MANAGERIAL OVERCONFIDENCE AND CORPORATE POLICIES

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ABSTRACT

We use a direct measure of overconfidence to test whether managerial overconfidence manifests itself in corporate policies. We collect a unique panel of over 6,500 quarterly stock market forecasts (expected returns, and the 10^{th} and 90^{th} percentiles of their perceived distributions) by Chief Financial Officers (CFOs) over a span of more than six years. On average, CFOs are miscalibrated: realized returns are within respondents' 80% confidence intervals only 40% of the time. Controlling for firm characteristics, companies with overconfident CFOs (i.e., CFOs with narrow confidence intervals) invest more, have higher debt leverage, pay out fewer dividends, use proportionally more long-term than short-term debt, engage in market timing activity, and tilt executive compensation towards performance-based bonuses. In addition, merger announcements by firms with overconfident CFOs are negatively received by investors.

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I. Introduction

A key role of managers is to estimate future unknowns (e.g., demand, cash flows, competition) and use these predictions as inputs to design corporate policies. Complicating this task, psychological evidence indicate that people exhibit overconfidence in predictions, i.e., they forecast probability distributions that are too narrow. This happens either because they overestimate their ability to predict the future[1] or because they underestimate the volatility of random events.[2] Despite the importance of this issue, there has been no wide-scale empirical research that studies the relation between the overconfidence (miscalibration) of managers and the corporate policies they devise.

In this paper we measure the overconfidence of managers in a unique sample of over 6,500 stock market forecasts made by top U.S. financial executives. Our measure of overconfidence is based on miscalibration of beliefs, and operationalized using a method drawn from laboratory experiments of overconfidence. We link our estimate of executive overconfidence to firm-level archival data and study how miscalibration is reflected in corporate policies. Each quarter, from March 2001 to March 2007, we surveyed hundreds of U.S. Chief Financial Officers (CFOs) and asked them to predict expected one- and ten-year market equity returns as well as the 10^{th} and 90^{th} percentiles of the distribution of market returns. We use the narrowness of the individual probability distributions for stock market returns as a proxy for each respondent's confidence. By evaluating the same forecasting task across all executives, we can assess whether CFOs are miscalibrated and disentangle this bias from any potential bias in the mean estimate (optimism). We examine the time-series and cross-sectional de-

[1]Surveyed subjects typically provide too-narrow confidence bounds for their predictions (Alpert and Raiffa 1982). Researchers also document that experts in a variety of professional fields overestimate the precision of their information, e.g., clinical psychologists (Oskamp 1965), and physicians and nurses (Christensen-Szalanski and Bushyhead 1981, Baumann, Deber, and Thompson 1991).

[2]Studies have shown that professionals are miscalibrated with regard to estimating the probabilities of random outcomes, e.g., engineers (Kidd 1970) and entrepreneurs (Cooper, Woo, and Dunkelberg 1988). Related to our study, von Holstein (1972) documents that investment bankers provide miscalibrated forecasts of stock market returns; Deaves, Lüders, and Schröder (2005) find that stock market forecasters are overconfident on average and become more overconfident with past successful forecasts, and Bar-Yosef and Venezia (2006) report that subjects (students and security analysts) in the laboratory exhibit overconfidence in their predictions of future accounting numbers. Deaves, Lüders, and Lou (2003) find that laboratory subjects who are miscalibrated also tend to trade excessively.

terminants of overconfidence[3] (i.e., the narrowness of the confidence interval), and analyze the relation between our overconfidence measure and a range of corporate policies including investment, mergers and acquisitions, financing, payout, market timing, and compensation.

Several recent studies examine the relation between corporate policies and managerial biases. In several papers, Malmendier and Tate capture CEOs' overestimation of their own firm's future returns (feeling "above average") using the degree of under-diversification of the executives' personal portfolios, and also according to their respective characteristics as they are portrayed in the press (Malmendier and Tate 2005b). They show that biased managers exhibit high investment-cash flow sensitivity (Malmendier and Tate 2005a), engage intensively in unsuccessful mergers and acquisitions (Malmendier and Tate 2006), and avoid tapping the capital markets (Malmendier, Tate, and Yan 2006). Using Malmendier and Tate's news-based proxy, Hribar and Yang (2006) show that firms with CEOs who feel "above average" are more likely to issue point estimates in their earnings forecast (rather than estimate ranges) and are more likely to manage earnings around these forecasts.

In contrast, our empirical design allows us to separate overconfidence from optimism. We define overconfidence as a general miscalibration in beliefs (Lichtenstein and Fischoff 1977, Koriat, Lichtenstein, and Fischoff 1980, Lichtenstein, Fischoff, and Phillips 1982, Kruger and Dunning 1999, Alba and Hutchison 2000, Shefrin 2001, Soll and Klayman 2004, Hackbarth 2006). According to this definition, overconfident people overestimate the precision of their own beliefs, or underestimate of the variance of risky processes; in other words, their subjective probability distributions are too narrow. The specific interpretation of overconfidence is important particularly when testing theoretical predictions regarding the effects of specific biases on corporate policies. Theoretical models distinguish between optimistic managers who overestimate the *mean* of their firms' cash flows (Shefrin 2001, Heaton 2002, Hackbarth 2006), which we refer to as optimism, and overconfident managers who either underestimate the *volatility* of their firms' future cash flows (Shefrin 2001, Hackbarth 2006) or overweight their private signals relative to public information (Gervais, Heaton, and Odean 2005).[4] Our sur-

[3]Although we measure relative confidence, we use the term *overconfidence*, given that the majority of CFOs provide responses that would be considered overconfident by any reasonable scale, as revealed in Section III.

[4]Daniel, Hirshleifer, and Subrahmanyam (1998) and Gervais and Odean (2001) use similar overconfidence definitions for stock market investors.

vey allows us to disentangle respondents' biases in the first and second moments, in other words, we can measure miscalibration (overconfidence) separately from optimism. To our knowledge, our paper is the only paper with direct and distinct measures of miscalibration and optimism, and that links both these constructs to firms and their actions.

The paper consists of two parts. In the first part, we investigate whether respondent CFOs are, on average, overconfident in their predictions. According to the confidence bounds that CFOs provide, they are severely miscalibrated: only 40% of the realized S&P 500 returns fall within the 80% confidence interval that respondents offer. We document that expected market returns and confidence bounds depend on recent past market returns and on returns of the CFOs' own firms. Interestingly, the lower confidence bound is far more sensitive to past market returns than is the upper confidence bound. As a consequence of the different sensitivities, CFOs are more confident following high market return periods and less confident following low market returns periods. This behavior is consistent with Soll and Klayman (2004), who argue that people make inference about the distribution of random or unknown variables from a few known cases (such as past returns), and with Arnold (1986), March and Shapira (1987) and Kahneman and Lovallo (1993), who argue that managers focus on downside risk. In addition, we document that CFO overconfidence is a time-persistent characteristic that increases with skill.

In the second part of the paper, we associate CFO overconfidence with a variety of corporate policies. Our main result is that overconfident CFOs maintain aggressive investment and financing policies, and behave as if they perceive their firms as undervalued by the market. This result is consistent with the hypothesis that overconfident managers value risky cash flows with discount rates that are too low (Roll 1986, Gervais, Heaton, and Odean 2005, Hackbarth 2006).

We find that several corporate policies are associated with the overconfidence of CFOs. First, firms with overconfident CFOs invest more on average, and in particular, acquire other firms. Nevertheless, they systematically experience low returns at merger announcements, suggesting that their merger plans are expected to destroy value in the eyes of investors. Second, we find that firms with overconfident CFOs have less flexible capital structure. In particular, debt leverage and the proportion of long-term debt to total debt are higher

for firms with overconfident managers. Third, firms with overconfident CFOs pay fewer dividends. Fourth, these firms repurchase more stock following a decline in their share price, but issue less stock in response to an increase in price. Finally, in firms with overconfident CFOs, compensation is more likely to be performance-based, yet total compensation is the same as in firms of less confident CFOs.

Our paper is organized as follows. Section II details the method that we use to collect the overconfidence data, the construction of variables, and presents some summary statistics. In Section III, we provide evidence on the miscalibration in CFO expectations. Section IV explores the determinants of overconfidence. Section V examines the relation between managerial overconfidence and corporate policies. In Section VI we discuss interpretation issues. Some concluding remarks are offered in Section VII.

II. Data

A. Executive Survey

Our study is based on a unique data set of stock market predictions made by senior finance executives, the majority of whom are CFOs and financial vice presidents, collected in 25 quarterly surveys conducted by Duke University between March 2001 and March 2007. Each quarter we poll between 2,000 and 3,000 financial officers with a short survey on important topical issues (Graham and Harvey 2006). The usual response rate for the quarterly survey is 5% to 8% and most of the responses arrive within the first two days of the survey invitation date.[5] The survey usually contains eight questions about the U.S. economy, firm policies, and firm short-term forecasts. Some of the questions are identical for each survey and some change through time depending on economic conditions. The historical surveys as well as the results can be accessed at `www.cfosurvey.org`.

We base our overconfidence proxies on two survey questions. The first question is:

[5]The bulk of our tests exploit variation within the respondent group, yet the overall response rate of 5% to 8% could potentially lead to non-response bias in the inference of some tests (e.g., in Section III). We explore this issue further in Section II.E.

"Over the next year, I expect the average annual S&P 500 return will be:

- There is a 1-in-10 chance it will be less than ____%

- Expected return: ____%

- There is a 1-in-10 chance it will be greater than ____%"

The second question is similar but relates to annualized stock market return forecasts over the next 10 years, where the first words change from *"Over the next year, ..."* to *"Over the next 10 years, ..."*.[6]

In contrast to most studies that use survey data, we are able to examine the characteristics of a sizable fraction of the respondents. Although the survey does not require CFOs to provide identifying information, in about half of the cases firms voluntarily provide such information, and about a quarter of the firms are confirmed to be U.S. public firms. Overall, our sample includes 6,505 one-year expected returns and 5,895 ten-year expected returns with valid 10^{th} and 90^{th} percentiles. Of this sample, 2,507 observations are from public firms (self-reported), and of them, we are able to match 1,877 observations (721 unique firms) to CRSP and Compustat. For the analysis in Section V, we exclude utility firms (2-digit SIC code 49) and financial firms (2-digit SIC code 60 to 69), and require respondents to respond to optimism questions (see Section II.C below), leaving 1,074 observations (505 unique firms).

B. Measures of Overconfidence

Our overconfidence measure maps each CFO's 10^{th} and 90^{th} percentile predictions into an individual probability distribution for each respondent. Wide distributions reflect high subjective uncertainty about the estimated variable, while narrow distributions reflect subjective confidence. We use the method proposed by Davidson and Cooper (1976) to recover respondent i's individual probability distribution, based on the normal distribution. The imputed volatility is calculated as:

$$\hat{\sigma}_i = \frac{x(0.90) - x(0.10)}{Z} \tag{1}$$

[6]The first question appeared in the surveys in its current form starting 2001Q2. The second question has been asked in its current form since 2002Q1. In the earliest surveys, executives were asked only for their expected returns.

where $x(0.90)$ and $x(0.10)$ represent the 90^{th} and 10^{th} percentile of the respondent's distribution, and Z is the number of standard deviations within the confidence interval. For confidence intervals of 80% in a normal distribution, Z equals 2.65. Keefer and Bodily (1983) show that, given information about the 90^{th} and 10^{th} percentiles, this simple approximation is the preferred method for estimating the standard deviation of a probability distribution of a random variable.

Our desired measure of overconfidence is a relative measure that is independent of CFOs' opinions about the future *level* of the stock market.[7] To disentangle the tightness of confidence bounds from the level of expected returns and contemporaneous market effects, we use a double-sorting procedure. This procedure allows us to measure the narrowness of CFOs' confidence intervals with respect to confidence intervals of other CFOs who hold similar beliefs about the stock market at the same point in time. First, for each survey date, we form deciles based on expected returns, then within each of these groups, we sort again to form deciles based on confidence intervals.[8] We use this procedure to generate two overconfidence variables, one short-term and one long-term. $Overconfidence\ ST$ is the short-term overconfidence measure and is based on one-year forecasts of the S&P 500. $Overconfidence\ LT$ is the long-term overconfidence measure, analogously based on the ten-year forecasts. To ease interpretation of the results, we orthogonalize the two overconfidence variables and scale them so that they have values between 0 and 1.

C. Attitudes Towards the Stock Market, U.S. Economy and Own Firms

Our survey data have the advantage of allowing the measurement of overconfidence while controlling for potential optimism in expected returns. We create two optimism variables, *Optimism ST* and *Optimism LT*, based on expected one- and ten-year return forecasts,

[7]For example, CFOs who are bullish about the stock market may also anticipate high volatility and thus provide wide confidence intervals because they believe that the direction of the stock market is related to volatility, and not because they have low confidence.

[8]Our results are qualitatively the same if, instead of the double-sorting procedure, we decile rank respondents according to their confidence interval scaled by their expected returns. The non-parametric double-sorting procedure that we use has the advantage of not imposing a linear relation between confidence intervals and expected returns.

respectively. The optimism variables reflect the decile-rank of expected returns within a given survey date. Since we are interested in disentangling the effects of optimism from the effects of overconfidence, we orthogonalize each optimism variable with respect to the relevant overconfidence variable, and then orthogonalize the long-term optimism variable against the short-term optimism variable. Finally, we scale the variables to be within 0 and 1.

We are also interested in isolating the effects of overconfidence from other, potentially correlated, attitudes about the U.S. economy and about own firms. In particular, it is plausible that managers who exhibit overconfidence are also optimistic about the future of their firms. Alternatively, it is possible that managers who anticipate a bright future for their firms feel more confident. In these two cases, our tests might capture the effects of the covariates of overconfidence, rather than the direct effect of overconfidence. To address this concern, in addition to using *Optimism ST/LT* about the expected returns of the stock market, we introduce additional controls for optimism about the U.S. economy (*Optimism U.S.*) and for firm-specific optimism (*Optimism firm*), based on two questions that appear in most surveys.[9] The questions are:

> *"a. Rate your optimism about the U.S. economy on a scale from 0-100, with 0 being the least optimistic and 100 being the most optimistic.*
> *b. Rate your optimism about the financial prospects for your company on a scale from 0-100, with 0 being the least optimistic and 100 being the most optimistic."*

To facilitate the interpretation of these variables, we decile-rank them within survey date, orthogonolize them to each other, and scale them so that they have values between 0 and 1.

D. Firm Data

Throughout the analysis, we use several databases with firm-level information. A detailed description of the variables is provided in the Appendix. First, we retrieve accounting data from Compustat, including industry classification, book leverage, asset market-to-book ratio,

[9]We have responses for these questions for 84% of the identified observations (excluding three surveys: 2001Q4, 2002Q1, 2005Q1).

profitability, 5-year sales growth, collateralized assets, capital expenditures scaled by lagged assets, cash spent on acquisitions scaled by lagged assets, and indicator variables for repurchases and dividend payments. We merge the survey observations with annual Compustat data, matching by the nearest fiscal end-of-year date. We also gather information about equity issuances and repurchased equity from the Quarterly Compustat file. Second, we use CRSP to compute one-year past returns for the market and firms; in addition we use CRSP in addition to Compustat to approximate firm age. Third, in our analysis of executive compensation, we use Execucomp. These data include the details of the compensation packages of the top five executives at the 1,500 largest firms in the U.S. stock market. Fourth, we use merger transactions data and information about acquired targets from Thomson SDC Platinum.[10]

E. Summary Statistics

In Table I, Panels A through D, we present summary statistics for survey responses and the characteristics of the respondent firms. Panel A presents a broad profile of respondent firms. The annual sales of the median firm is $2.0bn. The average asset market-to-book ratio (M/B) is 1.50, and the average annualized five-year sales growth rate is 6.5%. Their profitability (operating profit scaled by lagged total assets) averages 13.5% and capital expenditure intensity averages 5.1% (capital expenditures scaled by lagged total assets). 54.8% of the firms pay dividends and 40.1% repurchase their own shares around the survey date. Respondents come from a balanced range of industries (Table I, Panel B).

In Panel C we compare the attributes of our sample for which we have Compustat data to the attributes of the pooled population of Compustat firms between 2001 and 2006. Overall, our sample firms are more established and advanced in their life cycle than most Compustat firms. In particular, respondent firms are relatively mature and large: 50.2% of the identified firms in our sample are from the top firm-age quintile of Compustat firms and 62.2% are from the top sales quintile of Compustat firms. In other characteristics, such as market-to-book

[10]To ensure that our results are not driven by outliers and following the practice of many studies using similar data, we winsorize our survey data within each survey date at the 1% level. Similarly, we winsorize Compustat and CRSP data.

ratio, past sales growth, and debt, our sample firms are similar to the universe of Compustat firms. Overall, the portion of our respondents that we can link to Compustat over-samples large and mature firms, and therefore our results should be interpreted with this in mind.

III. Are CFOs Overconfident?

In this section we conduct two tests to assess whether CFO respondents are, on average, overconfident. There could be two reasons for CFO overconfidence. First, as discussed in the introduction, previous studies in psychology have almost unanimously shown that people, and professionals in particular, are overconfident on average. Second, and most compelling, is an argument attributed to Goel and Thakor (2005). They argue that top executives should be expected to be overconfident because promotion in corporations is typically based on past performance, which is ultimately tied to the risk taken by executives. Overconfident managers underestimate risk and therefore take actions with excessive risk. As a consequence, the variance of outcomes from their actions is greater, and therefore overconfident managers will be over-represented among the right-tail "winners" and are more likely to get promoted.

We perform two tests to investigate whether CFOs are overconfident. The first test measures the fraction of ex post S&P 500 return realizations that fall between the 10^{th} and 90^{th} percentiles provided by CFOs' predictions. The second test compares the individual volatility imputed from the survey data to the individual volatility as predicted by a simple model of bias.

A. Ex Post Realizations vs. Ex Ante Predictions

We begin by calculating CFO overconfidence as miscalibration of beliefs. We compute the percentage of executives for whom the realized return of the stock market falls within their 80% confidence intervals as derived from the 10^{th} and 90^{th} percentile survey responses. If executives are well-calibrated and our sample period is representative, we expect this figure to be 80%.

Table II presents the response statistics per survey. We list the survey means for the lower confidence bounds (column (1)), expected returns (column (2)), and upper confidence bounds (column (3)) for the one-year forecasts. In column (4) we present the mean of the individual volatilities where each is computed using Equation (1), and column (5) contains the disagreement volatility (dispersion of beliefs), which is calculated as the standard deviation of expected returns across all respondents for any given date. Similarly, we present the results for the ten-year forecasts starting in column (6). Finally, we report market data in columns (11) to (13): realized returns and volatility for the forecasted horizon, and the VIX[11] for the survey date.

Table III compares the S&P 500 forecasts to realizations. In column (1) we calculate the average forecast error (the difference between mean expected returns from Table II, column (2), and the S&P 500 return realization in column (11)). The mean forecast error is 2.5%.

In columns (2) to (4) of Table III we compute for each survey cohort the percentage of CFOs for whom the S&P 500 realization was in the 80% confidence interval. We judge whether CFOs are miscalibrated by examining whether ex post market realizations fall in the ex ante confidence intervals. Over the sample period, only 40.4% of the stock market return realizations are within the 80% confidence bounds estimated by CFOs (see column (3) and Figure 1). This degree of miscalibration is not unusual for studies that request respondents to estimate 80% confidence bounds (Lichtenstein, Fischoff, and Phillips 1982, Russo and Schoemaker 1992, Klayman, Soll, Gonzáles-Vallejo, and Barlas 1999, Soll and Klayman 2004). Thus, based on a miscalibration definition, CFOs as a group are overconfident in our sample.

B. Model of Bias

Next, we consider a simple model of forecasting that allows us to assess *ex ante* whether CFOs are overconfident. With the model, we assess the tightness of CFO confidence intervals without needing to compare forecasts to outcomes (as in the Section III.A). This procedure

[11]VIX is an index that reflects the average of imputed volatility across traded options in the S&P 500 futures index, traded in the Chicago Board of Options Exchange (CBOE).

helps us assess whether ten-year stock market forecasts are too tight (even though ex post realizations are not yet available), and also provides additional tightness benchmarks for the one-year forecasts. In particular, we test whether the 10^{th} and 90^{th} percentiles provided by CFOs fit anticipated volatility, as well as whether they are calibrated to historical S&P 500 volatility.

We assume that the true model of the S&P 500 returns is:

$$r_{SP} = \mu_{SP} + \tilde{\epsilon}_{SP}, \tag{2}$$

where μ_{SP} is the unobservable mean return, and the error term $\tilde{\epsilon}_{SP} \sim N(0, \sigma^2_{SP})$.

Forecaster i believes that the future return of the S&P 500 is

$$\hat{r}_i = \hat{\mu}_i + \hat{\epsilon}_i, \tag{3}$$

where $\hat{\mu}_i$ is the mean return estimate, and ϵ_i is a forecaster-specific error term. The forecaster does not know the unobservable mean return of the stock market μ_{SP}, instead she believes that

$$\hat{\mu}_i = \mu_{SP} + \bar{e} + \hat{e}_i, \tag{4}$$

where $\bar{e}$ potentially captures a systematic bias in beliefs about the mean. If $\bar{e} > 0$ then forecasters are on average optimistic. The error term $\hat{e}_i$ captures the uncertainty that forecaster i has about the mean, and $\hat{e}_i \sim N(0, \sigma^2_e)$. For simplicity, we assume mutual independence between $\hat{e}_i$ and $\hat{\epsilon}_i$.

The forecaster-specific error term $\hat{\epsilon}_i$ is assumed normally distributed $\hat{\epsilon}_i \sim N(0, \sigma^2_{SP} + \theta_i)$. The additional term θ_i potentially captures overestimation ($\theta_i < 0$) or underestimation ($\theta_i > 0$) of stock market volatility. This parameter corresponds with the definition of overconfidence as underestimating the volatility of random process (as in Hackbarth 2006).

Thus the total variance of the forecasted returns $\hat{r}_i$ is:

$$\hat{\sigma}^2_i = \sigma^2_{SP} + \theta_i + \sigma^2_e. \tag{5}$$

In the context of our survey, we interpret the CFO responses as the mean and the 10^{th} and 90^{th} percentiles of the return distribution $\hat{r}_i$, from which we can extract the total variance $\hat{\sigma}_i^2$.

B.1. Model Calibration: Are CFOs Optimistic?

Using the survey data, we calibrate some of the parameters of the model.[12] We estimate whether CFOs are optimistic on average with respect to the S&P 500 by examining whether their forecast errors (expected returns minus realized returns) are significantly greater than zero. The forecast error, therefore, is:

$$\bar{e} = E[\hat{r}_i] - \mu_{SP}. \tag{6}$$

Forecast errors are presented in Table III, column (1). The average forecast error is positive but insignificantly different from zero $\bar{e} = 2.5\%$ ($t = 0.49$). Hence, expected returns provided by the CFOs appear unbiased within the sample period.

B.2. Model Calibration: Are CFOs Overconfident?

We first assess whether CFOs are overconfident in the short-term. For each survey we estimate the mean bias about the variance, $\bar{\theta}$, across agents:

$$\bar{\theta} = E[\hat{\sigma}_i^2] - \sigma_{SP}^2 - \sigma_e^2. \tag{7}$$

We estimate $E[\hat{\sigma}_i^2]$ as the mean of the individual variances in each survey, averaged across surveys (0.0040), and σ_e^2 as the variance of point estimates across forecasters, averaged across surveys (0.0015). We use three different proxies for the variance of the stock market, σ_{SP}^2, based on: (1) market expectation of future stock market variance, averaged across surveys[13]

[12] All our statistical inferences adjust for the overlapping periods, using Newey and West (1987).

[13] Based on the VIX index (see Table II, column (13)). The mean annual variance imputed by the VIX over the sample period was 0.0443 (21.0% in standard deviation terms).

(0.0443), (2) realized stock market variance, averaged across surveys[14] (0.0286), and (3) historical stock market variance[15] (0.0201).

Even if we pick the most conservative estimate for the variance of the stock market, drawn from historical statistics, CFOs underestimate the variance of the stock market by $E[\bar{\theta}] = -0.0176$ ($t = -67.7$) (-13.3% in standard deviation terms). Therefore, CFOs are overconfident as a group according to the short-term miscalibration definition.[16]

Next, we assess *ex ante* whether CFOs are overconfident in the long-term. To do so, we re-estimate Equation (7) for the long-term overconfidence. We estimate $E[\hat{\sigma}_i^2]$ as the mean of the individual variances, averaged across surveys (0.0015), and σ_e^2 as the mean of the variance of point estimates, averaged across surveys (0.0007) (both are annualized estimates). We use two estimates for the ten-year stock market variance, σ_{SP}^2, both based on historical realizations: (1) the average annualized stock market variance across all ten-year windows since 1950 (0.0209), and (2) the lowest annualized stock market variance across all ten-year windows since 1950 (0.0129).

The results indicate that CFOs in our sample are overconfident in the long-term. When using the average stock market variance for the calculation, the bias in the perceived variance of stock market returns is $\bar{\theta} = -0.0201$ (-14.2% in standard deviation terms). Based on the lowest stock market variance in any given ten year window, CFOs still underestimate the variance by $\bar{\theta} = -0.0121$ (-11.0% in standard deviation terms). This bias is depicted in Figure 3. The top histogram presents the distribution of annualized ten-year historical market volatilities and the bottom histogram presents the distribution of the corresponding survey-imputed volatilities. While historical ten-year volatilities are concentrated between

[14]The mean of the squared one-year realized volatility: 0.0286 (16.9% in standard deviation terms; see Table II, column (12)).

[15]The variance of the S&P 500 is the mean of all historical one-year windows of realized variance of the S&P 500 between January 1950 and December 2006, 0.0201 (14.2% in standard deviation terms). The historical distributions of the one-year volatilities are illustrated in Figure 2. In the top chart we present the histogram of the distribution of one-year historical volatilities of the S&P 500. In the bottom panel of the figure we provide the histogram of imputed survey volatilities for comparison. The histograms indicate that CFOs anticipate distinctly lower volatilities than those actually experienced over the previous 57 years.

[16]We could also introduce a bias in the uncertainty about the mean, σ_e^2, relative to a Bayesian forecaster. Such a parameter would match the definition of overconfidence as being "too sure of oneself," i.e., forecasters discount the public signal (as in Gervais, Heaton, and Odean 2005). Nonetheless, the size of such bias is bounded from above by σ_e^2 and therefore is economically unimportant relative to the empirical size of the estimated bias in the variance $\bar{\theta}$.

11% and 16%, almost the entire distribution of survey-based volatilities is below 10%. The fact that overconfidence is stronger in the long-term than in the short-term is consistent with the findings of Gilovich, Kerr, and Medvec (1993) that overconfidence increases with the temporal distance between forecast and realization.

IV. Determinants of Overconfidence

In this section, we investigate which factors affect managerial forecasts, and examine some candidate variables that could potentially explain temporal and cross-sectional overconfidence.

A. Past Market and Firm Performance

There is theoretical justification that, following good outcomes, people predict narrower distributions of future events. In a model by Einhorn and Hogarth (1978), decision makers "learn" about their ability by observing the outcomes of past decisions, ignoring exogenous determinants of these outcomes. Following favorable outcomes, decision makers become more confident about their judgemental abilities through a self-attribution mechanism, even if the outcome was independent of their prior decisions. In applying this idea to trading behavior, Gervais and Odean (2001) argue that traders become overconfident after observing a series of past successes that they attribute to their own abilities. As an extension of this reasoning, Hilary and Menzly (2006) find that security analysts exhibit greater aggressiveness following successes in predicting earnings.

Table IV explores the relation between one-year survey forecasts and future and past S&P 500 return realizations.[17] In Panel A we regress average forecasts across surveys (lower bounds, expected returns, and upper bounds), as well as the average imputed individual volatility, on future and past S&P 500 one-year returns. Since we examine quarterly forecasts for one-year horizons, we encounter autocorrelations due to overlapping data and therefore

[17]For brevity we present only analysis of one-year forecasts. Ten-year forecasts exhibit similar patterns. Results are available upon request.

adjust the standard errors for the two-year overlap[18] in the data using the Newey and West (1987) procedure with 7 quarterly lags. The negative (and statistically insignificant) coefficients on one-year future S&P returns in columns (1) to (3) indicate that the CFOs' stock market forecasts are not associated with future market return realizations.

Interestingly, CFOs are more confident following periods of high stock market returns. One-year forecasts are correlated with past S&P 500 returns (columns (1) to (3) in Panel A). This effect is especially strong on the lower bound ($R^2 = 0.76$) and on the expected returns that CFOs provide. Since the average confidence upper bounds are not affected by past returns very much ($R^2 = 0.11$), individual volatility effectively increases following poor past returns and decreases following periods of high stock market returns (negative coefficient in column (4)).[19] This effect is well depicted in 10^{th} and 90^{th} percentiles (averaged across respondents) in Figure 4. In March 2003, the lower confidence bound was relatively low (-7.0%) because the actual S&P 500 return in the year before the survey date was exceptionally low (-31.0%). Likewise, the average lower confidence bound in September 2003 was relatively high (1.1%) because the realized return in the preceding year was especially high (17.5%). The average upper confidence bound, however, does not co-move as much with past market returns. These results are consistent with the model of Gervais and Odean (2001) and with Alba, Hutchison, and Lynch (1991) and Soll and Klayman (2004), who argue that forecasters often use past extreme cases to estimate the distribution of uncertain variables. The lower confidence bound is particularly sensitive to past returns, perhaps because managers tend to focus on downside risk in their analysis of projects (Arnold 1986, March and Shapira 1987, Kahneman and Lovallo 1993).

In Panel B of Table IV, we test whether CFO stock market forecasts are influenced by past returns of their own firms. In these regressions, we face cross-sectional correlation (executives forecast the same index) and overlapping data problems (forecasting horizon is one year and observations are quarterly). We resolve the issue by using a Fama and MacBeth (1973) approach in which we perform cross-sectional regressions of forecasts on past one-year firm returns. Then, we compute the mean of the regressions' coefficients and

[18] Allowing for data overlap for both one-year past returns and for one-year future returns.

[19] These results are in line with Deaves, Lüders, and Schröder (2005), who analyze the forecasts of German stock market forecasters and with Shefrin (2005), who reports results from the UBS survey of retail investors.

adjust the standard errors with the Newey and West (1987) procedure for three lags. This procedure is also advantageous because it implicitly demeans firm returns each quarter, so that the effects depicted in the regressions in Panel B are distinct from the effects depicted in the regressions in Panel A. The results suggest that lower return bounds and expected returns provided by CFOs are associated with their own firms' past returns. Comparing the results in Panel A to those in Panel B, we note that the effect of past market-wide returns on the confidence bounds is larger by an order of magnitude, relative to the effect of past firm-specific returns.

B. Personal Characteristics

In this section, we examine the personal determinants of CFO overconfidence. In particular, we explore the persistence of overconfidence through time, its relation to demographic attributes, and its association with skill.

B.1. Persistence of Overconfidence

First, we investigate whether overconfidence and optimism are persistent characteristics of decision makers. Across surveys, there are 764 pairs of sequential responses from the same executives (i.e., respondent from the same firm with same position in the firm). For these observations, the correlation between sequential $Overconfidence\ ST$ ($Overconfidence\ LT$) is 0.46 (0.30), and the correlation between sequential $Optimism\ ST$ ($Optimism\ LT$) is slightly lower 0.33 (0.27). Hence, both optimism and overconfidence persist through time for a given CFO, although overconfidence exhibits stronger persistence. These results are consistent with evidence about the stability of individual biases over time (Jonsson and Allwood 2003, Glaser, Langer, and Weber 2005).

B.2. Demographic Profile

Second, we conduct a test that explores the relation between executive biases and demographic characteristics. We collect demographic details from respondents in two surveys

(2003Q4 and 2004Q1). The questions inquire about age, education, professional experience, and gender. Our analysis (untabulated) reveals few significant relations between overconfidence and demographic attributes. Specifically, we find that CFOs with different levels of education and experience express the same degree of overconfidence, while older CFOs are more overconfident in the short-term. Furthermore, we find no significant gender difference in overconfidence.

B.3. Do Overconfidence Variables Capture Skill?

Third, we consider the possibility is that our overconfidence measures simply capture skill rather than miscalibration, i.e., CFOs who forecast the stock market better also provide narrower confidence bounds. To investigate the relation between overconfidence and skill we examine whether overconfident CFOs produce more accurate forecasts. Table V, column (1) presents regressions of absolute forecast error (as a proxy for skill) on the overconfidence variables. The results indicate that overconfident CFOs predict future stock market returns more precisely.

However, the tradeoff between the size of confidence intervals and the improvement in accuracy is less than proportional. When moving from the median to the top decile of long-term overconfidence, the size of confidence intervals decreases by about 6.5% (untabulated), but the average absolute forecast error decreases only by 0.32% (half of 0.63%, Table V, column (1)). This difference in magnitudes implies that miscalibration could overshadow accuracy on net. In other words, although overconfident CFOs are slightly more accurate, their confidence intervals are still *much* too narrow.

To test this hypothesis, we examine whether the likelihood that a realization would fall within the confidence interval is correlated with overconfidence, even after controlling for the absolute forecast error. Thus, we regress an indicator variable of whether S&P 500 realizations fall within each individual confidence interval on two variables: the individual overconfidence measures, and the absolute forecast error. If skill (low forecast error) entirely explains CFOs' tight confidence intervals, then the overconfidence variables should not be significant in the regression. The results in column (2) show that both overconfidence variables

remain negative and statistically significant even after controlling for the absolute forecast error. These results are consistent with the findings of the psychological literature suggesting that overconfidence increases with accuracy (Sporer, Penrod, Read, and Cutler 1995) and expertise (Arkes, Dawes, and Christensen 1986, Paese and Feuer 1991, Spense 1996). We conclude therefore that although CFO overconfidence is associated with skill, our overconfidence measures capture genuine miscalibration.

C. Firm Characteristics

Next, we investigate whether CFO overconfidence and optimism are related to firm characteristics. We assess whether company age, profitability, sales growth, firm size, market-to-book, or 12-month past returns are associated with overconfidence and optimism. In an untabulated analysis we find that CFOs who work for large firms, high past growth firms, and firms with high past 12-month returns are more confident in the short-term. CFOs at high market-to-book firms are overconfident in the long-term. CFOs at old firms, profitable firms, small firms, and firms with high past returns are more optimistic about the S&P 500, and CFOs from successful firms (high market-to-book and high past returns) are optimistic about the prospects of their own firms.

V. Managerial Overconfidence and Corporate Policies

In this section, we investigate whether corporate policies are associated with biases in the beliefs of decision makers. In a previous study, Bertrand and Schoar (2003) document that managers have their own unique personal style which helps to explain the cross-section of corporate policies. Overconfidence may be one of the managerial traits that affects decision making. In particular, overconfident managers may make different decisions than do their peers in a variety of corporate domains that involve assessing uncertain outcomes.

In general, overconfidence can cause two related effects. First, overconfident managers underestimate the risk in cash flows. As a consequence executives may perceive some negative NPV projects as profitable and therefore invest too much (Gervais, Heaton, and

Odean 2005, Aktas, de Bodt, and Roll 2005, Hackbarth 2006) and/or divert internal funds towards investment (Hackbarth 2006). In addition, overconfident managers are hypothesized to choose an aggressive capital structure for their firms (Hackbarth 2006), or they may agree to link their compensation more closely to performance (Keiber 2002). Second, because overconfident managers underestimate the volatility of risky processes, they may perceive their firms' cash flows as safer than they really are. In other words, they believe that their firms are undervalued by the market (Hackbarth 2006). As a result, they may repurchase shares more intensely in response to a decline in share prices, or may be more reluctant to issue new shares following run-ups in price, in anticipation of further increases.

All our corporate policy regressions contain a similar set of controls for the known determinants of such policies. Specifically, our controls include collateral (measured as the portion of tangible assets out of total assets), logged firm value, asset market-to-book, book leverage, profitability, 5-year past sales growth, 12-month past returns, a dividend-payer dummy, industry fixed effects, and survey date fixed effects. In addition, we include the S&P 500 optimism variables and firm and U.S. optimism variables. We believe that these variables control for common determinants of corporate policies, including for growth opportunities that could be correlated with overconfidence. Furthermore, to keep consistency with the corporate finance literature, we exclude utilities and financial firms from the sample. In a robustness test, we confirm that our results qualitatively hold for the entire sample of firms.

A. Investment Policy

The first prediction that we test is proposed by several theoretical studies. Roll (1986), Shefrin (2001), Gervais, Heaton, and Odean (2005), Hackbarth (2006), and Goel and Thakor (2005) predict that managers who underestimate risk end up investing more. We test this hypothesis by regressing capital expenditure (capex) intensity and acquisition intensity on overconfidence and control variables. The capex intensity variable is computed as quarterly capital expenditures scaled by lagged assets. Acquisitions intensity is calculated as the dollar value of quarterly acquisitions scaled by lagged assets.

The results for the investment analysis are presented in Table VI, columns (1) and (2). Overall, firms with overconfident managers invest more in capital expenditures in general (column (1)), and in acquisitions in particular (column (2)). Both capital expenditures and acquisitions intensity strongly increase with long-term overconfidence but not with short-term overconfidence ($t = 2.8$ and $t = 2.0$, respectively), possibly because investments are generally long-term decisions. To quantify the effect, moving from the median to the top decile of overconfidence increases firm capital expenditures by about 1.7% (the mean of capex intensity across sample firms is 8.1%). Note that other than long-term overconfidence, no other confidence- or optimism-related variable is statistically significant, stressing the importance of our overconfidence measure in the decision making process.

We further investigate the relation between CFO overconfidence and the characteristics of mergers executed by their firms. In column (3) of Table VI, we analyze the market reaction to merger announcements. For each observation in our sample we match announced mergers from Thomson SDC Platinum according to the nearest date to the survey date, restricting the date-difference to, at most, two years. The regression includes controls for the method of payment (stock or cash), whether the merger is diversifying or not (according to whether the acquirers' 2-digit SICs match their targets' 2-digit SICs), and the logged transaction value.

Our results show that merger plans by firms of overconfident managers are negatively received by the market. In column (3) we use a sample of 373 merger announcements to regress announcement returns (3-day market-adjusted returns around the announcement event) on overconfidence and optimism variables. We find that firms of overconfident CFOs (in the long-term) experience lower announcement returns at an economically and statistically significant magnitude ($t = -2.3$). Malmendier and Tate (2006) report a similar effect on announcement returns for CEOs who do not exercise their executive options, and who are described as "optimistic" and "confident" in the press. Consistent with the previous results about firm investments, also in this case overconfidence is the only attitude variable that is significant in the regression. A shift from the median to the top decile of overconfidence reduces announcement returns by -1.2% (mean announcement returns are 0.9%).

B. Capital Structure Policy

Hackbarth (2006) argues that overconfident managers pursue aggressive financial policies. In particular, overconfident managers believe that the volatility of their firms' cash flows is lower than it actually is, and therefore they underestimate the chances of bankruptcy. As a consequence, overconfident CFOs may choose more aggressive debt policies.

Our tests concentrate on two types of debt policies: leverage and maturity structure. First, we regress book-leverage on a set of right-hand side variables similar to those used in the previous tests. The results in Table VI, column (4), indicate that overconfidence is positively related to debt leverage, although weakly so ($t = 1.8$ and $t = 0.6$ for short-term overconfidence and long-term overconfidence, respectively). To illustrate the economic magnitude of the effect, a shift from the median to the top decile of overconfidence increases leverage ratios by about 1.5% (average leverage in our sample is 21.2%).

Second, we test whether overconfidence leads managers to select a risky capital structure, in the sense of being inflexible. In particular, overconfident CFOs may commit their firms to long-term interest payments, thereby committing debt capacity and potentially increasing interest rate risk. Furthermore, overconfident CFOs may be able to convince investors to supply long-term funds based on the current assets in place more effectively than could their peers.

We test this hypothesis in column (5). We construct a variable that measures the portion of long-term debt (above one year in maturity) out of total debt ($LT\ debt/Total\ debt$) and use it as the dependent variable. In column (5), the coefficients on both overconfidence variables are positive and statistically significant ($t = 1.8$ and $t = 2.4$ for short-term and long-term overconfidence, respectively). An increase from the median to the top decile in each overconfidence variable is associated with a higher share of long-term debt by about 7.9% (the mean proportion of long-term debt out of total debt is 76.2%). Thus, overconfidence is associated with committing more heavily to long-term debt.

C. Payout Policy

Executive overconfidence could also be associated with payout policy. Overconfident managers may believe that available investment opportunities are less risky or more profitable than they really are, and therefore overestimate their net present value (Gervais, Heaton, and Odean 2005). To finance those projects, overconfident managers might use funds that otherwise would have been paid out to investors as dividends (Hackbarth 2006). This prediction is consistent with survey evidence of Brav, Graham, Harvey, and Michaely (2005) who document that dividend-paying firms are on average mature firms with less available investment opportunities; hence, firms of overconfident managers may pay less dividends because their managers perceive greater investment opportunities than there really are.

In Table VI, column (6), we perform a probit regression of an indicator variable for whether firms pay dividends in the current year on the overconfidence variables and the usual controls (including a control for whether the firm repurchases stock in the current year). Both overconfidence variables are negative; however, only the long-term overconfidence is statistically significant ($t = -2.5$), perhaps because dividend decisions are viewed as very sticky and long-term commitments by CFOs (Brav et al., 2005). The effect of overconfidence on dividend payout is economically significant. For the average firm, when increasing long-term overconfidence from the median to the top decile, the propensity to pay dividends decreases by about 12.4%.

D. Market Timing Activity

Empirical evidence suggests that many firms engage in market timing, i.e., they issue shares following price increases and repurchase shares following price declines. Baker and Wurgler (2002) argue that the cross-section of corporate capital structure can be explained as an accumulation of responses to past price changes. Further, Graham and Harvey (2001) document that CFOs agree that market timing (recent past stock price changes) is a primary consideration for decisions about stock issuances and repurchases.

Miscalibration in beliefs may exacerbate timing activity. Similar to the behavior of overconfident investors (Gervais and Odean 2001), overconfident managers may discount the public signal (market valuation) and repurchase shares shortly after price declines. If in addition overconfident CFOs believe that the market undervalues their firms (as in Hackbarth 2006), they may defer engaging in SEOs following high returns.

We test these predictions by examining the magnitude of repurchases and equity issuances as a response to past returns, interacted with the overconfidence variables. Specifically, for each firm-quarter we compute the ratio of repurchases to lagged total assets ($Repurchases_q/Total\ assets_{q-1}$) and the ratio of seasoned equity issuances (SEOs) to lagged total assets ($SEOs_q/Total\ assets_{q-1}$). We regress these variables on overconfidence interacted with past returns, in addition to the usual variables.

The repurchase analysis is presented in Table VI, column (7). The dependent variable is $Repurchases_q/Total\ assets_{q-1}$. The coefficients on both overconfidence variables interacted with past returns are negative, although only short-term overconfidence is significantly different from zero ($t = -2.9$ and $t = -1.1$ for short-term and long-term overconfidence, respectively). This coefficients should be interpreted as follows. Given a decline in share price, firms with overconfident CFOs repurchase a *greater* fraction of their shares (in terms of book assets), all else being equal. This result is in line with Hackbarth (2006) who argues that overconfident managers perceive their firms as undervalued by the market.

In column (8), we use $SEOs_q/Total\ assets_{q-1}$ as dependent variable. Consistent with the extant literature, the coefficients on the past returns variables suggest that SEOs are larger following high past returns (Table VI, column (6)). Both coefficients of the interactions are negative, although only long-term overconfidence is significantly different from zero ($t = -0.7$ and $t = -1.9$ for short-term and long-term overconfidence, respectively). These coefficients imply that, given an increase in returns, firms with overconfident CFOs issue a *smaller* fraction of equity.

Put together, the results for repurchases and SEOs are consistent with the hypothesis that overconfident managers perceive their firms as undervalued by the market. Overconfident

CFOs repurchase equity more intensely following a decline in stock prices and limit their issuances following increases in share prices.

E. Executive Compensation

Overconfidence may alter executive demand for variable compensation that is contingent on performance. There are two competing hypotheses for the effects of managerial overconfidence on the composition of compensation. Gervais, Heaton, and Odean (2005) argue that overconfident managers have fewer career concerns and, therefore, are aligned with stockholders in their objectives. Consequently, overconfident managers would require *less* incentive compensation to induce them to exert effort. Keiber (2002) argues that overconfidence leads to the opposite effect. Since overconfident managers underestimate the risk in variable compensation, they are willing to take on more such risk.

We use Execucomp data to test the compensation hypotheses. First, we compute for each firm-year the average fraction of bonus compensation out of salary and bonus across the range of executives. The data set is based on Execucomp database and includes 571 observations. Then, we regress this variable on the overconfidence variables in addition to controls and industry and time fixed effects. The regression in Table VI, column (8), indicates that the fraction of variable compensation significantly increases with short-term overconfidence.[20] An increase from the median to the top decile of short-term overconfidence translates to an increase of 2.8% in the importance of the bonus (average bonus is 42.1%).

We next investigate whether overconfident managers are compensated for the greater risk contained in their compensation packages. To do so, we examine whether total compensation (including options, stock grants, etc.) is different for overconfident managers. We find that the coefficients on the overconfidence variables are small and statistically insignificant (results are untabulated for brevity.) Hence, overall compensation is insensitive to overconfidence. In sum, the results are consistent with (Keiber 2002), suggesting that overconfident executives are willing to bear more risk in their own portfolios without being compensated for it.

[20]In unreported analysis, we do not find that options compensation is associated with overconfidence.

VI. Forecasting the S&P 500 vs. Forecasting Cash-Flows

Our tests about the effects of managerial overconfidence on corporate decision making are a joint test of (i) whether our S&P 500 overconfidence variable is a valid proxy for CFOs' overconfidence about their own firms and cash flows (carryover effect), and (ii) whether managerial overconfidence affects corporate policies. Our results are consistent with both the carryover effect and the link between overconfidence and corporate policies. In addition, the carryover effect is supported by some psychology research.

An extensive literature in psychology and in experimental economics examines whether biases like overconfidence spill over from one domain to other domains. West and Stanovich (1997) find that overconfidence regarding motor skills is correlated with overconfidence regarding cognitive skills. Glaser and Weber (2007) present a study in which overconfidence is measured in several ways, such as by different types of miscalibration questions. The authors find that respondents who exhibit overconfidence in stock market forecasts are likely to exhibit overconfidence in general knowledge questions. Several studies document that individual degrees of overconfidence are stable within tasks (forecasting, in our case), e.g., Glaser, Langer, and Weber (2005), Klayman, Soll, Gonzáles-Vallejo, and Barlas (1999), Jonsson and Allwood (2003). These studies show that although people sometimes exhibit different levels of overconfidence across domains, there are reliable differences in overconfidence across individuals. While many studies find that overconfidence spills over from one domain to another, others find weak or no carryover effects. For example, Biais, Hilton, Mazurier, and Pouget (2005) find that although in there is some evidence that overconfidence carries over across domains (subjects that are classified as miscalibrated perform worse in a trading game), in other cases, the link does not exist (there is no relation between miscalibration score and trading volume).

Carryover effects are found also in empirical economics. For example, Puri and Robinson (2007) find that people with optimistic beliefs about their life-span also make optimistic economic decisions, e.g., they are more likely to be self-employed and tilt their portfolios towards individual stocks. In the context of our results, CFOs who are overconfident in

forecasting the S&P 500 also appear to be overconfident in the dimensions of their own firms, as evidenced by the relation between overconfidence and corporate policies.

Finally, to investigate these issues further, we test whether our overconfidence measures better explain the corporate policies of firms that co-move with the market. Future cash flows of high-beta firms are highly correlated with the future market returns, and thus S&P-based overconfidence variables should be more closely linked to CFO overconfidence about cash flows and other corporate attributes in these firms. We pursue this idea by interacting market beta (β_{MKT}) with overconfidence variables and adding it to the regression specifications used in the previous section.[21] If the overconfidence variables reflect executive overconfidence about their own firms' attributes, then there should be a stronger association between corporate policies and the overconfidence variables for high-beta firms (i.e., the coefficient of the interaction term should have the same sign as the main effect of overconfidence).

Table VII presents the results of this test. In each column we regress one corporate policy (capex intensity, acquisitions intensity, merger announcement returns, debt leverage, fraction of long-term debt, dividends, and executive compensation) on the interactions of beta and the overconfidence variables, and also on the main effect of beta, optimism, control variables, and industry and time fixed effects. To support our hypothesis, the coefficients on the statistically-significant overconfidence variables in Table VI should have the same signs as the coefficients interacted with market beta. The results provide some support for the idea that the impact of overconfidence on corporate policies is stronger for high-beta firms. For example, for long-term overconfidence, the beta-interactions have the same signs as the main effect variables, and three of the seven beta terms are significant (Table VI). To illustrate, keeping long-term overconfidence level constant, high-beta firms invest more than do low-beta firms. Similarly, high-beta firms with overconfident CFOs experience lower returns when announcing prospective mergers than do low-beta firms. Hence, our results are generally consistent with the hypothesis that the effects of market-based overconfidence carry over more strongly in firms with cash flows that co-move with the market.[22]

[21] For each firm-quarter we form a sample of the previous 60 month returns (minimum of 20 months). In a regression of monthly firm excess returns on contemporaneous market excess returns, market beta β_{MKT} is the coefficient on stock market excess returns.

[22] In an additional test we replaced β_{MKT} with R^2 from a firm-level regression of firm past returns on the market portfolio. Returns of high-R^2 are more correlated with the market than are those of low-R^2 firms.

VII. Conclusion

We provide new evidence and novel insights about the relation between behavioral biases of managers and corporate policies. Our study is based on a unique data set of stock market predictions by over 6,500 top financial executives collected over a span of more than six years. Our survey questions are targeted to measure overconfidence as the degree of miscalibration of beliefs, a method that has been exclusively used before in laboratory experiments. Our data set is distinct because we have direct measures of *both* overconfidence and optimism for a large number of top U.S. executives, and because we can link our estimates to archival data and thus examine the relation between overconfidence and corporate actions.

The paper highlights the drivers behind managerial biases. We find that CFOs are miscalibrated on average: only 40% of stock market realizations fall within the 80% confidence intervals that executives provide. We find that confidence intervals are especially narrow following high stock market returns because managers condition their lower confidence bound on past stock market performance. Moreover, our results indicate that miscalibration depends on personal traits (skill) in addition to corporate characteristics.

We present novel empirical analysis that ties managerial overconfidence (measured as miscalibration) to a wide range of corporate policies, as predicted by the theoretical literature. Firms with overconfident CFOs invest more and engage in more acquisitions, and the market reaction to their acquisitions is negative. We also find a positive relation between managerial overconfidence and financial structure: firms of overconfident CFOs have higher debt leverage, rely more on long-term debt, and pay fewer dividends. Also, they repurchase more shares after a decline in share prices, but issue fewer shares following price run-ups. Finally, we find that executive compensation in firms with overconfident CFOs is tilted towards performance-based pay.

We find that the correlation between β_{MKT} and R^2 is high (0.63), and that the results from the regression analysis are qualitatively the same. The results are untabulated for brevity but are available upon request.

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Appendix: Variable Definitions

Variables from CFO Survey

Raw short-term forecast	Survey response of expected one-year S&P 500 return.
Raw long-term forecast	Survey response of expected ten-year S&P 500 return.
Raw lower (upper) bounds	Survey response for the level of S&P 500 returns for which there is a 1-in-10 chance of being lower (greater). Applies to short-term (one-year) and long-term (ten-year) returns.
abs(forecast error)	Absolute value of the forecast error (forecasted returns minus realized returns).
Individual volatility	(Raw upper bound - raw lower bound) / 2.65. Applies to short-term (one-year) and long-term (ten-year) forecasts.
Disagreement volatility	Standard deviation of mean forecasts (expected returns) within survey date. Applies to short-term (one-year) and long-term (ten-year) forecasts.
Optimism ST	Decile ranking of individual short-term expected returns within each survey date. Orthogonalized with respect to $Overconfidence\ ST$. Variable is scaled between 0 and 1.
Optimism LT	Decile ranking of individual short-term expected returns within each survey date. Orthogonalized with respect to $Overconfidence\ ST$ and $Optimism\ ST$. Variable is scaled between 0 and 1.
Overconfidence ST	Decile ranking of individual volatility of short-term forecasts within each survey date and forecast decile (i.e., double sorting on short-term optimism). Ranking is scaled between 0 and 1, and sorted in descending order so that 0 reflects the decile of least overconfident executives and 1 reflects the decile of most overconfident executives.
Overconfidence LT	Decile ranking of individual volatility of long-term forecasts within each survey date and forecast decile (i.e., double sorting on raw long-term optimism). Orthogonalized with respect to $Overconfidence\ ST$. Ranking is scaled between 0 and 1, and sorted in descending order so that 0 reflects the decile of least overconfident executives and 1 reflects the decile of most overconfident executives.
Optimism firm	Raw response to a question about how optimistic managers are about their firms' financial future (responses range from 0 to 100). Variable is decile-ranked within survey date and scaled between 0 and 1.
Optimism U.S.	Raw response to a question about how optimistic managers are about the future of the U.S. economy (responses range from 0 to 100). Variable is decile-ranked within survey date and scaled between 0 and 1.

Variables from Annual Compustat

Sales	Annual sales in millions of USD (item 12).
5-year Sales growth	Annualized 5-years sales (item 12) growth.
Book leverage	Total debt / total assets at book values = (long-term debt (item 9) + debt in current liabilities (item 34)) / total assets at book value (item 6). Missing items 9 and 34 due to insignificance (missing code .I) or inclusion in another item (missing code .C) were substituted with zeros.
Asset Market-to-book (M/B)	Total assets at market values / total assets at book values = (share price (item 199) * #shares (item 54) + debt in current liabilities (item 34) + long-term debt (item 9) + preferred-liquidation value (item 10) - deferred taxes and investment tax credit (item 35)) / total assets (item 6). Missing items 9 and 34 due to insignificance (missing code .I) or inclusion in another item (missing code .C) were substituted with zeros. Missing items 10 and 35 were substituted with zeros.
LT debt / Total debt	Portion of long-term debt (item 9) out of total debt (item 9 + item 34).
Profitability	Operating profit (item 13) / lag(total assets (item 6)).
Collateral	Tangible assets / total assets at book values = (plant property & equipment (item 8) + inventory (item 3)) / total assets (item 6).
Dividends	Sign(declared dividends (item 21)).
Repurchases	Sign(purchase of common and preferred stock (item 115)). Restricted to quarterly repurchases greater than 1% of equity.
Capital expenditures (capex) intensity	Net investments / lag(total assets at book values) = (capital expenditures (item 128) + increase in investments (item 113) + acquisitions (item 129) - sales of property, plant and equipment (item 107) - sale of investments (item 109)) / lag(total assets (item 6)). Missing items 128, 113, 129, 107, and 109 due to insignificance (missing code .I) or inclusion in another item (missing code .C) were substituted with zeros.
Acquisitions intensity	Acquisitions (item 129) / lag(total assets (item 6)). Missing items 129 due to insignificance (footnote .I) were substituted with zeros.

Variables from CRSP

Age	Firm age in years. Calculated as years elapsed since first appearance on CRSP.
12-month cumulative returns	Cumulative value-weighted monthly returns over 12 months. Applied to market, industry and firm returns.
Beta (β_{MKT})	For each firm-quarter, a sub-sample of past 60 months (minimum 20 months) was formed. Then, beta (β_{MKT}) was assigned with the coefficient of a regression of stock returns on the market portfolio in each sub-sample.
R^2 (R^2_{MKT})	For each firm-quarter, a sub-sample of past 60 months (minimum 20 months) was formed. Then, R^2 (R^2_{MKT}) is calculated for a regression of stock returns on the market portfolio in each sub-sample.

Variables from Quarterly Compustat

Repurchases$_q$ / Total assets$_{q-1}$	Quarterly repurchases scaled by lagged total assets: (item 93) / lag(item 44).
SEOs$_q$ / Total assets$_{q-1}$	Quarterly seasoned equity offerings scaled by lagged total assets: (item 84) / lag(item 44).

Variables from Execucomp

Bonus fraction	Average across the firm's executives of: bonus (BONUS) / (Salary (SALARY) + bonus (BONUS)).
log(Total compensation)	Average across the firm's executives of total compensation (TDC1): Salary, Bonus, Other Annual, Total Value of Restricted Stock Granted, Total Value of Stock Options Granted (using Black-Scholes), Long-Term Incentive Payouts, and All Other Total.

Variables from The Chicago Board Options Exchange

Volatility Index (VIX)	An index for the implied volatility on 30-day options. The index is constructed by the Chicago Board Options Exchange (CBOE) from a wide range of wide range of S&P 500 (S&P 100 until August 2003) index options (both calls and puts). The index reflects the anticipated volatility in the next 30 days. See `http://www.cboe.com/micro/vix/vixwhite.pdf` for further details.

Variables from Thomson SDC Platinum

Merger announcement excess returns (-1,1)	Market-adjusted returns of acquirers for the day preceding merger announcement through the day following the announcement.

Table I
Summary Statistics

The table presents descriptive statistics of the sample firms. Panel A presents summary statistics for the variables used in the study. Panel A B presents an industry and size breakdown according to CFOs' own reporting. Panel C compares the distribution of key attributes of the sample firms to those of firm from the Compustat universe from 2001 to 2006. The columns represent Compustat quintiles, and the numbers report the percentage sample observations that fall within each quintile. Panel D presents a correlation table (sample is restricted to identified firms), where bold figures represent significance level of 10%. Variable definitions are provided in the Appendix.

Panel A: Summary Statistics

Survey Variables (Full Sample)	Obs	Mean	Std Dev	Min	Median	Max
Raw forecasts ST (%)	6505	6.34	3.84	-15.00	6.00	25.00
Individual volatility ST (%)	6505	4.91	3.58	0.38	3.77	26.42
Confidence interval ST (%)	6505	13.08	9.84	0.09	10.00	100.00
Optimism ST	6505	0.50	0.31	0.00	0.56	1.00
Overconfidence ST	6505	0.50	0.31	0.00	0.56	1.00
Raw forecasts LT (%)	5895	7.67	2.76	1.00	8.00	40.00
Individual volatility LT (%)	5895	3.33	2.11	0.38	3.02	19.25
Confidence interval LT (%)	5895	8.99	6.93	0.04	8.00	120.00
Optimism LT	5895	0.50	0.32	0.00	0.56	1.00
Overconfidence LT	5895	0.50	0.32	0.00	0.56	1.00
abs(forecast error ST) (%)	4252	7.99	8.49	0.00	5.64	66.00
S&P 500 realization within confidence interval	4252	0.46	0.50	0.00	0.00	1.00
Optimism firm	4997	0.51	0.32	0.00	0.56	1.00
Optimism U.S.	5039	0.51	0.31	0.00	0.56	1.00
Firm Characteristics (for sample firms that can be linked to Compustat)						
Profitability	1072	0.14	0.12	-1.93	0.13	0.71
log(Sales)	1074	7.60	1.93	0.49	7.60	10.93
Asset Market-to-Book	1074	1.47	0.98	0.16	1.17	13.97
Collateral	1074	0.38	0.22	0.01	0.38	0.94
5yr Sales growth	1036	0.09	0.17	-0.32	0.07	1.46
Book leverage	1073	0.21	0.17	0.00	0.21	1.17
LT debt / Total debt	995	0.76	0.28	0.00	0.88	1.00
Dividends	1074	0.58	0.49	0.00	1.00	1.00
Repurchases	1074	0.40	0.49	0.00	0.00	1.00
Capex intensity	1073	0.08	0.11	-0.24	0.05	1.23
Acquisitions intensity	1024	0.04	0.09	-0.02	0.00	1.00
Repurchases_q / $\text{Total assets}_{q-1}$	1010	0.02	0.04	0.00	0.00	0.33
SEOs_q / $\text{Total assets}_{q-1}$	1010	0.02	0.07	0.00	0.00	1.39
Firm Characteristics (for sample firms that can be linked to CRSP)						
Age (years)	1074	32.52	22.18	3.25	26.25	81.08
Firm 12-month past returns	1073	0.18	0.50	-0.91	0.13	5.23
Beta (β_{MKT})	1061	1.12	0.87	-0.48	0.93	4.49
Executive Compensation (for sample firms that can be linked to Execucomp)						
Bonus / (Salary + Bonus)	574	0.42	0.20	0.00	0.45	0.87
log(Salary + Bonus)	574	6.85	0.68	5.07	6.84	8.81
Thomson SDC Platinum (for sample firms that can be linked to Thomson)						
Merger announcement excess returns	377	0.01	0.05	-0.14	0.00	0.29

Table I: **Summary Statistics (Cont.)**

Panel B: Distribution of Responses by Industry and Size

Industry	Full Sample	Identified Sample	Revenues	Full Sample	Identified Sample
Retail / Wholesale	774	203	Less than $24m	867	69
Mining / Construction	229	44	$25 - 99m	1,350	130
Manufacturing	1,807	487	$100 - 499m	1,822	343
Transportation / Energy	363	150	$500 - 999m	630	270
Communications / Media	298	87	$1 - 4.999bn	983	510
Tech (Software / Biotech)	457	154	More than $5bn	550	395
Banking / Finance / Insurance	934	386			
Service / Consulting	566	123			
Healthcare / Pharmaceutical	254	79			
Other	725	164			
Total	6,407	1,877	Total	6,202	1,717

Panel C: Distribution of firms across Compustat quintiles

	Compustat quintiles				
Variable	Q1	Q2	Q3	Q4	Q5
Age (years)	5.9	9.5	16.4	18.0	50.2
Sales	0.5	2.9	13.0	21.3	62.2
Asset Market-to-Book	12.5	29.5	24.3	23.9	9.9
Profitability	1.4	12.8	28.2	33.2	24.4
5-year Sales growth	7.5	28.0	33.0	21.8	9.7
Collateral	10.5	22.6	25.6	25.4	15.9
Book leverage	11.0	21.0	30.3	29.9	7.8
LT debt / Total debt	10.9	18.5	24.2	26.8	19.7
Operating leverage	8.5	17.7	26.1	27.2	20.6
Capex intensity	5.4	12.3	21.2	37.1	24.1
Acquisitions intensity	33.5	12.6	0.0	0.0	54.0

Panel D: Correlation Table

	OC ST	OC LT	Opt ST	Opt LT	Profit	log(sales)	Asset M/B	Coll	Sales growth	Lev	Opt Divs	Opt Firm
Overconfidence LT	0.03											
Optimism ST	**0.15**	**0.17**										
Optimism LT	-0.01	**0.30**	0.02									
Profitability	**-0.05**	0.00	**0.10**	**0.05**								
log(sales)	0.00	0.02	0.01	0.02	**0.30**							
Asset M/B	-0.01	0.04	0.00	-0.02	**0.19**	**-0.06**						
Collateral	**-0.06**	-0.02	**0.06**	**0.07**	**0.13**	**0.10**	**-0.23**					
5-year Sales growth	**0.07**	-0.03	-0.03	-0.02	**-0.08**	**-0.09**	**0.15**	-0.03				
Book leverage	0.07	0.03	0.04	0.04	**-0.09**	**0.20**	**-0.35**	**0.32**	0.00			
Dividends	**-0.05**	**-0.07**	0.03	-0.01	**0.20**	**0.50**	-0.01	**0.19**	**-0.17**	**0.09**		
Optimism Firm	0.03	0.01	**0.07**	0.02	0.05	-0.01	**0.15**	-0.02	**0.07**	**-0.07**	0.04	
Optimism U.S.	**0.13**	**0.05**	**0.27**	**0.05**	**0.08**	0.04	**0.06**	0.00	-0.01	-0.04	**0.08**	**0.07**

Table II: **S&P 500 Return Forecasts and Confidence Intervals by Survey Date**

The table presents summary statistics by survey date. *Avg lower bound (%)* is average CFO 10^{th} percentile for one-year (column (1)) or ten-year (column (6)) S&P 500 return. *Avg one-year S&P 500 expected return (%)* is average CFO forecasts for one-year (column (2)) or ten-year (column (7)) S&P 500 return. *Avg upper bound (%)* is average CFO 90^{th} percentile for one-year (column (3)) or ten-year (column (8)) S&P 500 return. *One-year (Ten-year) Individual volatility(%)* is the individual volatility measure imputed from respondents' confidence interval for the one-year (ten-year) S&P 500 forecasts. *One-year (Ten-year) Disagreement volatility (%)* is the standard deviation of point estimates for the one-year (ten-year) S&P 500 forecasts across respondents. *Realized one-year S&P 500 return (%)* is realized one-year S&P 500 return following the survey date. *Realized volatility* is the annual volatility of the S&P 500 one year from the survey date measured with daily returns. *VIX* is the Chicago Board of Options Exchange (CBOE) volatility index, that reflects the average of imputed volatility across traded options on the S&P 500 (S&P 100 before August 2003) futures index.

	One-year forecasts						Ten-year forecasts						Market data		
Survey date	Obs	Avg lower bound (%) (1)	Avg expected return (%) (2)	Avg upper bound (%) (3)	Avg individual volatility (%) (4)	Dis-agreement volatility (%) (5)	Obs	Avg lower bound (%) (6)	Avg expected return (%) (7)	Avg upper bound (%) (8)	Avg individual volatility (%) (9)	Dis-agreement volatility (%) (10)	Realized one-year returns (%) (11)	Realized volatility (%) (12)	VIX (%) (13)
13 Mar 2001	138	n/a	5.3	n/a	n/a	6.7	141	n/a	9.4	n/a	n/a	3.0	-3.6	20.4	27.6
11 Jun 2001	146	-2.7	6.0	13.6	6.1	3.8	145	n/a	9.2	n/a	n/a	2.4	-19.2	18.8	24.0
10 Sep 2001	136	-5.0	4.6	12.9	6.8	5.9	136	n/a	9.1	n/a	n/a	2.6	-16.7	24.1	31.8
3 Dec 2001	188	-4.3	6.9	14.8	7.2	5.3	188	n/a	8.8	n/a	n/a	2.5	-18.5	25.9	25.8
12 Mar 2002	173	-0.4	7.4	12.6	4.9	3.6	173	3.7	8.4	12.7	3.3	2.4	-31.0	26.5	19.6
4 Jun 2002	315	-3.3	5.1	10.6	5.2	3.6	308	3.0	8.2	12.2	3.5	2.6	-5.2	27.1	23.9
17 Sep 2002	351	-4.2	5.0	10.9	5.7	4.2	344	3.2	8.0	12.1	3.4	2.4	17.5	21.8	38.0
3 Dec 2002	276	-2.0	6.8	12.5	5.5	4.0	271	3.4	7.9	11.9	3.2	2.7	15.6	17.6	28.3
17 Mar 2003	182	-6.9	4.6	11.3	6.9	4.3	178	2.0	7.4	11.5	3.6	2.3	28.7	14.5	31.8
12 Jun 2003	350	-1.6	7.9	14.4	6.1	4.9	344	1.9	7.6	12.2	3.9	2.6	13.8	12.5	20.4
15 Sep 2003	151	1.1	7.7	12.6	4.3	3.8	147	3.3	7.4	10.6	2.8	1.9	11.2	11.6	19.3
4 Dec 2003	216	1.1	9.2	15.0	5.2	3.8	212	3.4	8.2	12.1	3.3	2.3	11.4	11.2	16.3
18 Mar 2004	202	-0.9	7.4	13.7	5.5	4.4	198	2.9	7.8	11.8	3.3	2.1	6.0	10.8	18.5
9 Jun 2004	175	-0.4	7.1	12.3	4.8	3.6	172	3.1	8.0	11.5	3.1	2.8	6.2	10.7	15.8
8 Sep 2004	180	-0.6	6.7	12.0	4.7	3.8	174	2.7	7.6	11.1	3.2	2.9	10.3	10.2	14.1
1 Dec 2004	284	-0.2	6.6	11.4	4.4	3.1	281	3.2	7.6	11.1	3.0	2.6	6.2	10.4	13.0
22 Feb 2005	271	-0.6	6.2	11.1	4.4	3.2	269	3.2	7.5	11.3	3.1	2.7	9.2	10.4	13.1
24 May 2005	308	-0.9	5.3	9.9	4.1	2.6	299	2.6	7.3	11.3	3.3	3.3	5.4	9.5	12.7
28 Aug 2005	315	-0.7	5.6	10.2	4.1	3.0	309	2.3	7.2	10.9	3.2	2.2	8.0	10.8	13.7
15 Nov 2005	337	-0.8	5.5	10.2	4.2	3.0	329	2.3	6.9	11.0	3.3	2.1	13.6	10.0	12.2
23 Feb 2006	264	-0.6	6.4	11.4	4.5	3.2	258	2.1	7.2	11.1	3.4	2.3	12.7	9.6	11.9
23 May 2006	477	-0.1	6.2	10.8	4.1	3.3	470	3.1	7.7	11.8	3.3	2.5			18.3
29 Aug 2006	453	-0.9	5.7	10.2	4.2	3.2	436	2.6	7.7	11.7	3.4	4.0			12.3
21 Nov 2006	383	-0.1	6.7	11.8	4.5	3.2	374	2.9	7.9	12.1	3.5	3.4			9.9
1 Mar 2007	372	0.4	7.0	11.8	4.3	3.4	363	2.8	7.8	11.7	3.4	2.7			15.8
Average	266	-1.4	6.4	12.0	5.1	3.9	261	2.8	7.9	11.6	3.3	2.6	3.9	15.4	19.5

Table III
One-Year S&P 500 Return Forecasts vs. Realizations by Survey Date

The table compares survey forecasts with S&P 500 realizations by survey date. *Average forecast error (%)* is defined as *Average one-year S&P 500 expected return (%)* minus *Realized one-year S&P 500 return (%)* (see definitions in Table II). *S&P 500 realizations: % below 10^{th} percentile* is the percentage of respondents for whom the realized one-year S&P 500 return is below their 10^{th} percentile predictions. *S&P 500 realizations: % between 10^{th} and 90^{th} percentiles* is the percentage of respondents for whom the realized one-year S&P 500 return is between their 10^{th} percentile and 90^{th} percentile predictions. *S&P 500 realizations: % above 90^{th} percentile* is the percentage of respondents for whom the realized one-year S&P 500 return is above their 90^{th} percentile predictions.

		S&P 500 realizations...		
	Average forecast error (%)	% below 10^{th} percentile	% between 10^{th} and 90^{th} percentiles	% above 90^{th} percentile
Survey date	(1)	(2)	(3)	(4)
13 Mar 2001	9.0	n/a	n/a	n/a
11 Jun 2001	25.2	96.6	3.4	0.0
10 Sep 2001	21.2	89.0	11.0	0.0
3 Dec 2001	25.2	91.0	9.0	0.0
12 Mar 2002	38.2	100.0	0.0	0.0
4 Jun 2002	10.3	73.0	27.0	0.0
17 Sep 2002	-12.5	0.0	14.0	86.0
3 Dec 2002	-8.8	0.0	19.9	80.1
17 Mar 2003	-24.1	0.0	2.7	97.3
12 Jun 2003	-4.8	0.0	50.3	49.7
15 Sep 2003	-3.5	0.0	53.6	46.4
4 Dec 2003	-2.2	0.0	68.5	31.5
18 Mar 2004	1.5	11.9	83.2	5.0
9 Jun 2004	1.0	5.1	86.9	8.0
8 Sep 2004	-3.7	0.0	47.2	52.8
1 Dec 2004	0.4	4.9	78.9	16.2
22 Feb 2005	-2.9	0.0	61.3	38.7
24 May 2005	-0.1	3.9	82.5	13.6
28 Aug 2005	-1.8	0.0	56.5	43.5
15 Nov 2005	-8.1	0.0	19.9	80.1
23 Feb 2006	-6.3	0.0	31.8	68.2
Average	2.5	23.8	40.4	35.9

Table IV
Determinants of Forecasts and Individual Volatilities

The table explores the determinants of CFO forecasts of the one-year ahead S&P 500 return and individual volatilities. Panel A presents regressions of lower bounds, expected returns, upper bounds and individual volatilities on future S&P 500 returns and past returns, where standard errors (in parentheses) in are adjusted for autocorrelation using the Newey and West (1987) procedure with 7 lags. Observation units in Panel A are means of survey responses within a given quarter. Panel B presents results from Fama and MacBeth (1973) regressions, where standard errors (in parentheses) are adjusted for autocorrelation using the Newey and West (1987) procedure with three lags. In Panel B, the independent variables are past firm returns. In both panels, dependent variables are expressed as decimals (not percentage points). Variable definitions are provided in the Appendix. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively.

Panel A: Regressions of mean forecasts on S&P 500 returns

	One-year forecasts (%)			
	Lower bound	Expected return	Upper bound	Individual volatility
	(1)	(2)	(3)	(4)
12-months future S&P return	-1.18	-1.12	-3.31	-0.80
	(0.95)	(1.09)	(1.94)	(0.99)
12-months past S&P return	11.30***	4.64***	0.88	-3.93***
	(1.37)	(1.06)	(2.04)	(1.04)
Intercept	-1.57***	6.43***	12.24***	5.21***
	(0.13)	(0.31)	(0.49)	(0.20)
Observations	20	21	20	20
R^2	0.76	0.40	0.11	0.48

Panel B: Regressions of forecasts on own-firm returns (Fama-MacBeth)

	One-year forecasts (%)			
	Lower bound	Expected return	Upper bound	Individual volatility
	(1)	(2)	(3)	(4)
12-months past firm return	0.59**	0.39***	0.17	-0.13
	(0.22)	(0.12)	(0.33)	(0.12)
Intercept	-1.92**	6.24***	11.89***	5.21***
	(0.70)	(0.21)	(0.34)	(0.33)
Average number of observations	79	82	80	79
Number of regressions	22	22	22	22
Average R^2	0.01	0.01	0.03	0.02

Table V
Skill and Overconfidence

The table explores the relation between CFO overconfidence and skill. Column (1) presents the results of a regression of absolute forecast errors (in percentage) on overconfidence measures (Fama-Macbeth regression). Column (2) presents the results of a regression where the dependent variable is an indicator variable that receives the value 1 if S&P 500 realization is within the 10^{th} and 90^{th} percentiles provided by CFOs, and 0 otherwise (Fama-Macbeth regression). Standard errors are adjusted for autocorrelation of three lags using the Newey and West (1987) procedure. Variable definitions are provided in the Appendix. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. All regressions have intercepts that are not presented.

	abs(forecast error) (%)	Realization within 10^{th} and 90^{th} and percentiles (0/1) $\times 100$
	(1)	(2)
Overconfidence ST	-0.65***	-52.67***
	(0.18)	(3.98)
Overconfidence LT	-0.63***	-5.01**
	(0.21)	(1.93)
abs(forecast error) (%)		-6.21***
		(0.73)
Average number of observations	247	252
Number of regressions	17	16
Average R^2	0.02	0.35

Table VI: Overconfidence and Corporate Policies

The table presents results from regressing CFO overconfidence on capital structure, payout policy, and compensation variables. The dependent variables are capex intensity (%) (column (1)), acquisitions intensity (%) (column (2)), 3-day merger announcement excess (market-adjusted) returns (-1, 1) (column (3)), book leverage (column (4)), $\frac{LT\ debt}{Total\ debt}$ (%) (column (5)), dividend payer dummy (column (6)), quarterly repurchases scaled by lagged total assets $\frac{Repurchases_q}{Total\ assets_{q-1}}$ (%) (column (7)), quarterly equity issuances (SEOs) scaled by lagged total assets $\frac{SEOs_q}{Total\ assets_{q-1}}$ (%) (column (8)), $\frac{Bonus}{Bonus+Salary}$ (%) (column (9)). All regressions are OLS regressions apart from column (6) which is a probit regression (marginal effects for the average firm are reported). Independent variables include *Overconfidence ST*, *Overconfidence LT*, *Optimism ST*, *Optimism LT*, *Optimism firm*, *Optimism U.S.*, interactions of overconfidence variables with past returns, controls, and fixed effects. Control variables include book leverage (except for in column (4)), collateral, log(sales), asset M/B, profitability, dividends indicator (except for in column (6)), 5-year sales growth, and 12-month past returns. Fixed effects include industry fixed effects (SIC2) and survey date fixed effects. The regression reported in column (6) includes a control for repurchases (dummy). Utilities and financial firms are excluded from the sample. Accounting data are from Compustat. Mergers data are from Thomson SDC Platinum. Returns data are from CRSP. Variable definitions are provided in the Appendix. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. Standard errors are clustered at the 2-digit SIC level.

	Capex intensity (%)	Acquisitions intensity (%)	Merger announcement excess returns (-1, 1) (%)	Book leverage (%)	$\frac{LT\ debt_q}{Total\ debt_{q-1}}$ (%)	Dividends 0/1	$\frac{Repurchases_q}{Total\ Assets_{q-1}}$ (%)	$\frac{SEOs_q}{Total\ Assets_{q-1}}$ (%)	Bonus fraction (%)
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) probit	(7) OLS	(8) OLS	(9) OLS
Overconfidence ST	-1.34	-1.68	-0.19	2.91*	8.44*	-0.03	-0.60	-0.03	5.69*
	(1.11)	(1.15)	(0.98)	(1.65)	(4.61)	(0.09)	(0.55)	(0.66)	(2.98)
Overconfidence LT	3.30***	2.03**	-2.43**	0.98	7.40**	-0.25**	-0.38	0.04	0.94
	(1.19)	(1.00)	(1.08)	(1.64)	(3.08)	(0.10)	(0.36)	(0.59)	(2.66)
Optimism ST	-0.20	0.59	-0.77	1.32	-5.36*	0.05	-0.01	-0.34	-0.67
	(1.93)	(1.61)	(1.10)	(1.70)	(3.12)	(0.08)	(0.63)	(0.48)	(3.06)
Optimism LT	-0.29	-0.34	1.38	1.02	-1.78	0.03	-0.47	-0.15	1.75
	(1.23)	(1.04)	(1.11)	(1.58)	(2.98)	(0.08)	(0.52)	(0.33)	(3.18)
Optimism firm	0.09	-1.08	0.85	-0.99	2.81	0.09	0.25	-0.01	3.07
	(0.87)	(0.67)	(0.77)	(1.86)	(4.07)	(0.07)	(0.45)	(0.28)	(1.90)
Optimism U.S.	0.12	-0.63	-1.22	-1.00	3.21	0.13*	-0.25	-0.11	-1.32
	(1.41)	(1.38)	(1.25)	(1.83)	(3.46)	(0.08)	(0.42)	(0.39)	(4.01)
Overconfidence ST							-1.53**	-1.32	
× 12mth past ret							(0.63)	(2.01)	
Overconfidence LT							-0.56	-1.96**	
× 12mth past ret							(0.50)	(0.98)	
Observations	1033	988	373	1033	956	961	972	971	571
R^2 (Pseudo-R^2)	0.25	0.24	0.31	0.40	0.26	0.39	0.37	0.44	0.48

Table VII
Is the Effect of Overconfidence Stronger in High-Beta Firms?

The table tests how closely linked the overconfidence variables are with corporate policies in high beta firms. The dependent variables correspond to the dependent variables in the previous tables (capex intensity, acquisitions intensity, the fraction of long-term debt out of total debt, dividend indicator, and the fraction of bonus compensation out of bonus and salary compensation). Independent variables include *OC ST* (*Overconfidence ST*), *OC LT* (*Overconfidence LT*), *Optimism ST*, *Optimism LT*, *Optimism firm*, *Optimism U.S.*, market beta, interactions of market beta and overconfidence variables, controls, and fixed effects. Control variables include book leverage (except for in column (4)), collateral, log(sales), M/B, profitability, dividends indicator (except for in column (6)), 5-year sales growth, and 12-month past returns. Fixed effects include industry fixed effects (SIC2) and survey date fixed effects. Column (6) includes a control for repurchases (dummy). Utilities and financial firms are excluded from the sample. Detailed variable definitions are provided in the Appendix. All regressions are OLS regressions except for regression (4) which is a probit regression (marginal effects for the average firm are reported). *, **, *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. All regressions have intercepts that are not presented. Standard errors are clustered at the 2-digit SIC level.

	Capex intensity (%)	Acquisitions intensity (%)	Merger announcement excess returns (-1, 1) (%)	Book leverage (%)	$\frac{LT\ debt_q}{Tot\ Debt_{q-1}}$ (%)	Dividends 0/1	Bonus fraction (%)
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) probit	(7) OLS
OC ST $\times\beta_{MKT}$	-2.35**	-0.09	-0.04	-0.01	-3.44	0.18	-1.12
	(1.08)	(0.99)	(1.06)	(1.76)	(3.82)	(0.12)	(2.18)
OC LT $\times\beta_{MKT}$	1.20	0.85	-1.96**	0.51	7.09	-0.23**	5.64**
	(1.37)	(0.79)	(0.73)	(2.32)	(4.50)	(0.12)	(2.22)
Observations	1025	980	370	1025	950	953	568
R^2 (Pseudo-R^2)	0.26	0.25	0.33	0.41	0.27	0.52	0.50

Figure 1. Time-Series of CFO Miscalibration

Figure 1. The percentage of CFOs for whom S&P 500 realized returns fall in the 80% confidence interval, by survey quarter

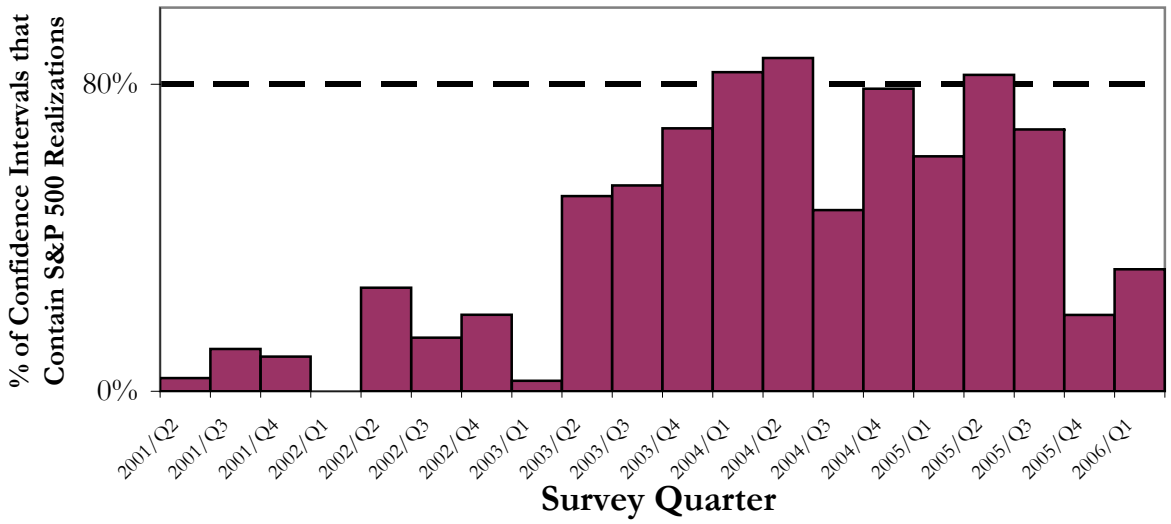

Figure 2. Distribution of One-Year S&P 500 Volatilities

Figure 2a. Historical distribution of S&P 500 one-year volatility (1950-2006)

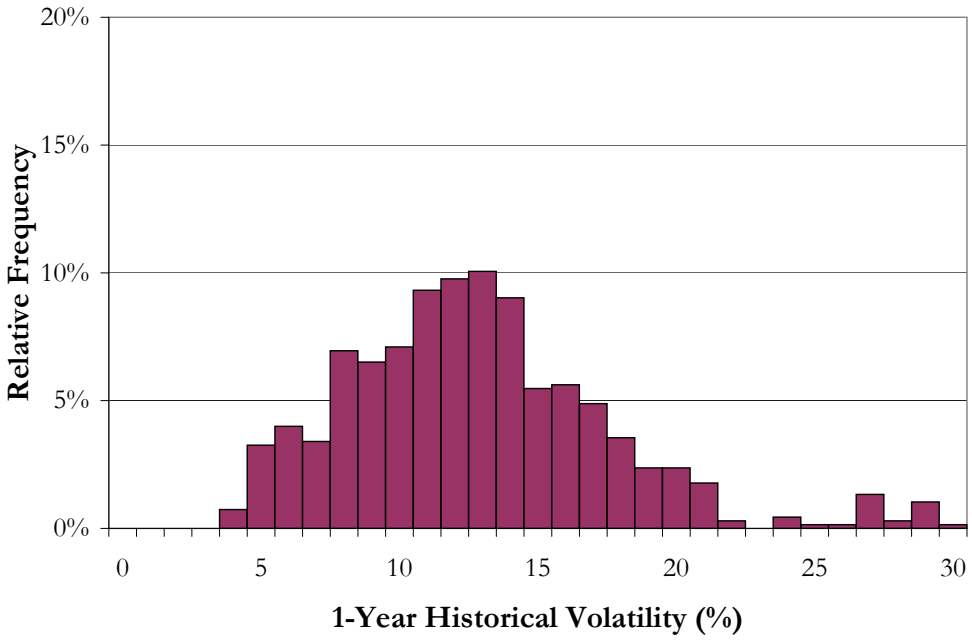

Figure 2b. One-year volatility imputed from survey confidence intervals

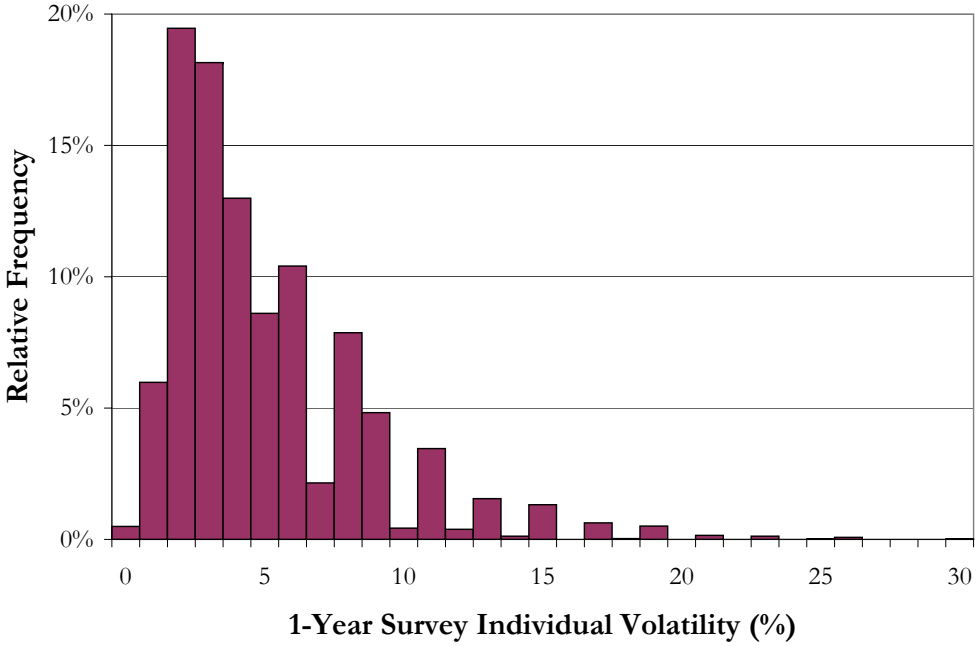

Figure 3. Distribution of Ten-Year S&P 500 Volatilities

Figure 3a. Historical distribution of S&P 500 ten-year volatility (1950-2006)

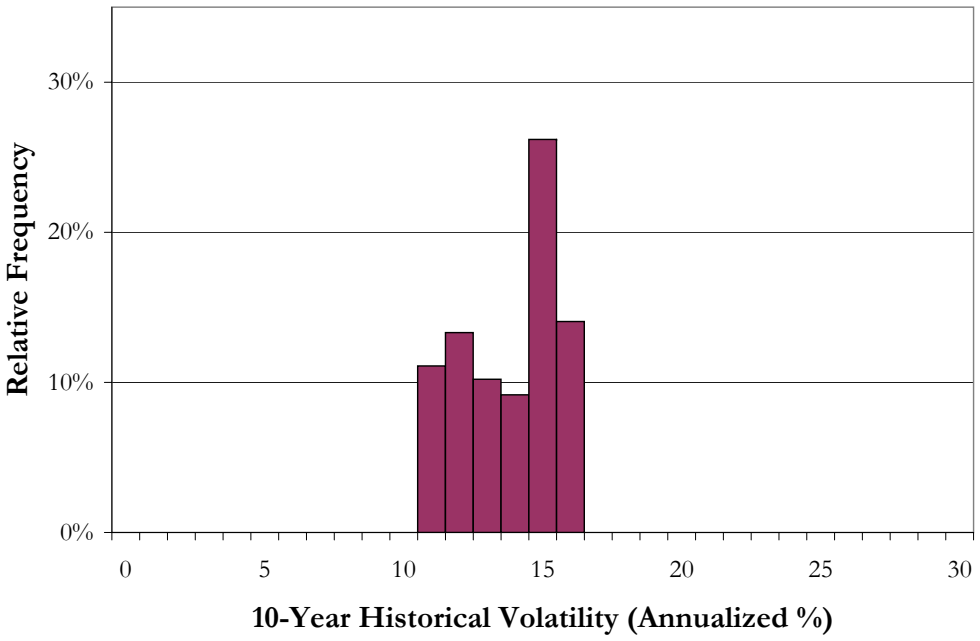

Figure 3b. Ten-year volatility imputed from survey confidence intervals

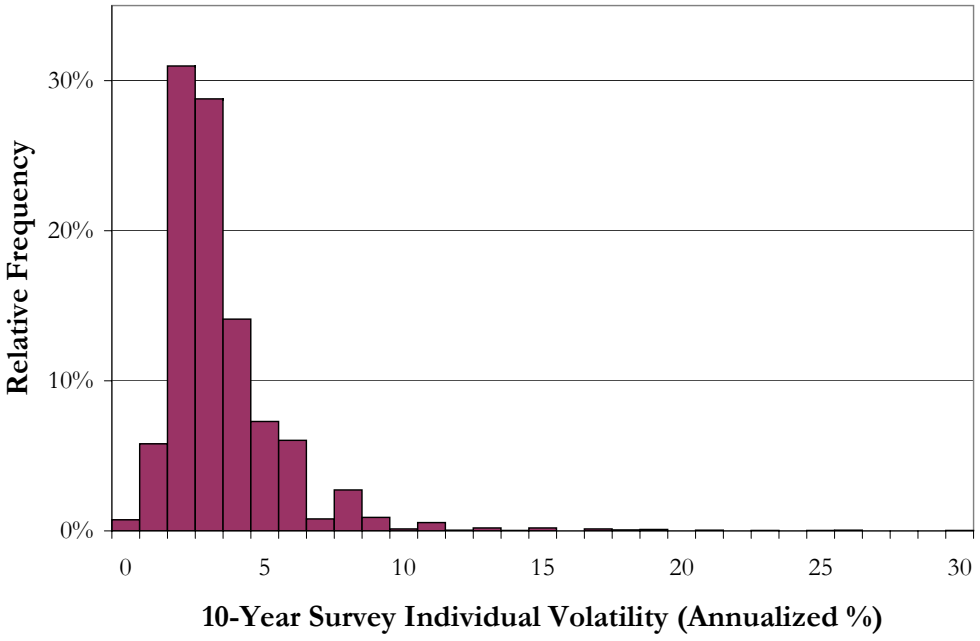

Figure 4. Expected Returns, Confidence Bounds and Realized Returns

Figure 4. Means of expected returns, 80% confidence bounds (means of lower and upper confidence bounds) and one-year ahead realized S&P 500 returns, by survey quarter