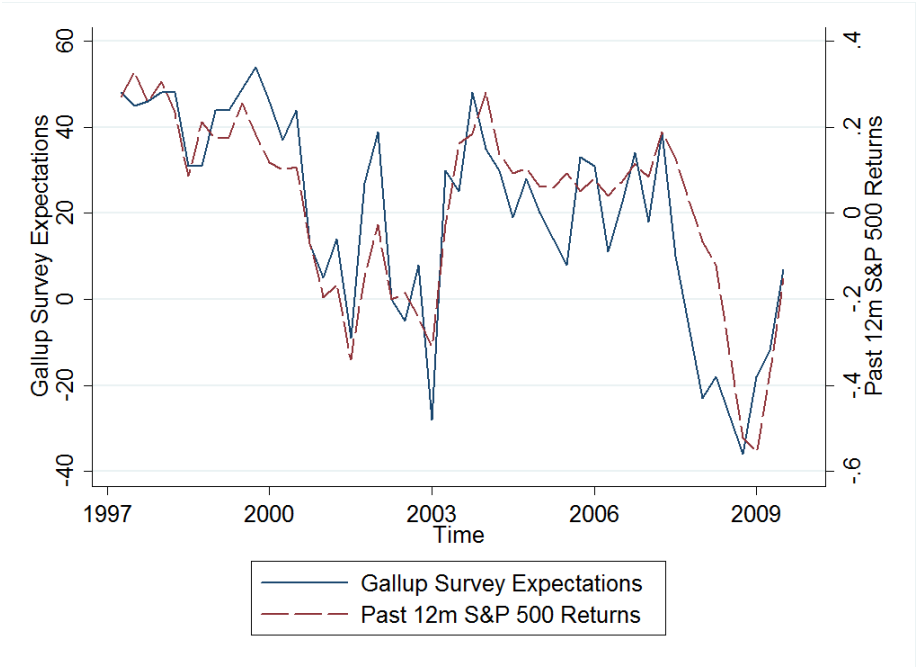
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Figures and Tables

Figure 1. Stock Market Expectations of Investors and CFOs and Past Stock Returns

The dashed line denotes S&P 500 index returns in the past twelve months. In Panel A, the solid line denotes expectations from the Gallup survey (% optimistic - % pessimistic about performance of the stock market in the next twelve months). In Panel B, the solid line denotes the average response in the CFO survey, to the question "Over the next year, I expect the average annual S&P 500 return will be: ___." Frequency is quarterly.

Panel A. Expectations in Gallup Survey and Past Year Stock Returns



Panel B. Expectations in CFO Survey and Past Year Stock Returns

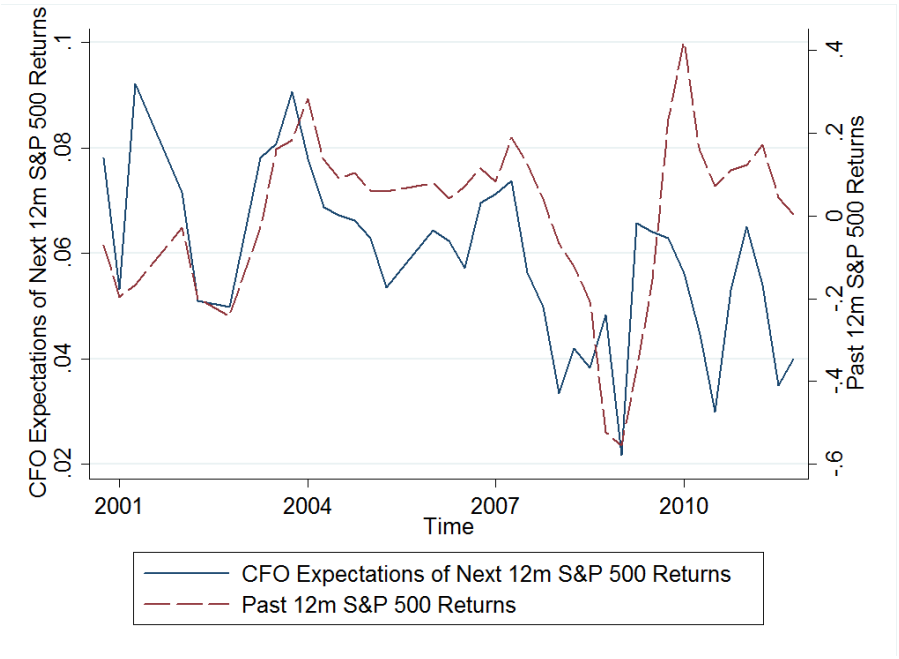


Figure 2. Expectations of Next Twelve Month Earnings Growth by CFOs and Analysts

The solid line is aggregate CFO expectations of next twelve month earnings growth from the CFO survey. The dashed line is aggregate analyst expectations of next twelve month earnings growth computed from analyst EPS forecasts. Frequency is quarterly.

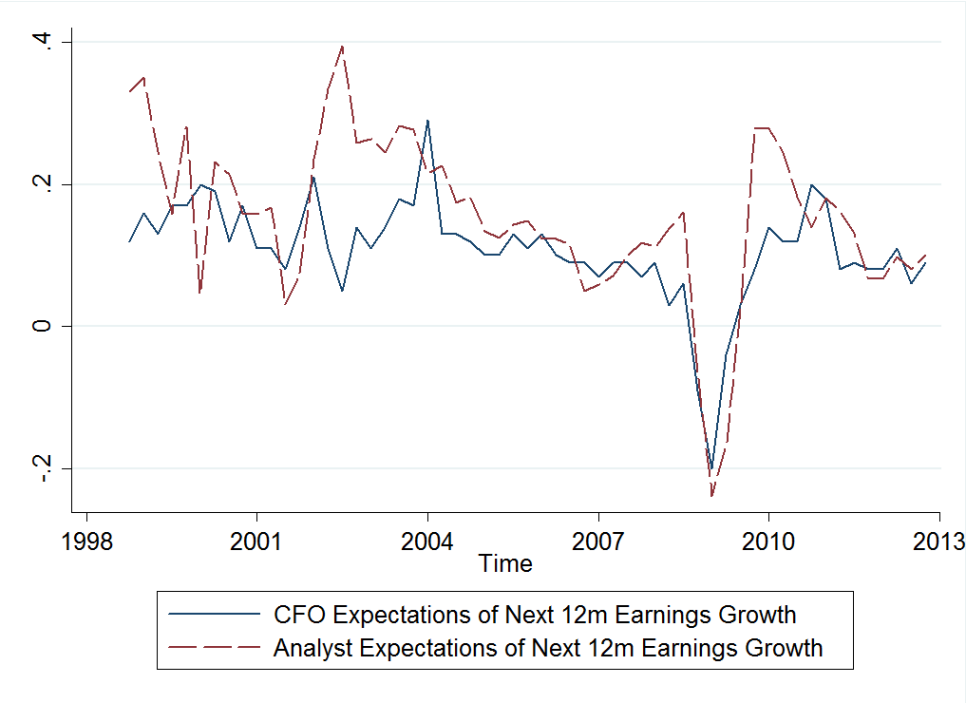
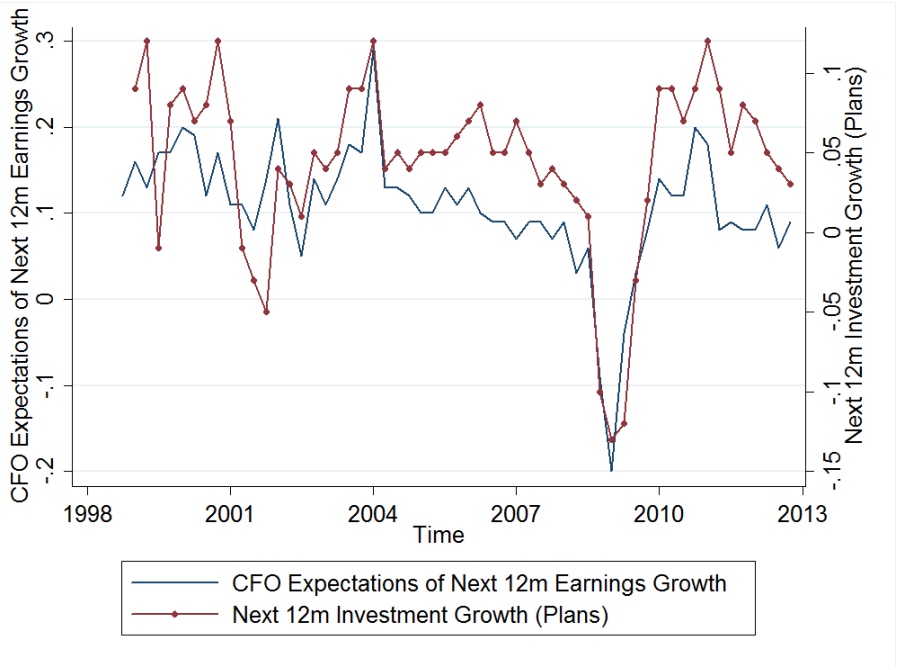


Figure 3. CFO Earnings Growth Expectations and Investment

The plots below present aggregate CFO expectations of future earnings growth, aggregate planned investment growth, and aggregate actual investment growth. In Panel A, the solid line is aggregate CFO expectations of next twelve month earnings growth. The solid line with circles is aggregate planned investment growth in the next twelve months. In Panel B, the solid line is planned investment growth in the next twelve months fitted on contemporaneous CFO earnings growth expectations. The solid line with circles is aggregate planned investment growth in the next twelve months. The dashed line is actual growth of private non-residential fixed investment in the next twelve months. Frequency is quarterly.

Panel A. CFO Earnings Expectations and Investment Plans



Panel B. CFO Earnings Expectations, Investment Plans, and Realized Investment

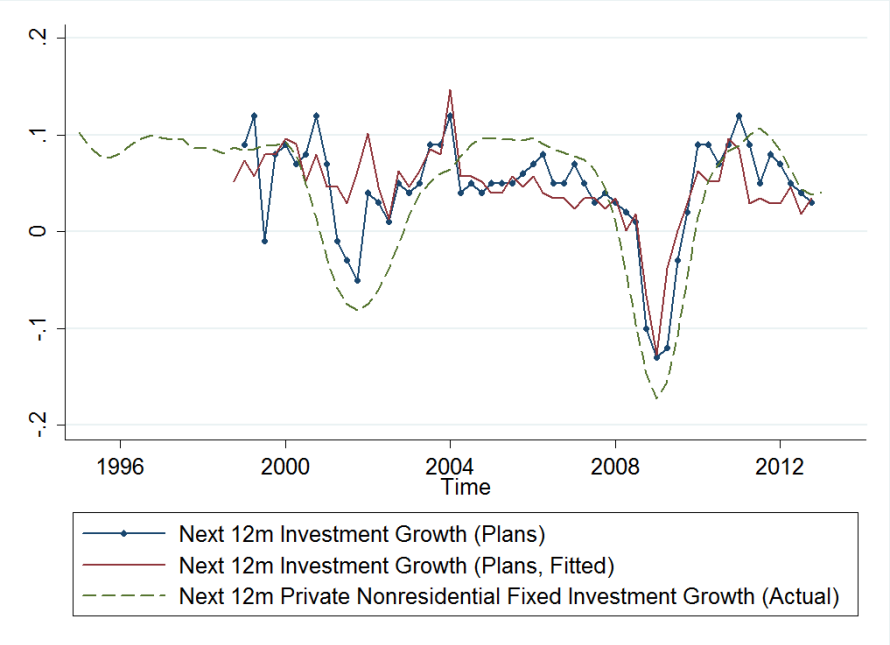
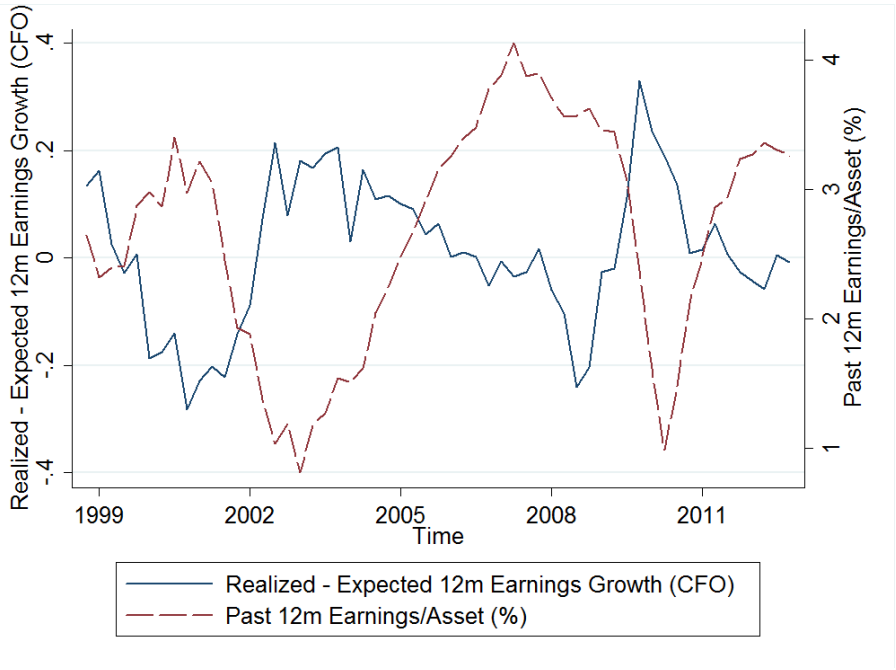


Figure 4. Errors in Earnings Expectations and Past Profitability: Time Series Plots

The plots below show aggregate errors in earnings expectations and past twelve month corporate profitability. In both panels, the dashed line is aggregate earnings over asset in the past twelve months. In Panel A, the solid line is aggregate earnings growth in the next twelve months minus aggregate CFO expectations of earnings growth in the next twelve months. In Panel B, the solid line is aggregate earnings growth in the next twelve months minus aggregate analyst expectations of earnings growth in the next twelve months. Series are linearly detrended. Frequency is quarterly.

Panel A. Errors in CFO Expectations and Past Year Profitability over Time



Panel B. Errors in Analyst Expectations and Past Year Profitability over Time

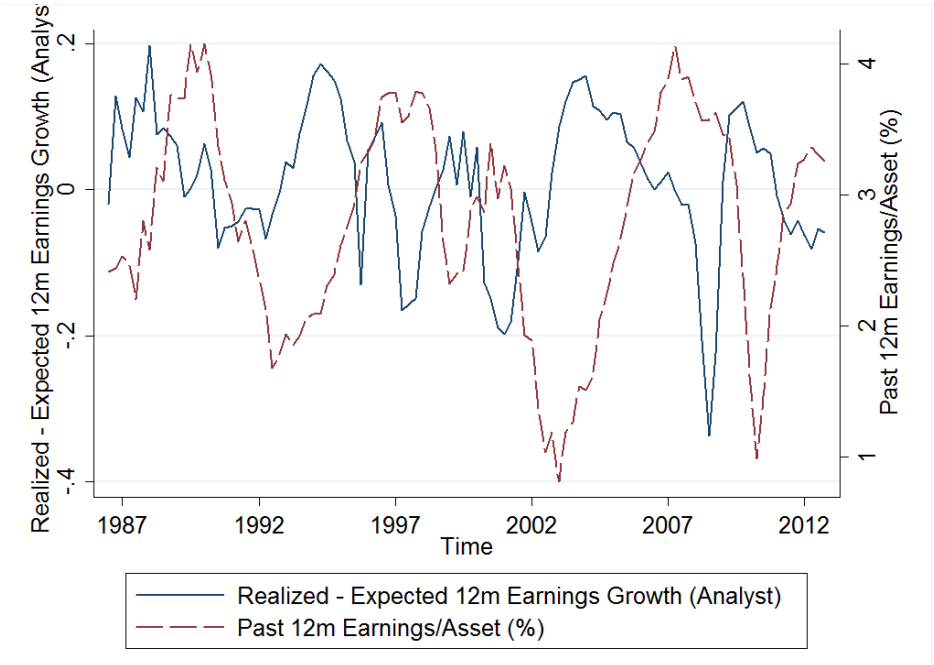
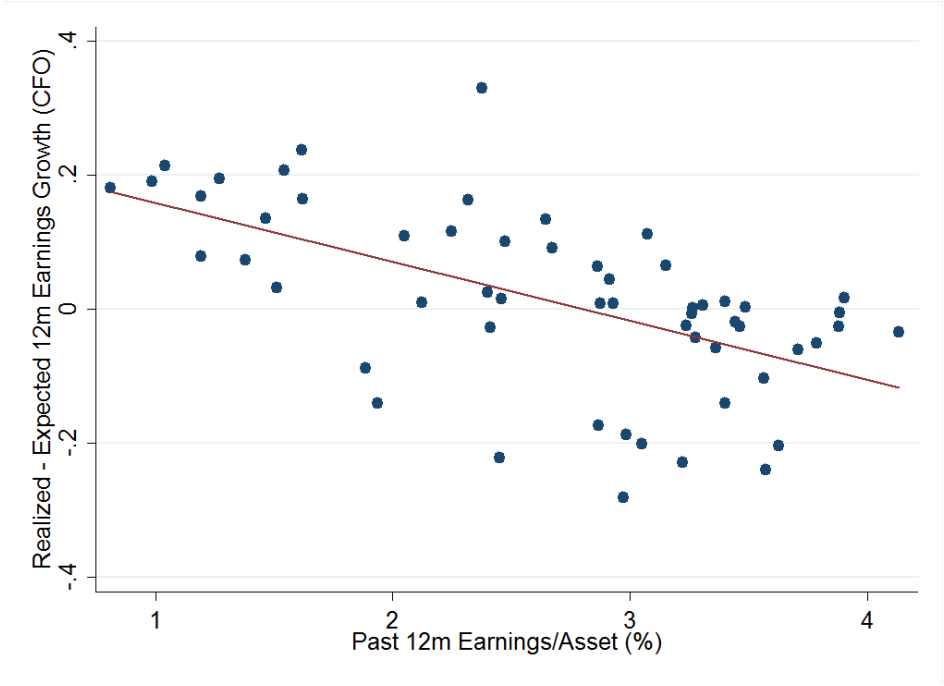


Figure 5. Errors in Earnings Expectations and Past Profitability: Scatter Plots

Scatter plots of aggregate errors in earnings expectations against past twelve month corporate profitability. Variables are identical to those in Figure 4. Frequency is quarterly.

Panel A. Scatter Plot of Errors in CFO Expectations on Past Year Profitability



Panel B. Scatter Plot of Errors in Analyst Expectations on Past Year Profitability

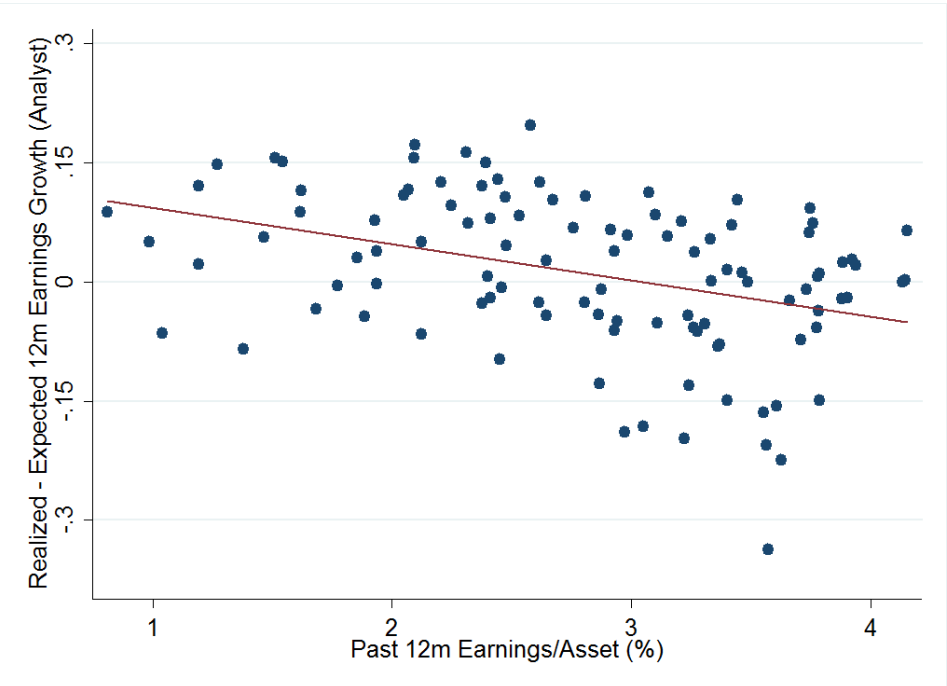


Table 1. Correlations among Different Measures of Investor Expectations of Stock Market Returns and Model-based Expected Returns

This table shows correlations between different measures of investor expectations about future aggregate stock market returns, as well as correlations between survey expectations and discount rate proxies. Survey expectations variables are described in detail in Greenwood and Shleifer (2014). CFO Survey refers to the Duke/CFO Magazine Survey, and AAII refers to surveys run by the American Association of Individual Investors. Investor Intelligence aggregates opinions expressed in newsletters published by institutional investors. Shiller denotes the survey led by Rober Shiller, and Michigan is University of Michigan Survey of Consumers. Horizon of survey expectations is mostly the next twelve months (Gallup, CFO survey, Shiller); the AAII survey asks about next six month expectations, and the horizon in Investor Intelligence and the Michigan survey varies. Discount rate proxies are presented in a way so that the value is increasing in model-based expected returns (we use the negative of surplus consumption because high surplus consumption should be associated with low expected returns). Numbers in brackets denote *p*-values on the hypothesis that the correlation between the two series is zero.

	Gallup	CFO Survey	AAII	Investor Intelligence	Shiller	Michigan
CFO Survey	0.77					
	[0.000]					
AAII	0.64	0.56				
	[0.000]	[0.000]				
Investor Intelligence	0.60	0.64	0.55			
	[0.000]	[0.000]	[0.000]			
Shiller	0.39	0.66	0.51	0.43		
	[0.000]	[0.000]	[0.000]	[0.000]		
Michigan	0.61	-0.12	0.60	0.19	-0.56	
	[0.003]	[0.922]	[0.003]	[0.395]	[0.020]	
Log(D/P)	-0.33	-0.44	-0.31	-0.19	-0.55	-0.57
	[0.000]	[0.003]	[0.000]	[0.000]	[0.000]	[0.006]
cay	0.02	0.14	-0.02	-0.19	0.37	0.00
	[0.776]	[0.380]	[0.788]	[0.000]	[0.000]	[0.988]
-Surplus Consumption	-0.48	-0.53	-0.28	-0.05	-0.67	-0.74
	[0.000]	[0.000]	[0.000]	[0.191]	[0.000]	[0.000]
Past 12m Stock Returns	0.78	0.36	0.37	0.43	0.05	0.44
	[0.000]	[0.018]	[0.000]	[0.000]	[0.578]	[0.042]
Equity Fund Flows	0.70	0.71	0.41	0.20	0.33	0.40
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.068]

Table 2. Expectations of Stock Returns and Realized Future Stock Returns

This table presents results from Table 6 in Greenwood and Shleifer (2014). The regressions are $R_t^x = a + bX_t + u_t$ where R_t^x denotes next twelve month stock market returns (in excess of the risk free rate), and X is a predictor variable. The independent variables include measures of expectations from investor surveys and discount rate proxies. Selected investor expectations variables are starred to indicate that they are rescaled versions of the raw data. The rescaled versions can be interpreted in units of nominal stock returns. Details see Greenwood and Shleifer (2014). The regressions are monthly. Standard errors are Newey-West with twelve lags. In columns (1) to (6), for each measure of survey expectations, we show the *p*-value on the test that $b = 1$ (which is the null under rational expectations).

	Realized Next 12m Aggregate Stock Market Returns								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gallup*	-1.985								
	(-1.370)								
CFO Survey		-0.021							
		(-0.670)							
AAII*			-1.655						
			(-0.892)						
Investor Intelligence*				-1.534					
				(-2.323)					
Shiller*					-0.612				
					(-0.228)				
Michigan						-0.081			
						(-3.964)			
Log(D/P)							0.072		
							(1.424)		
cay								3.095	
								(3.031)	
-Surplus Consumption									0.958
									(4.147)
[*p*-val, *b*=1]	[0.040]	[0.000]	[0.154]	[0.000]	[0.550]	[0.000]			
N	132	39	285	579	123	22	579	579	579
R^2	0.057	0.03	0.015	0.036	0.004	0.342	0.03	0.107	0.116

t-statistics in parenthesis. Standard errors are Newey-West with twelve lags.

Table 3. Summary Statistics

Summary statistics of firms covered in the CFO survey sample, analyst forecast sample, and full Compustat sample. Mean, median, standard deviation, and selected percentiles are presented. For comparability, all statistics are based on the sample period for which we have CFO expectations (2005 to 2012).

Variable	Mean	Std	5%	25%	50%	75%	95%
			Panel A. Sample with CFO Expectations				
CFO expectations of next 12m earnings growth	0.07	0.19	-0.25	0.02	0.10	0.15	0.30
Realized next 12m earnings growth	0.09	0.48	-0.60	-0.11	0.09	0.26	0.85
Realized next 12m earnings/asset	0.06	0.06	-0.02	0.03	0.06	0.10	0.16
CFO expectations of next 12m capital spending growth	0.05	0.23	-0.3	0	0.3	0.1	0.5
Asset	21,808.42	101,176.00	80.48	541.10	1,959.22	6,453.33	44,791.00
Market value	14,326.91	48,370.41	75.81	550.28	1,843.50	6,848.73	45,621.37
Q	1.51	0.73	0.67	0.99	1.35	1.84	2.97
BTM	0.49	0.31	0.16	0.29	0.41	0.60	1.06
Annual net income/asset	0.03	0.17	-0.18	0.02	0.06	0.10	0.18
Annual sales/asset	1.09	0.67	0.27	0.61	0.92	1.38	2.55
Annual capx/asset	0.04	0.03	0.01	0.02	0.03	0.05	0.11
Annual capx growth	0.13	0.53	-0.52	-0.18	0.06	0.33	1.11
			Panel B. Sample with Analyst Forecasts				
Next 12m earnings growth implied by analyst EPS forecasts	0.16	0.34	-0.31	-0.01	0.12	0.28	0.81
Realized next 12m earnings growth	0.09	0.47	-0.65	-0.12	0.09	0.30	0.86
Realized next 12m earnings/asset	0.07	0.05	0.00	0.04	0.06	0.10	0.16
Asset	6,355.03	26,367.43	114.72	401.15	1,178.22	3,835.99	26,735.00
Market value	6,610.21	23,094.48	129.51	473.98	1,287.45	3,887.96	25,692.68
Q	1.53	0.83	0.65	0.93	1.29	1.90	3.27
BTM	0.51	0.32	0.14	0.29	0.45	0.66	1.10
Annual net income/asset	0.06	0.07	-0.03	0.03	0.06	0.10	0.17
Annual sales/asset	1.12	0.63	0.32	0.64	1.00	1.46	2.37
Annual capx/asset	0.05	0.04	0.01	0.02	0.04	0.07	0.15
Annual capx growth	0.17	0.55	-0.54	-0.17	0.08	0.38	1.20
			Panel C. All Compustat Firms				
Asset	3,021.22	16,706.02	0.44	25.34	201.06	1,278.93	12,105.00
Market value	3,684.34	16,780.76	17.35	107.49	433.32	1,726.60	14,127.71
Q	1.53	0.91	0.61	0.88	1.24	1.90	3.51
BTM	0.55	0.38	0.11	0.28	0.47	0.73	1.24
Annual net income/asset	-0.11	0.39	-0.87	-0.11	0.02	0.07	0.15
Annual sales/asset	1.01	0.70	0.10	0.47	0.89	1.41	2.40
Annual capx/asset	0.05	0.04	0.00	0.01	0.03	0.06	0.14
Annual capx growth	0.16	0.68	-0.69	-0.28	0.04	0.42	1.53

Table 4. CFO Earnings Growth Expectations and Investment Plans: Aggregate Evidence

This table presents aggregate quarterly regression $\Delta\widehat{CAPX}_t = \alpha + \beta \mathrm{E}_t^*[\Delta Earnings] + \lambda X_t + \epsilon_t$. $\mathrm{E}_t^*[\Delta Earnings]$ is aggregate CFO expectations of earnings growth in the next twelve months. $\Delta\widehat{CAPX}_t$ is aggregate planned investment growth in the next twelve months. All control variables are measured at the end of quarter t-1. Past twelve month stock returns is index returns from the end of quarter t-5 to the end of quarter t-1. Past twelve month aggregate credit spread change is log change in credit spread from the end of quarter t-5 to the end of quarter t-1. Past twelve month changes in stock volatility and bloom policy uncertainty index, as well as past twelve month asset growth, are calculated in the same way (i.e. as the log difference between values at the end of quarters t-1 and t-5). Past twelve month change of net income/asset is net income from t-4 to t-1 normalized by asset at the end of quarter t-5 minus normalized net income in the previous four quarters. Past twelve month GDP (investment) growth is the log difference between GDP (investment) in quarters t-4 through t-1 and GDP (investment) in the previous four quarters. A constant is included but not reported, and a linear time trend is included. Standard errors are Newey-West with twelve lags.

	Planned Investment Growth in the Next Twelve Months						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CFO Expectations of	0.6313	0.5959	0.5869	0.4235	0.4853	0.5997	0.5435
Next 12m Earnings Growth	(9.39)	(11.65)	(11.40)	(7.21)	(12.83)	(11.79)	(9.78)
Q			0.0532				
			(1.68)				
Past 12m Agg. Stock Returns				0.1082			
				(3.64)			
Past 12m Credit Spread Change					-0.0352		
					(-2.26)		
Log(D/P)						0.0271	
						(0.62)	
cay							-0.9700
							(-1.86)
Past 12m Asset Growth		0.2181	0.1461	0.0784	0.2643	0.2481	0.2536
		(3.97)	(2.39)	(1.89)	(5.88)	(2.97)	(3.92)
Observations	56	56	56	56	56	56	56
R-squared	0.616	0.660	0.672	0.741	0.685	0.663	0.674

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table 4. Continued

	Planned Investment Growth in the Next Twelve Months					
	(8)	(9)	(10)	(11)	(12)	(13)
CFO Expectations of	0.5969	0.5429	0.5301	0.5882	0.5573	0.4315
Next 12m Earnings Growth	(11.37)	(8.20)	(14.03)	(8.55)	(16.72)	(8.21)
Past 12m Credit Spread Change						-0.0447
						(-1.49)
Surplus Consumption	0.0154					
	(0.30)					
Past 12m Change of Net Income/Asset		4.3277				-4.3302
		(1.70)				(-1.03)
Past 12m Agg. Stock Vol Change			-0.0044			0.0421
			(-0.37)			(2.51)
Bloom Policy Uncertainty Index			-0.0328			-0.0303
(Past 12m Change)			(-2.11)			(-2.23)
Past 12m GDP Growth				0.6118		2.3154
				(0.77)		(1.89)
Past 12m Investment Growth					-0.1300	-0.5391
					(-2.26)	(-2.69)
Past 12m Asset Growth	0.2114	0.1716	0.2376	0.0547	0.3859	0.4349
	(3.40)	(3.25)	(4.22)	(0.29)	(6.21)	(3.59)
Observations	56	56	56	56	56	56
R-squared	0.660	0.672	0.694	0.666	0.667	0.739

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table 5. CFO Earnings Growth Expectations and Investment Plans: Firm-level Evidence

This table presents firm-level quarterly regression $\Delta\widehat{CAPX}_{i,t} = \alpha + \eta_i + \beta \mathrm{E}^*_{i,t}[\Delta Earnings] + \lambda X_{i,t} + \epsilon_{i,t}$. $\mathrm{E}^*_{i,t}[\Delta Earnings]$ is firm-level CFO expectations of earnings growth in the next twelve months. $\Delta\widehat{CAPX}_{i,t}$ is firm-level planned investment growth in the next twelve months. All control variables are measured at the end of quarter t-1. Past twelve month firm stock returns, change of net income/asset, change of stock volatility, investment growth, and asset growth are firm-level counterparts of variables defined in Table 4. A constant is included but not reported. Standard errors are clustered by firm. R-squared excludes firm fixed effects.

	Planned Investment Growth in the Next Twelve Months										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CFO Expectations of	0.4200	0.4259	0.4639	0.3487	0.3887	0.3713	0.4172	0.3420	0.4139	0.4233	0.3149
Next 12m Earnings Growth	(4.44)	(4.50)	(4.40)	(3.25)	(3.94)	(3.99)	(4.25)	(3.16)	(4.35)	(4.28)	(2.80)
Q			0.0384								
			(1.53)								
BTM				-0.2303							
				(-4.32)							
Past 12m Firm Stock Returns					0.0833						
					(3.49)						
Past 12m Credit Spread Change						-0.1130					-0.1391
						(-4.39)					(-2.99)
Past 12m Change of Net Income/Asset							0.0025				0.0025
							(2.23)				(1.16)
Past 12m Firm Stock Vol Change								-0.0905			-0.0148
								(-2.87)			(-0.33)
Bloom Policy Uncertainty Index								-0.0764			0.0385
(Past 12m Change)								(-2.35)			(0.96)
Past 12m GDP Growth									1.0087		0.6293
									(1.86)		(0.95)
Past 12m Investment Growth										0.0010	0.0048
										(0.05)	(0.19)
Past 12m Asset Growth		0.1163	0.1089	0.0529	0.0626	0.0964	0.0929	0.0393	0.0800	0.1276	0.0008
		(1.37)	(1.15)	(0.63)	(0.69)	(1.17)	(0.97)	(0.40)	(1.00)	(1.39)	(0.01)
Observations	850	834	740	761	764	834	809	719	834	790	692
R-squared	0.095	0.104	0.125	0.139	0.132	0.132	0.114	0.115	0.109	0.105	0.132
Number of id	194	190	171	172	176	190	187	168	190	187	164

t-statistics in parentheses. Standard errors are clustered by firm.

Table 6. CFO Earnings Growth Expectations and Realized Investment Growth: Aggregate Evidence

This table presents aggregate quarterly regression $\Delta CAPX_t = \alpha + \beta \mathrm{E}_t^*[\Delta Earnings] + \lambda X_t + \epsilon_t$. $\mathrm{E}_t^*[\Delta Earnings]$ is aggregate CFO expectations of earnings growth in the next twelve months. $\Delta CAPX_t$ is next twelve month growth in private non-residential fixed investment. All control variables are the same as those in Table 4. Standard errors are Newey-West with twelve lags.

	Realized Investment Growth in the Next Twelve Months						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CFO Expectations of	0.7041	0.5903	0.5853	0.2799	0.2611	0.6278	0.4569
Next 12m Earnings Growth	(5.40)	(8.14)	(8.41)	(3.52)	(3.20)	(7.38)	(5.74)
Q			0.0278				
			(0.37)				
Past 12m Agg. Stock Returns				0.1975			
				(4.20)			
Past 12m Credit Spread Change					-0.1035		
					(-3.82)		
Log(D/P)						0.2202	
						(2.68)	
cay							-2.4272
							(-2.27)
Past 12m Asset Growth		0.7021	0.6645	0.4473	0.8382	0.9458	0.7909
		(6.48)	(3.53)	(3.43)	(11.72)	(10.36)	(8.32)
Observations	57	57	57	57	57	57	57
R-squared	0.380	0.610	0.611	0.748	0.719	0.721	0.655

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table 6. Continued

	Realized Investment Growth in the Next Twelve Months					
	(8)	(9)	(10)	(11)	(12)	(13)
CFO Expectations of	0.5899	0.3727	0.3725	0.5563	0.5913	0.2168
Next 12m Earnings Growth	(8.43)	(3.42)	(6.22)	(3.94)	(6.57)	(2.08)
Past 12m Credit Spread Change						-0.0995
						(-2.43)
Surplus Consumption	-0.0097					
	(-0.06)					
Past 12m Change of Net Income/Asset		17.7940				4.8652
		(3.06)				(0.88)
Past 12m Agg. Stock Vol Change			-0.0362			0.0405
			(-3.15)			(2.40)
Bloom Policy Uncertainty Index			-0.0501			-0.0154
(Past 12m Change)			(-2.48)			(-1.12)
Past 12m GDP Growth				2.8443		3.2147
				(1.68)		(1.88)
Past 12m CAPX Growth					0.0032	-0.2927
					(0.02)	(-1.21)
Past 12m Asset Growth	0.7063	0.5112	0.7221	-0.0570	0.6980	0.3239
	(7.22)	(5.00)	(9.00)	(-0.12)	(2.40)	(0.67)
Observations	57	57	57	57	57	57
R-squared	0.610	0.717	0.695	0.675	0.610	0.795

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table 7. CFO Earnings Growth Expectations and Realized Investment Growth: Firm-level Evidence

This table presents firm-level quarterly regression $\Delta CAPX_{i,t} = \alpha + \eta_i + \beta \mathrm{E}^*_{i,t}[\Delta Earnings] + \lambda X_{i,t} + \epsilon_{i,t}$. $\mathrm{E}^*_{i,t}[\Delta Earnings]$ is firm-level CFO expectations of earnings growth in the next twelve months. $\Delta CAPX_{i,t}$ is firm-level actual capital expenditure growth in the next twelve months. All control variables are the same as those in Table 5. A constant is included but not reported. Standard errors are clustered by firm. R-squared excludes firm fixed effects.

	Realized Investment Growth in the Next Twelve Months										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CFO Expectations of	0.5970	0.5930	0.5482	0.4069	0.3787	0.4118	0.6137	0.3243	0.5622	0.6043	0.3610
Next 12m Earnings Growth	(5.13)	(5.04)	(3.94)	(3.23)	(3.08)	(3.47)	(4.99)	(2.53)	(4.61)	(4.83)	(2.53)
Q			0.1298								
			(1.88)								
BTM				-0.5246							
				(-4.51)							
Past 12m Firm Stock Returns					0.3047						
					(4.32)						
Past 12m Credit Spread Change						-0.3801					-0.1354
						(-4.62)					(-1.43)
Past 12m Change of Net Income/Asset							-0.0003				0.0002
							(-0.08)				(0.05)
Past 12m Firm Stock Vol Change								-0.4806			-0.3511
								(-5.76)			(-3.24)
Bloom Policy Uncertainty Index								-0.0844			0.0493
(Past 12m Change)								(-0.96)			(0.54)
Past 12m GDP Growth									2.4608		2.8272
									(1.22)		(1.35)
Past 12m CAPX Growth										-0.2917	-0.3074
										(-4.68)	(-4.26)
Past 12m Asset Growth		0.3565	0.2850	0.1675	0.1914	0.3300	0.3371	0.1248	0.2582	0.6969	0.4428
		(1.83)	(1.36)	(0.78)	(1.00)	(1.69)	(1.69)	(0.65)	(1.36)	(4.59)	(2.48)
Observations	852	845	760	784	788	845	819	741	845	810	717
R-squared	0.043	0.054	0.063	0.086	0.103	0.125	0.057	0.175	0.060	0.152	0.271
Number of id	193	193	172	176	180	193	189	170	193	187	166

t-statistics in parentheses. Standard errors are clustered by firm.

Table 8. Predicting Errors in CFO Expectations

Quarterly regressions of errors in CFO expectations of next twelve months earnings growth on past profitability and past economic conditions. In Panel A, the dependent variable is aggregate earnings growth in the next twelve months minus aggregate CFO expectations of earnings growth in the next twelve months. Independent variables include aggregate earnings/asset and GDP growth in the four quarters prior to quarter t-1. Controls include VIX by the end of quarter t-1 and aggregate stock volatility as of quarter t-1. In Panel B, the dependent variable is firm level earnings growth in the next twelve months minus firm CFO expectations of earnings growth in the next twelve months. Independent variables include firm-level earnings/asset in the four quarters prior to quarter t-1, and volatility of firm stock in quarter t-1. A constant is included by not reported. In Panel A, standard errors are Newey-West with twelve lags. In Panel B, standard errors are clustered by firm. R-squared excludes firm and time fixed effects.

Panel A. Aggregate Evidence

	Realized – CFO Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Earnings/Asset (%)	-0.0881		-0.0915		-0.0882	
	(-6.48)		(-8.85)		(-7.42)	
Past 12m GDP Growth		-3.2999		-3.6632		-4.2078
		(-3.06)		(-3.38)		(-3.30)
VIX			-0.2552	-0.3288		
			(-1.51)	(-1.46)		
Agg. Stock Index Vol					-0.0089	-0.4101
					(-0.02)	(-1.52)
Observations	57	57	57	57	57	57
R-squared	0.335	0.225	0.361	0.266	0.335	0.269

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Panel B. Firm-level Evidence

	Realized – CFO Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Firm Earnings/Asset (%)	-0.0511		-0.0500		-0.0324	-0.0353
	(-5.14)		(-5.22)		(-3.40)	(-3.56)
Past 12m GDP Growth		-4.1472		-2.811		
		(-2.44)		(-1.75)		
Firm Stock Vol			0.3959	0.2229		0.5299
			(1.74)	(0.94)		(1.13)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Time Fixed Effects		No			Yes	
Observations	606	651	594	638	606	594
R-squared	0.082	0.032	0.103	0.033	0.037	0.050
Number of id	142	147	139	144	142	139

t-statistics in parentheses. Standard errors clustered by firm.

Table 9. Predicting Errors in Analyst Expectations

Quarterly regressions of errors in CFO expectations of next twelve months earnings growth on past profitability and past economic conditions. In Panel A, the dependent variable is aggregate earnings growth in the next twelve months minus aggregate analyst expectations of earnings growth in the next twelve months. In Panel B, the dependent variable is firm level earnings growth in the next twelve months minus analyst expectations of earnings growth in the next twelve months. All control variables are the same as in Table 8. A linear time trend is included. A constant is included by not reported. In Panel A, standard errors are Newey-West with twelve lags. In Panel B, standard errors are clustered by firm and time. R-squared excludes firm and time fixed effects.

Panel A. Aggregate Evidence

	Realized – Analyst Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Earnings/Asset (%)	-0.0456		-0.0550		-0.0467	
	(-3.68)		(-6.16)		(-3.76)	
Past 12m GDP Growth		-1.3940		-1.1277		-1.6171
		(-1.70)		(-1.67)		(-1.64)
VIX			-0.2904	-0.3260		
			(-1.73)	(-2.52)		
Agg. Stock Index Vol					-0.0991	-0.1116
					(-0.47)	(-0.51)
Observations	106	112	91	91	106	112
R-squared	0.144	0.057	0.245	0.078	0.150	0.062

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Panel B. Firm-level Evidence

	Realized – Analyst Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Firm Earnings/Asset (%)	-0.0080		-0.0081		-0.0061	-0.0062
	(-7.43)		(-7.36)		(-6.71)	(-6.63)
Past 12m GDP Growth		-1.6167		-1.6235		
		(-3.83)		(-3.72)		
Firm Stock Vol			0.0158	-0.0256		-0.0123
			(0.26)	(-0.50)		(-0.40)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Time Fixed Effects	No				Yes	
Observations	103,930	123,430	100,451	115,120	103,930	100,451
R-squared	0.005	0.004	0.006	0.004	0.003	0.003
Number of id	4,432	5,080	4,227	4,606	4,432	4,227

t-statistics in parentheses. Standard errors clustered by firm.

Appendix A. Mathematical Appendix

Denote by Λ_t the Lagrange multiplier attached to the capital accumulation equation. The optimal policy is characterized by the first order conditions:

$$\eta A_t^{1-\eta} K_t^{\alpha} L_t^{\eta-1} = w, \tag{A.1}$$

$$\frac{\partial C}{\partial I_t} = \beta \mathbb{E}_t(\Lambda_{t+1}), \tag{A.2}$$

$$\alpha A_t^{1-\eta} K_t^{\alpha-1} L_t^{\eta} - \frac{\partial C}{\partial K_t} - \Lambda_t + \beta(1-\delta)\mathbb{E}_t(\Lambda_{t+1}) = 0. \tag{A.3}$$

Under quadratic adjustment costs, Equations (A.1)-(A.3) imply the standard Q-theory investment equation:

$$\frac{I_t}{K_t} = \left(a - \frac{1}{b}\right) + \frac{\beta}{b}\mathbb{E}_t(\Lambda_{t+1}), \tag{A.4}$$

where it is immediate to link $\mathbb{E}_t(\Lambda_{t+1})$ to Tobin's Q. To do so, one needs to: i) multiply both sides of Equation (A.3) by current capital stock K_t, to ii) use the capital accumulation equation to replace K_t with $(K_{t+1} - I_t)/(1-\delta)$ in front of Λ_{t+1}, and ii) exploit constant returns to scale of output and investment costs. By so doing, one obtains the stochastic difference equation:

$$\Lambda_t K_t = \Pi_t + \beta \mathbb{E}_t[\Lambda_{t+1} K_{t+1}] = 0, \tag{A.5}$$

where $\Pi_t = A_t^{\alpha} K_t^{\alpha} L_t^{1-\alpha} - wL_t - C(I_t, K_t)$ are the firms' earnings in period t. By iterating Equation (A.5) forward, and by imposing the transversality condition, we find:

$$\mathbb{E}_t(\Lambda_{t+1}) = \frac{\mathbb{E}_t\left[\sum_{s \geq t+1} \beta^{s-(t+1)} \Pi_s\right]}{K_{t+1}}. \tag{A.6}$$

Consider now how we obtain our main estimating equation from Equation (2) in the text. Log-linearization of Equation (2) yields:

$$i_{t_b}^{p} = \mu_0 + \mu_1 \mathbb{E}_{t_b}(\pi_t) + (1-\mu_1) k_t, \tag{A.7}$$

where μ_0, μ_1 are log-linearization constants ($\mu_1 > 0$). Subtract equation (A.7) from its counterpart in the previous period, we get

$$i_t^{p} - i_{t-1}^{p} = \mu_1[\mathbb{E}_t(\pi_t) - \mathbb{E}_{t-1}(\pi_{t-1})] + (1-\mu_1)(k_t - k_{t-1}) \tag{A.8}$$

and therefore

$$\underbrace{i_t^p - i_{t-1}}_{\substack{\text{planned investment growth} \\ \text{in next 12m}}} = \mu_1 \underbrace{[\mathbb{E}_t(\pi_t) - \pi_{t-1}]}_{\substack{\text{expectations of earnings growth} \\ \text{in the next 12m}}} + (1-\mu_1)(k_t - k_{t-1})$$

$$+\mu_1[\pi_{t-1} - \mathbb{E}_{t-1}(\pi_{t-1})] - \left[i_{t-1} - i_{t-1}^p\right] \quad (A.9)$$

The left hand side term in Equation (A.9) is planned investment growth in the next twelve months, which we observe in the data. The first right hand side term is expectations of next twelve month earnings growth, which is our main explanatory variable of interest. In addition, the change in capital stock over the last period enters Equation (A.9) as capital stock affects both investment and earnings. Lastly, there are two final terms in Equation (A.9) because we do not directly observe the change in log planned investment or the change in expected log earnings. The term $\pi_{t-1} - \mathbb{E}_{t-1}(\pi_{t-1})$ is unexpected earnings shock in period $\mathrm{t}-1$, and the term $i_{t-1} - i_{t-1}^p$ is revisions to investment plans in period $\mathrm{t}-1$. These two terms would be highly correlated, as they are both reactions to news that came in during period $\mathrm{t}-1$ which cause realizations in $\mathrm{t}-1$ to deviate from projections made at the beginning of $\mathrm{t}-1$. They will have offsetting effects in Equation (A.9). To the extent that investment has implementation lags and revisions to investment plans are not highly flexible, they may not completely net out. In the data we can approximate $\pi_{t-1} - \mathbb{E}_{t-1}(\pi_{t-1})$ by $[\pi_{t-1} - \pi_{t-2}] - [\mathbb{E}_{t-1}(\pi_{t-1}) - \pi_{t-2}]$, which is the error in the expectations of next twelve month earnings growth reported twelve months ago, and approximate $i_{t-1} - i_{t-1}^p$by $[i_{t-1} - i_{t-2}] - [i_{t-1}^p - i_{t-2}]$, which is realized past twelve month investment growth minus projected investment growth that was reported twelve months ago. We verify that these two terms are highly correlated (around 0.7), so it might not be advisable to include both of them in a regression. We perform extensive robustness checks to include one of the two terms in lieu of the other, and our main results are similar.[24]

[24] We perform these checks at the aggregate level, and with analyst panel. In the CFO panel, unfortunately we are not always able to continuously observe individual firms, so in many cases we do not know earnings expectations and investment plans reported twelve months ago, and thus we cannot obtain information to approximate the last two terms in Equation (A.9).

Appendix B. Variable Definitions

Aggregate Level

Variable	Construction	Sources	Notes	Time Range
Expectations				
CFO Expectations of Next 12m Earnings Growth	Revenue-weighted average of firm-level response (public firms)	CFO survey. Data available at http://www.cfosurvey.org/pastresults.htm		1998Q3-2012Q4
CFO Expectations of Next 12m Investment Growth	Revenue-weighted average of firm-level response		Missing 2001Q3. Missing value linearly interpolated.	1999Q1-2012Q4
CFO Confidence of US Economy (on a scale of 0 to 100)	Mean of all responses in survey (public firms)		Missing 2005Q1. Missing value linearly interpolated.	2002Q2-2012Q4
Analyst Expectations of Next 12m Earnings Growth	1) Calculate consensus forecast of firm-level EPS over the next four quarters; 2) Multiply by shares outstanding to get implied consensus forecast of total earnings over the next four quarters, and then sum across all firms; 4) Divide by actual earnings of all firms in the past four quarters	IBES	IBES reports historical EPS as normalized by the *latest* number of shares outstanding	1985Q1-2012Q4
Firm Financials and Other Variables				
Actual Earnings Growth in the Next 12m Earnings	1) Calculate actual firm-level earnings as actual firm-level EPS multiplied by number of shares outstanding, and then sum across all firms; 2) Take the sum of actual earnings by all firms in the next 4 quarters and divide by the sum of actual earnings by all firms in the past 4 quarters	IBES		1985Q1-2012Q4
Investment	Private Non-residential Fixed Investment	National Income and Product Accounts	Can use alternative measures of capital expenditures from	1947Q1-2012Q4

			Flow of Funds, or by aggregating firm-level capital expenditures from Compustat	
Net Income	FA146110005.Q	Flow of Funds		1951Q4-2012Q4
Total Asset	FL102000005.Q	Flow of Funds		1951Q4-2012Q4
Q	Compute aggregate market value of firm equity from CRSP data (MKVAL); compute aggregate long-term debt (item DLTT), debt in current liability (DLC), and total asset (AT) from Compustat. Q =(MKVAL+DLTT+DLC)/AT	CRSP, Compustat		1980Q1-2012Q4
Surplus Consumption Ratio	Follow Campbell and Cochrane (1999)			1959Q1-2012Q4
cay		Sydney Ludvigson's website		1952Q1-2012Q4
Credit Spread	Moody's seasoned Baa corporate bond yield minus 10 year Treasury yield	FRED		1953Q2-2012Q4
Past 12m Stock Volatility	Standard deviation of daily SP500 index returns in the past 12 months	CRSP		1951Q4-2012Q4
Economic Policy Uncertainty Index		Nicolas Bloom's website		1985Q1-2012Q4

Firm Level

Variable	Construction	Sources	Notes	Time Range
Expectations				
CFO Expectations of Next 12m Earnings Growth	–––	CFO survey	Excludes firms with negative earnings in the past 12 months. Firms are not always consistently observed in the identifiable sample.	2005Q1-2012Q4
CFO Expectations of Next 12m Investment Growth			Excludes firms that report negative capital expenditure in the past 12 months. Firms are not always consistently observed in the identifiable sample.	
CFO Confidence of US Economy (on a scale of 0 to 100)			Firms are not always consistently observed in the identifiable sample.	
Analyst Expectations of Next 12m Earnings Growth	1) Calculate consensus forecast of firm-level EPS over the next four quarters; 2) Multiply by number of shares outstanding to compute the implied consensus forecast of total earnings over the next four quarters 3) Divide by actual firm-level earnings in the past four quarters	IBES	IBES reports historical EPS as normalized by the *latest* number of shares outstanding.	1985Q1-2012Q4
Analyst Expectations of Future 1Y (or 2Y, 3Y) ROA		IBES		2002Q2-2012Q4

Firm Financials and Other Variables				
Actual Earnings Growth in the Next 12m Earnings	1) Calculate actual firm-level earnings as actual firm-level EPS multiplied by number of shares outstanding; 2) Take actual firm-level earnings in the next four quarters, and divide by actual firm-level earnings in the past four quarters	IBES		1985Q1-2012Q4
Capital Expenditure	CAPX	Compustat (Fundamentals Quarterly)		
Net Income	NI			
Total Asset	AT			
Book-to-Market	Compute market value of firm equity from CRSP data (MKVAL), then calculate book-to-market as SEQ/MKVAL	CRSP, Compustat		
Q	Compute market value of firm equity from CRSP data (MKVAL), then calculate Q =(MKVAL+DLTT+DLC)/AT	CRSP, Compustat		
Past 12m Stock Volatility	Standard deviation of daily firm stock returns in the past 12 months	CRSP		

Appendix C. Additional Tables

Table C1. CFO Optimism about the US Economy and Investment

Quarterly regressions of investment on CFO optimism about the US economy. In Panel A, the dependent variable is aggregate planned investment growth in the next twelve months in columns (1)-(4), and next twelve month growth of private non-residential fixed investment in columns (5)-(8). All controls are the same as those in Table 4. In Panel B, the dependent variable is firm-level planned investment growth in the next twelve months in columns (1)-(4), and firm-level actual capital expenditure growth in the next twelve months in columns (5)-(8). All control variables are the same as in Table 5. In Panel A, standard errors are Newey-West with twelve lags. In Panel B, standard errors are clustered by firm.

Panel A. Aggregate Evidence

	Planned Investment Growth in the Next 12m				**Realized Investment Growth in the Next 12m**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFO Optimism about	0.0060	0.0024	0.0044	0.0042	0.0073	0.0018	0.0046	0.0023
the US Economy	(4.25)	(2.98)	(3.37)	(6.86)	(5.03)	(2.54)	(3.78)	(2.43)
Past 12m Change in Credit Spread		-0.0821		-0.0868		-0.1266		-0.1312
		(-3.64)		(-3.57)		(-9.22)		(-5.70)
Past 12m Change of			10.0842	-13.2410			17.1875	-2.6954
Net Income/Asset			(2.98)	(-1.87)			(6.06)	(-0.51)
Past 12m Firm Stock Vol Change				0.0449				0.0344
				(2.68)				(1.58)
Bloom Policy Uncertainty Index				0.0066				0.0057
(Past 12m Change)				(0.46)				(0.23)
Past 12m Investment Growth				3.6134				2.7186
				(2.48)				(2.34)
Past 12m GDP Growth				-0.9814				-0.5373
				(-3.63)				(-2.67)
Past 12m Asset Growth	0.1026	0.2765	-0.0057	0.7219	0.6073	0.8754	0.4227	0.8774
	(0.96)	(1.84)	(-0.05)	(4.10)	(8.10)	(10.76)	(5.53)	(5.24)
Observations	43	43	43	43	43	43	43	43
R-squared	0.509	0.649	0.569	0.804	0.735	0.896	0.819	0.928

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Panel B. Firm-level Evidence

	Planned Investment Growth in the Next 12m				**Realized Investment Growth in the Next 12m**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFO Optimism about	0.0032	0.0018	0.0033	0.0021	0.0048	0.0019	0.0051	0.0017
the US Economy	(3.86)	(2.01)	(3.94)	(2.27)	(3.32)	(1.17)	(3.57)	(1.24)
Past 12m Change in Credit Spread		-0.1423		-0.1362		-0.3521		-0.1869
		(-4.53)		(-3.18)		(-4.54)		(-2.11)
Past 12m Change of			0.0031	0.0043			0.0019	-0.0008
Net Income/Asset			(2.74)	(1.90)			(0.59)	(-0.27)
Past 12m Firm Stock Vol Change				-0.0511				-0.3090
				(-1.10)				(-3.00)
Bloom Policy Uncertainty Index				0.0328				0.1330
(Past 12m Change)				(0.81)				(1.58)
Past 12m Investment Growth				0.4025				4.5253
				(0.59)				(2.14)
Past 12m GDP Growth				0.0012				-0.2999
				(0.04)				(-3.98)
Past 12m Asset Growth	0.1345	0.1235	0.1510	0.0001	0.3263	0.3357	0.2299	0.2282
	(1.81)	(1.68)	(1.71)	(0.00)	(1.68)	(1.80)	(1.17)	(1.20)
Observations	852	852	824	701	965	965	934	819
R-squared	0.040	0.083	0.061	0.122	0.026	0.088	0.025	0.233
Number of id	192	192	189	164	215	215	212	186

t-statistics in parentheses. Standard errors clustered by firm.

Table C2. Analyst Earnings Growth Expectations and Investment Plans: Aggregate Evidence

This table presents aggregate quarterly regression $\Delta\widehat{CAPX}_t = \alpha + \beta \mathrm{E}_t^*[\Delta Earnings] + \lambda X_t + \epsilon_t$. $\mathrm{E}_t^*[\Delta Earnings]$ is aggregate analyst expectations of earnings growth in the next twelve months. $\Delta\widehat{CAPX}_t$ is aggregate planned investment growth in the next twelve months. All control variables are the same as those in Table 4. Standard errors are Newey-West with twelve lags.

	Planned Investment Growth in the Next Twelve Months						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Analyst Expectations of	0.3209	0.3569	0.3546	0.2379	0.2744	0.3605	0.3173
Next 12m Earnings Growth	(3.28)	(7.14)	(8.31)	(4.97)	(8.99)	(6.83)	(6.42)
Q			0.0785				
			(1.71)				
Past 12m Agg. Stock Returns				0.1180			
				(4.52)			
Past 12m Credit Spread Change					-0.0585		
					(-4.97)		
Log(D/P)						0.0325	
						(0.79)	
cay							-1.2021
							(-2.23)
Past 12m Asset Growth		0.4735	0.3633	0.2388	0.4797	0.5117	0.4894
		(8.46)	(6.53)	(4.34)	(8.97)	(5.94)	(8.68)
Observations	56	56	56	56	56	56	56
R-squared	0.397	0.609	0.635	0.706	0.702	0.614	0.631

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table C2. Continued

	Planned Investment Growth in the Next Twelve Months					
	(8)	(9)	(10)	(11)	(12)	(13)
Analyst Expectations of	0.3570	0.3125	0.2909	0.3539	0.3340	0.2551
Next 12m Earnings Growth	(7.12)	(6.27)	(7.07)	(5.85)	(9.98)	(6.78)
Past 12m Credit Spread Change						-0.0823
						(-3.41)
Surplus Consumption	-0.0399					
	(-0.56)					
Past 12m Change of Net Income/Asset		8.3887				-1.5603
		(3.53)				(-0.47)
Past 12m Agg. Stock Vol Change			-0.0192			0.0449
			(-1.65)			(2.80)
Bloom Policy Uncertainty Index			-0.0278			-0.0055
(Past 12m Change)			(-2.38)			(-0.57)
Past 12m GDP Growth				1.0524		2.1166
				(1.27)		(2.01)
Past 12m Investment Growth					-0.1110	-0.3599
					(-0.75)	(-1.92)
Past 12m Asset Growth	0.4902	0.3445	0.4368	0.1884	0.6018	0.4329
	(7.91)	(5.98)	(6.41)	(1.00)	(4.04)	(2.80)
Observations	56	56	56	56	56	56
R-squared	0.611	0.665	0.659	0.627	0.614	0.737

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table C3. Analyst Earnings Growth Expectations and Investment Plans: Firm-level Evidence

This table presents firm-level quarterly regression $\Delta\widehat{CAPX}_{i,t} = \alpha + \eta_i + \beta \mathrm{E}^*_{i,t}[\Delta Earnings] + \lambda X_{i,t} + \epsilon_{i,t}$. $\mathrm{E}^*_{i,t}[\Delta Earnings]$ is firm-level analyst expectations of earnings growth in the next twelve months. $\Delta\widehat{CAPX}_{i,t}$ is firm-level planned investment growth in the next twelve months. All control variables are the same as in Table 5. Standard errors are clustered by firm. R-squared does not include firm fixed effects.

	Planned Investment Growth in the Next Twelve Months										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Analyst Expectations of	0.2058	0.2138	0.1983	0.1662	0.1651	0.1721	0.2058	0.1779	0.2116	0.2286	0.1834
Next 12m Earnings Growth	(4.86)	(4.84)	(4.53)	(4.02)	(3.85)	(4.05)	(4.50)	(3.99)	(4.91)	(4.76)	(3.73)
Q			0.0792								
			(3.01)								
BTM				-0.2297							
				(-4.95)							
Past 12m Firm Stock Returns					0.1037						
					(2.58)						
Past 12m Credit Spread Change						-0.1082					-0.0903
						(-4.09)					(-1.85)
Past 12m Change of Net Income/Asset							0.0038				0.0018
							(1.40)				(0.58)
Past 12m Firm Stock Vol Change								-0.1003			-0.0492
								(-3.28)			(-1.21)
Bloom Policy Uncertainty Index								-0.0471			0.0307
(Past 12m Change)								(-1.53)			(0.73)
Past 12m GDP Growth									0.8690		0.4047
									(1.32)		(0.57)
Past 12m CAPX Growth										-0.0278	-0.0226
										(-0.83)	(-0.64)
Past 12m Asset Growth		-0.1052	-0.1286	-0.1387	-0.1087	-0.1010	-0.1300	-0.1281	-0.1356	-0.0844	-0.1132
		(-1.36)	(-1.55)	(-1.74)	(-1.36)	(-1.32)	(-1.50)	(-1.48)	(-1.83)	(-1.03)	(-1.23)
Observations	643	640	598	633	619	640	633	598	640	629	591
R-squared	0.075	0.079	0.085	0.108	0.093	0.108	0.086	0.112	0.083	0.087	0.127
Number of id	144	144	136	141	138	144	144	137	144	144	137

t-statistics in parentheses. Standard errors are clustered by firm.

Table C4. Analyst Expectations and Realized Investment Growth: Aggregate Evidence

This table presents aggregate quarterly regression $\Delta CAPX_t = \alpha + \beta \mathrm{E}_t^*[\Delta Earnings] + \lambda X_t + \epsilon_t$. $\mathrm{E}_t^*[\Delta Earnings]$ is aggregate CFO expectations of earnings growth in the next twelve months. $\Delta CAPX_t$ is next twelve month growth in private non-residential fixed investment. All controls are the same as those in Table 4. Standard errors are Newey-West with twelve lags.

	Planned Investment Growth in the Next Twelve Months						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Analyst Expectations of	0.1611	0.1889	0.1944	0.1020	0.1193	0.2225	0.2096
Next 12m Earnings Growth	(1.37)	(1.97)	(1.93)	(1.68)	(2.48)	(2.21)	(2.28)
Q			-0.0281				
			(-0.67)				
Past 12m Agg. Stock Returns				0.1671			
				(3.01)			
Past 12m Credit Spread Change					-0.1123		
					(-5.87)		
Log(D/P)						0.0693	
						(1.70)	
cay							0.5699
							(0.71)
Past 12m Asset Growth		0.6919	0.7566	0.4659	0.7052	0.9065	0.6671
		(4.14)	(4.04)	(2.69)	(4.80)	(5.74)	(3.83)
Observations	112	112	112	112	112	112	112
R-squared	0.078	0.347	0.351	0.507	0.577	0.421	0.357

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table C2. Continued

	Planned Investment Growth in the Next Twelve Months					
	(8)	(9)	(10)	(11)	(12)	(13)
Analyst Expectations of	0.2015	0.1383	0.1565	0.1653	0.2236	0.1777
Next 12m Earnings Growth	(2.19)	(2.37)	(2.65)	(1.48)	(2.32)	(5.02)
Past 12m Credit Spread Change						-0.0647
						(-3.17)
Surplus Consumption	-0.2738					
	(-2.27)					
Past 12m Change of Net Income/Asset		25.3008				16.6878
		(5.68)				(4.45)
Past 12m Agg. Stock Vol Change			-0.0317			-0.0036
			(-1.78)			(-0.38)
Bloom Policy Uncertainty Index			-0.0571			-0.0074
(Past 12m Change)			(-3.46)			(-0.68)
Past 12m GDP Growth				1.5397		0.4840
				(1.61)		(0.75)
Past 12m Investment Growth					0.2441	0.4012
					(0.87)	(4.65)
Past 12m Asset Growth	0.9398	0.4888	0.6603	0.2565	0.4490	0.0373
	(6.02)	(4.36)	(5.35)	(0.64)	(1.11)	(0.17)
Observations	112	112	107	112	112	107
R-squared	0.421	0.682	0.502	0.389	0.370	0.788

t-statistics in parentheses. Standard errors are Newey-West with twelve lags.

Table C5. Analyst Expectations and Realized Investment Growth: Firm Level Evidence

This table presents firm-level quarterly regression $\Delta CAPX_{i,t} = \alpha + \eta_i + \beta \mathrm{E}^*_{i,t}[\Delta Earnings] + \lambda X_{i,t} + \epsilon_{i,t}$. $\mathrm{E}^*_{i,t}[\Delta Earnings]$ is firm-level CFO expectations of earnings growth in the next twelve months. $\Delta CAPX_{i,t}$ is firm-level actual capital expenditure growth in the next twelve months. All control variables are the same as those in Table 5. A constant is included but not reported. Standard errors are clustered by firm and time. R-squared excludes firm fixed effects.

	Realized Investment Growth in the Next Twelve Months										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Analyst Expectations of	0.2401	0.2265	0.2101	0.1381	0.1973	0.1885	0.2132	0.1902	0.2229	0.2165	0.1589
Next 12m Earnings Growth	(10.86)	(10.63)	(10.59)	(9.52)	(11.39)	(13.52)	(10.73)	(13.25)	(11.53)	(9.53)	(12.34)
Q			0.1073								
			(13.10)								
BTM				0.2932							
				(17.84)							
Past 12m Firm Stock Returns					-0.3686						
					(-20.17)						
Past 12m Credit Spread Change						-0.2770					-0.1828
						(-9.30)					(-7.87)
Past 12m Change of Net Income/Asset							0.0105				0.0093
							(19.33)				(15.51)
Past 12m Firm Stock Vol Change								-0.2324			-0.1110
								(-8.56)			(-4.82)
Bloom Policy Uncertainty Index								-0.1089			-0.0082
(Past 12m Change)								(-4.38)			(-0.34)
Past 12m GDP Growth									2.4653		2.7499
									(2.98)		(7.56)
Past 12m CAPX Growth										-0.1864	-0.1956
										(-19.56)	(-25.68)
Past 12m Asset Growth		0.1983	0.0771	0.0706	0.0747	0.1943	0.1176	0.1871	0.1577	0.3944	0.2639
		(6.44)	(2.73)	(2.71)	(2.61)	(7.36)	(4.53)	(7.29)	(6.51)	(13.00)	(10.08)
Observations	115,699	113,660	103,802	108,336	109,984	113,660	109,388	93,935	113,660	105,047	90,590
R-squared	0.024	0.026	0.041	0.068	0.045	0.045	0.044	0.048	0.030	0.062	0.107
Number of id	4,814	4,751	4,568	4,662	4,648	4,751	4,511	3,834	4,751	4,351	3,732

t-statistics in parentheses. Standard errors clustered by both firm and time.

Table C6. Stambaugh Bias Adjusted Results: Investment Regressions

Stambaugh bias adjusted aggregate investment regressions with discount rate proxies as explanatory variables (columns (6)-(8) in Tables 4, 6, C2, and C4). Bias correction follows the simulation method in Baker, Taliaferro, and Wurgler (2006). The bootstrap procedure computes p-value by i) construct bootstrap samples under the null that a particular coefficient is zero, ii) estimate regressions using the bootstrap samples, iii) calculate the fraction of coefficients from bootstrap samples that are more extreme than the OLS coefficient. The idea is similar to the grid bootstrap procedure of Hansen (1999).

Panel A. Using CFO Expectations

	Expected Next 12m Inv Growth			Realized Next 12m Inv Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Agg. CFO Expectations of	0.6036	0.5528	0.5983	0.6417	0.4712	0.5944
Next 12m Earnings Growth	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Aggregate Log(D/P)	0.0258			0.2275		
	(0.354)			(0.008)		
cay		-0.8076			-2.3230	
		(0.128)			(0.004)	
Surplus Consumption			-0.0050			0.0157
			(0.514)			(0.518)
Past 12m Asset Growth	0.3332	0.3066	0.3026	1.1102	0.9130	0.8544
	(0.008)	(0.002)	(0.004)	(0.000)	(0.000)	(0.000)

Bootstrap p-value in parenthesis.

Panel B. Using Analyst Expectations

	Expected Next 12m Inv Growth			Realized Next 12m Inv Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Agg. Analyst Expectations of	0.3646	0.3227	0.3628	0.2226	0.2069	0.2002
Next 12m Earnings Growth	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Aggregate Log(D/P)	0.0097			0.0598		
	(0.412)			(0.110)		
cay		-1.1505			0.5877	
		(0.050)			(0.102)	
Surplus Consumption			-0.0316			-0.2732
			(0.416)			(0.014)
Past 12m Asset Growth	0.5809	0.5659	0.5839	0.9890	0.7297	1.0142
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Bootstrap p-value in parenthesis.

Table C7. Stambaugh Bias Adjusted Results: Error Prediction Regressions

Stambaugh bias adjusted aggregate error prediction regressions (Panel A of Table 8 and Table 9). Bias correction follows the simulation method in Baker, Taliaferro, and Wurgler (2006). Univariate results are very similar using the univariate bias correction method of Amihud and Hurvich (2004).

Panel A. Using CFO Expectations

	Realized – CFO Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Earnings/Asset (%)	-0.0873		-0.0916		-0.0848	
	(0.000)		(0.002)		(0.000)	
Past 12m GDP Growth		-2.6317		-3.0260		-3.7742
		(0.050)		(0.028)		(0.000)
VIX			-0.0027	-0.0035		
			(0.068)	(0.052)		
Agg. Stock Index Vol					-0.0488	-0.4400
					(0.416)	(0.040)

Bootstrap p-value in parenthesis.

Panel B. Using Analyst Expectations

	Realized – Analyst Expected Next 12m Earnings Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Past 12m Earnings/Asset (%)	-0.0416		-0.0526		-0.0429	
	(0.004)		(0.004)		(0.002)	
Past 12m GDP Growth		-1.2798		-0.9669		-1.5063
		(0.050)		(0.102)		(0.052)
VIX			-0.0031	-0.0035		
			(0.006)	(0.002)		
Agg. Stock Index Vol					-0.1192	-0.1231
					(0.174)	(0.234)

Bootstrap p-value in parenthesis.