What to Expect when Expecting Returns: Testing the Rational Expectations Hypothesis*

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Abstract

I test the rational expectations hypothesis for stock market returns using two different samples (UBS/Gallup, CFO). Although rational expectations are conditionally rejected, unconditionally, I cannot reject equality between average investor expectations during the survey periods (2000-2003, 2004-2018) and average stock market returns over long samples (1928-2003, 1928-2018). I conclude that investors develop expectations that are equal to long-term averages of realized stock market returns. However, these expectations are almost constant and do not account for important conditional information (e.g., dividend yield). I further study the economic effects of constant expectations and the survival of noise traders using a heterogeneous agent model.

Keywords: rational expectations, unconditional average, investor biases, heterogeneous agents, noise traders

JEL classification: D14, D84, E21, E71, G11

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1 Introduction

The rational expectations hypothesis postulates that there are no systematic deviations between expectations of economic variables and realized outcomes. In other words, realized outcomes should be equal to expectations plus a white noise shock process. The rational expectations hypothesis is one of the most important assumptions in economics and finance. Going back to Prescott (1971), Lucas (1980), and Sargent (1982), the overwhelming majority of dynamic models in economics are built around this assumption.

This is also true for dynamics models in finance. For instance, rational expectations is an important building block both for consumption-based (Breeden (1979)) and production-based (Liu et al. (2009)) asset pricing. The rational expectations hypothesis is also a key assumption in corporate and household finance. For example, structural models of capital structure dating back to Modigliani and Miller (1963) or the more recent in Hennesy (2004) and Hennesy and Whited (2005) assume rational expectations. Similarly, rational expectations are a fundamental component of the life-cycle income model in Hall and Mishkin (1982) and the corresponding portfolio allocation models in Viceira (2001).

Despite the paramount importance of the rational expectations hypothesis in finance, there is a limited number of works that empirically examines the validity of this assumption. The main reason is data availability. Recently however, proprietary surveys of investor expectations have become publicly available to facilitate the empirical testing of this hypothesis. Another issue with the existing literature on rational expectations is that it usually provides interesting empirical results without further incorporating these findings in a structural model that would examine the economic effects of realistically plausible deviations from rational expectations.

To this end, this paper adds to the existing literature in several ways. First, given the universal importance of market expectations in finance, I focus on rational expectations tests of stock market returns. Stock market expectations are key drivers of both consumption and production Euler equations in structural models of asset pricing (e.g., Breeden (1979), Cochrane (1991)). Stock market expectations also determine firm-level required equity returns (e.g., Litner (1965)) and the weighted-average cost of capital in corporate finance (e.g., Hennesy (2004)). Finally, stock market expectations are crucial in portfolio allocation problems for household investors (e.g., Viceira (2001)).

Second, I examine the rational expectations hypothesis across two different samples. The first one, in which I conduct the baseline empirical analysis, is the UBS/Gallup Investor Optimism Survey. The second one, which I mainly use to verify the robustness of the baseline results, is John Graham's CFO Survey. Using multiple samples strengthens the validity of statistical results because these surveys tend to cover a relatively short time period of return expectation compared to the rich history of realized stock returns.

Third, I employ two types of methodologies in testing the rational expectations hypothesis. The majority of rational expectations tests going to back to Lovell (1986) are conducted by regressing realized outcomes, which in this paper are stock market returns, on expectations. In these tests, if the regression intercept is statistically equal to zero and the regression coefficient is one, then the rational expectations hypothesis cannot be rejected. My empirical analysis also follows this approach. I term these regression tests of rational expectations strong tests because they examine both equality-in-levels as well as positive comovement between realized and expected returns.

In addition to the strong regression tests, I use another set of tests that examines equality-in-means between realized and expected returns. As discussed in D'Haultfoeuille et al. (2021), testing equality-in-means between expectations and realized outcomes is a simple way to examine the rational expectations hypothesis. However, these equality-in-means tests do not examine the comovement between expectations and realized returns. Hence, I term these tests weak tests of rational expectations. Nevertheless, equality-in-means tests are quite flexible because they can compare return expectations to realized returns across different samples and time periods using standard two-sample t-statistics (e.g., Welch's t-test). This paper is one of the first attempts to use the more flexible equality-in-means tests to assess the validity of the rational expectations hypothesis for stock market returns across different time periods.

The use of different empirical methodologies, and in particular the use of the equality-in-means tests, allows for a rich set of conclusions. Similarly to existing results (e.g., Adam et al. (2018)), the regression tests of realized market returns on market expectations in the UBS/Gallup sample reject the rational expectation hypothesis. Specifically, the regression coefficients are negative implying that expectations and realized returns move to opposite directions. Further, regression intercepts are statistically significant which means that the levels of return expectations and realized returns diverge. Similar findings also hold for the

CFO sample. The equality-in-means tests further support the regression results. When I compare average expectations in the UBS/Gallup and CFO samples to the average realized returns in the corresponding periods, the rational expectations hypothesis is rejected. The differences between expectations and realized returns in these samples are economically meaningful and statistically significant.

A key contribution of this study is that the equality-in-means tests are able to compare return expectations to realized returns across different time periods. Specifically, these tests can compare average return expectations in the UBS/Gallup (2000 - 2003) and CFO surveys (2004 - 2018) to average realized stock market returns over the longer 1928 - 2003 and 1928 - 2018 periods. In this case, I find that the rational expectations hypothesis cannot be rejected since average realized returns calculated over long periods are equal to average expectations in the UBS/Gallup and CFO samples.

Taken together these results indicate that even though the rational expectation hypothesis is rejected in a conditional sense (regressions, equality-in-means in short samples), unconditionally, investor expectations are aligned with average realized returns estimated over long samples. This is one of the first papers to show that investors in both the UBS/Gallup surveys and the CFO sample form return expectations that are equal to the unconditional averages of realized stock market returns.

Another important contribution of this paper is that it further examines why the rational expectation hypothesis for stock market returns is rejected in the regression tests (strong tests). To this end, I conduct additional empirical analysis by regressing the error terms from the rational expectations regressions on a host of investor demographics (e.g., age, wealth, experience, education, optimism) and stock market predictors (e.g., past market returns, risk-free rate, dividend yield). In this analysis, I find that the regression tests of rational expectations fail because investors and CFOs do not condition their return expectations on the risk-free rate, and, most importantly, on the dividend yield. Thus, this paper is among the first to show that even though investor form expectations that are consistent with unconditional averages of realized stock returns, they do not take into account conditional information. Consequently, the rational expectations hypothesis fails because investor expectations are almost constant across time while expected returns are time-varying.

The final contribution of this paper is that it goes beyond the empirical investigation of the rational expectation hypothesis and proposes a model to study the economic implications of empirically plausible deviations from rational expectations. Specifically, motivated by the findings, I employ a heterogeneous agents model similar to De Long et al. (1990) to investigate the economic effects of constant return expectations. In the model, fundamentals, i.e., dividends and prices, are functions of a predictable state variable. Nevertheless, consistent with my empirical results, a fraction of investors, termed noise traders, ignores the predictability of the state variable and forms constant expectations for dividends and prices. These expectations are equal to unconditional averages. The rest of the population are rational investors, who fully recognize the predictability aspect of the economy.

In the model, I show that during extreme good or extreme bad scenarios, investors with constant expectations will perform worse than rational investors. Nevertheless, there are certain states of the world associated with moderate economic scenarios for which constant-expectations investors outperform rational ones. Over the long-run, however, investors with constant expectations lose money to rational investors. These findings can be explained by the fact that contrary to the model in Delong et al. (1990), where the expectations perturbation parameter is arbitrary, in this paper, expectations of noise traders reflect the empirical finding that investors tend to have constant expectations for stock market returns. Hence, unlike Delong et al. (1990), where noise traders can outperform rational investors and survive, when I calibrate the expectations perturbation parameter using empirically plausible deviations from rational expectations, noise traders with constant expectations are expected to lose money to rational investors and disappear.

Overall, the empirical findings and theoretical framework of this paper complement the existing literature on rational expectations. Lovell (1986) summarizes a wealth of regression tests rejecting the rational expectations hypothesis from the corporate perspective of earnings and sales forecasts. Vissing-Jorgensen (2003) uses the UBS/Gallup poll to study how return expectations are affected by age, wealth, experience and other demographics. Nevertheless, Vissing-Jorgensen does not conduct formal tests of the rational expectations hypothesis.

Greenwood and Shleifer (2014), on the other hand, attempt direct tests of the rational expectations using the UBS/Gallup and CFO surveys. Their UBS/Gallup data do not include the direct expectations measures that are included here. Instead, they rely on a coarse sample of percentage of investors that are optimistic about stock market returns. Even though they do not formalize their findings thought the lens of a structural model, they also find evidence against the rational expectations hypothesis. However, they do not distinguish between conditional and unconditional tests, as they mostly rely on regression tests for their empirical analysis. Hence, they are unable to detect whether investor expectations are aligned with long-term averages of realized returns across different time periods.

Adam et al. (2018) study whether survey expectations reflect risk-neutral, i.e., risk-adjusted, returns and find evidence against this claim (Cochrane (2011)). Even though their main goal is not to directly test rational expectations, Adam et al. are among the first distinguish between conditional and unconditional tests of rational expectations in the UBS/Gallup and CFO surveys. However, similar to Greenwood and Shleifer (2014), Adam et al. rely mostly on regression tests, and ignore the more flexible equality-in-means tests that can detect equality between expectations and realized returns across different samples.

The rest of the paper is organized as follows. Section 2 discusses the UBS/Gallup sample and key variables. Section 3 introduces the different tests of the rational expectations hypothesis. Section 4 reports the results for the UBS/Gallup sample and Section 5 reports the findings for the CFO survey. Section 6 discusses the heterogeneous agents model and Section 7 concludes.

2 Data Sample and Key Variables

This section describes the UBS/Gallup Survey and the key variables in the empirical analysis.

2.1 UBS/Gallup Sample

The data used in this study comes from the UBS/Gallup Investor Optimism Survey.[1] The survey is conducted by the Gallup organization, and it encompasses a national cross-section of households with total savings or investments in stocks, bonds, and mutual funds of $10,000 or more. Based on the 1998 Survey of Consumer Finances, households with $10,000 or more in financial assets owned more than 99% of all household financial wealth in the U.S. (Vissing-Jorgensen (2003)). The data collection is done via telephone interviews usually conducted during the first two weeks of each month. There are approximately 1,000 interviewees each month, who are at least 18 years old. The polls start in October 1996 and were conducted

[1] I would like to thank the Roper Center at Cornell University for making the data accessible.

until October 2007. For the first few years, the polls were conducted sporadically. Monthly coverage started in February 1999.

Although the survey is not a panel, cohort analysis is possible due to the large number of investors interviewed each month. However, as shown in Adam et al. (2018), only the survey waves between 1999 and 2003 include questions regarding expected stock market returns, which is the key variable in my empirical analysis. Further, the 1999 waves report only the absolute magnitude of next twelve months expected stock market and portfolio returns. To the contrary, the 2000 to 2003 survey waves report both the absolute magnitude and the signed returns.[2] In total, my sample consists of 40 consecutive monthly waves of the UBS/Gallup poll from January 2000 to April 2003 with non-missing observations for past realized and future expected portfolio and stock market returns. The sample ends in April 2003 because this is the last month with data on expectations of stock market returns.

2.2 Key Variables

The empirical analysis relies on two sets of variables. The first one includes stock market performance and stock market predictors. Specifically, the UBS/Gallup poll asks respondents "What overall rate of return do you think the stock market will provide investors during the coming twelve months?" Using the answers to this question, I construct a measure of investor's expectations for market returns after deleting observations less than -100% and above 300%.

Further, I merge expected stock market performance with S&P500 returns from the CRSP S&P500 Index files. I measure the return of the stock market with the ex-dividend return of the S&P500 given the salience of this return. Since the return-related questions in the UBS/Gallup poll do not specify cum- or ex-dividend returns, I opt for the latter given the prevalence of this return in the media and in financial reports. The set of stock market variables also includes a number of return predictors. These are the risk-free rate, which is the one-month treasury yield bill from Kenneth French's database, the S&P500 dividend yield from CRSP, and the term premium, which is the difference in the rates of a one- and

[2] For instance, next twelve months expected stock market return in the 1999 and 2000 surveys are reported in question 16. However, only the 2000 survey waves provide signed returns (question 16n). Table A.1 in the Appendix reports summary statistics of expected stock market and portfolio returns by survey year to show that the return data of the 1999 surveys is not reliable.

ten-year Treasury bond from the Federal Reserve, H15 report (WRDS).

The second set of variables in my empirical analysis includes investor demographics, portfolio performance, and investor optimism regarding economic outcomes. The demographic variables consist of investor age, experience, education (high-school graduate or less, some college or vocation school, college graduate, post-graduate), gender, race, income, and an indicator for asset holdings ($> \$100,000$).[3] I delete observations with missing demographics, individuals whose age is greater than 85, and individuals whose difference between age and investment experience is less than 17 years.

The UBS/Gallup survey also asks respondents "What was the overall percentage rate of return you got on your portfolio in the past twelve months?" Using this information, I calculate investor's past portfolio performance after deleting observations less than -100% and above 300%. Similarly, the UBS/Gallup poll asks "What overall rate of return do you expect to get on your portfolio in the next twelve months?" I use this question to construct a measure of expected portfolio returns. Finally, the poll asks investor to respond with an optimism score (1 through 5) regarding their investment targets next year, their investment goals over the next five years, their income, economic growth, unemployment, stock market, and inflation. I use the above demographic, portfolio, and optimism variables as controls in tests of rational expectations.

Summary statistics for the key variables are reported in Table 1. Panel A reports statistics for the full UBS/Gallup sample and Panel B reports statistics for the time series version of the UBS/Gallup sample. In the time series sample, I average expected returns across individuals for each survey wave to construct a time series of average expected stock market returns. The statistics in Panel A are consistent with those reported in Adam et al. (2018) and Bernile et al. (2023). The average investor in the UBS/Gallup sample is 48 years old, has 15 years of experience in the stock market, tends to be a college graduate, white, male with an income of $100,000.

According to the results in Panel B, the time period (2000 - 2003) for which the UBS/Gallup

[3] The survey classifies respondents in income bins of $10,000 (e.g., $20,000 - $30,000) starting from "under to $20,000" to "$100,000 or over." For those respondents with income greater of $100,000, I assign a value of $150,000. The survey also asks whether investors have assets above or below $100,000. Based on this question, respondents are further asked to provide a more refined classification of their assets (e.g., $100,000 - $200,000, $200,000 - $500,000, etc.). However, the more refined asset classification is only available after 1999 with a large number of missing observations. Hence, I use the coarser asset classification with a single cutoff value ($100,000).

poll reported expected portfolio and market returns is not a typical period in the stock market, which is characterized by low realized past and future expected returns. This is because the expectations sample in the UBS/Gallup surveys coincide with the Dotcom crash. Given that the 2000 - 2003 period may not be representative for stock market returns, I verify the robustness of the findings in the UBS/Gallup sample using a completely different dataset from John Graham's CFO survey. The CFO survey spans the period from 2004 to 2018.

3 Testing the Rational Expectation Hypothesis

In this section, I briefly describe the empirical methodology used to test the rational expectations hypothesis. The existing literature has proposed several tests of the rational expectations hypothesis (e.g., Lovell (1986), D'Haultfoeuille et al. (2018)). I consider two types of tests, which I term the strong and weak tests.

3.1 Strong Tests of Rational Expectations

As discussed in D'Haultfoeuille et al. (2018), a direct test of the rational expectations hypothesis can be formulated using the conditional expectations operator

$$E\big[R_{m,t,t+12}|E_{k,t}[R_{m,t,t+12}]\big] = E_{k,t}[R_{m,t,t+12}]. \tag{1}$$

Above $R_{m,t,t+12}$ is the realized stock market return for the next twelve months and $E_{k,t}[R_{m,t,t+12}]$ is the expected return of the stock market over the same period conditional on all the available information at time t. Similar to equation (1), Mills (1957) and Lovell (1986) test the rational expectations hypothesis with the regression

$$R_{m,t,t+12} = a + bE_{k,t}[R_{m,t,t+12}] + \epsilon_{k,t}. \tag{2}$$

Under the rational expectation hypothesis, we would expect a to be zero and b to be one. Additionally, we would expect the R^2 of the above regression to be relatively large. The rational expectations test in equation (2) is termed strong because it tests both equality in levels ($a = 0$) between realized and expected returns as well as strong positive comovement ($b = 1$) that would explain a significant part of the variation in realized returns ($\mathrm{R}^2 > 0$).

If the rational expectations hypothesis is violated in the above regression, we can continue with a second-stage regression where we would regress the error term $\epsilon_{k,t}$ from equation (2) on a set of valid covariates $\boldsymbol{X}_t$ for $R_{m,t,t+1}$

$$\epsilon_{k,t} = c + \boldsymbol{d'}\boldsymbol{X}_t + e_{k,t}. \tag{3}$$

Statistical tests on the vector of regression coefficients $\boldsymbol{d}$ would identify which of these covariates are ignored by individuals when forming expectations about stock returns in the first regression (equation (2)). In a similar approach, Adam et al. (2018) combine regressions (2) and (3) into a single specification

$$R_{m,t,t+12} - E_{k,t}[R_{m,t,t+12}] = \tilde{c} + \tilde{\boldsymbol{d}}'\boldsymbol{X}_t + u_{k,t}. \tag{4}$$

In this case, the rational expectations hypothesis would imply that the coefficients $\tilde{c}$ and $\tilde{\boldsymbol{d}}$ above are zero. I opt for the two-stage approach of equations (2) and (3) because it allows for a more detailed analysis. First, equation (2) indicates to what extend the rational expectations hypothesis is violated. Second, equation (3) reveals which conditioning variables are ignored by investors when making expectations about future returns.

3.2 Weak Tests of Rational Expectations

As indicated in D'Haultfoeuille et al. (2018), an alternative way to test rational expectations is by examining the equality-in-means condition

$$E[R_{m,t,t+12}] - E\big[E_{k,t}[R_{m,t,t+12}]\big] = 0 \tag{5}$$

The above test only examines equality in levels and ignores covariances between realized and expected returns, hence the term weak tests.[4] Nevertheless, testing equation (5) is much more flexible than testing equation (2). This is because the former equation can be tested across different samples with unequal number of observations and sample variances using standard t-statistics (e.g., Welch's t-test).

[4] A stronger version of the test in equation (5) is one where, in addition to equality-in-means, we examine whether $var(R_{m,t,t+12})$ is greater than $var(E_{k,t}[R_{m,t,t+12}])$. In this case, the distribution of $R_{m,t,t+12}$ is a mean preserving spread of the distribution $E_{k,t}[R_{m,t,t+12}]$.

In my empirical analysis, I use the strong tests of rational expectations of equations (2) and (3) and the weak tests of equation (5) in both the full and the time series versions of the UBS/Gallup sample. For the weak tests, I also consider the annual subsamples of the 2000 - 2003 period covered by the UBS/Gallup survey. Finally, to verify the robustness of the results, I repeat the empirical analysis in a completely different sample of CFO expectations.

4 Empirical Results

In this section, I report the results for the strong and weak tests of the rational expectations hypothesis in the UBS/Gallup sample.

4.1 Strong Tests: Regressions

Table 2 reports the results from regressing realized stock market returns on expectations of stock market returns in the UBS/Gallup survey. Panel A shows results from testing equation (2). For these tests, standard errors are double-clustered by survey year-month and cohort, i.e., year of initial investment in the stock market according to the experience variable and the survey wave year.

Contrary to the predictions of the rational expectations hypothesis, the regression coefficient on expected returns is negative and statistically significant (-0.22, t-stat.= -3.19). This means that covariances between realized and expected returns are negative. Further, the estimate of the intercept is also negative and statistically significant (6.55, t-stat.= -2.02). Hence, the levels of average realized returns and average expected returns diverge. These results imply that the rational expectations hypothesis is rejected by the strong tests in the UBS/Gallup poll.

The next step in the rational expectations regressions is to try to identify why these tests fail. To this end, following equation (3), Panel B in Table 2 reports regressions of the error term from the rational expectations regressions in Panel A on stock market predictors (previous twelve month's return, risk-free rate, dividend yield, term premium). These regressions also control for investor demographics (age, experience, race, education, income, assets), investor optimism (investment goals, income, economy, unemployment, stock market, inflation), past realized and future expected portfolios performance, as well as cohort fixed effects. Similar to Panel A, standard errors are double-clustered by survey year-month and cohort.

According to these tests, the rational expectations regressions in Panel A of Table 2 fail because investors do not condition their expectations on economically and statistically significant predictors of stock market returns such as the risk-free rate and the dividend yield. Specifically, as shown in Table A.2 of the Appendix, the dividend yield predicts stock market returns positively and significantly. Yet, investors in the UBS/Gallup sample ignore this information. As a result, the rational expectations regressions in Panel A of Table 2 fail, while the error terms of these regressions covary significantly with the dividend yield.

The results are the same in the time series version of the UBS/Gallup poll where I average expectation across individuals in each survey wave. In these tests, standard errors are based on the small-sample and heteroscedacity correction of Davidson and MacKinnon (1993) since the cross-sectional dimension of the data is suppressed. As shown in Panel A of Table 3, the first-stage regression tests of the rational expectation hypothesis (equation (2)) yield a negative and significant coefficient for average expectations (-3.21, t-stat: -3.11). Further, the intercept is positive and significant (20.69, t-stat: 2.05). Similar to the results for the full UBS/Gallup sample in 2, these findings confirm that realized returns are negatively correlated to average expectations and their levels diverge. As shown in Panel B of Table 3, the second-stage regressions of error terms on stock market covariates reveal that rational expectations tests fail because the average investor in the UBS/Gallup poll does not take into account the covariation of market returns with the dividend yield.

4.2 Weak Tests: Equality in Means

For the second set of tests of the rational expectations hypothesis, I use the equality-in-means condition of equation (5) in the UBS/Gallup survey. To this end, Table 4 reports summary statistics (e.g., means, variances, autocorelations) for stock market expectations in the full UBS/Gallup sample ($E_{t,k}[R_{m,t,t+12}]$ in Panel A), average stock market expectations in the time series version of the UBS/Gallup sample ($\overline{E_{t,k}[R_{m,t,t+12}]}$ in Panel B), and realized stock market returns ($R_{m,t,t+12}$ in Panel C). I use these statistics to test equality-in-means between realized and expected stock market returns. For these tests, the variances of stock market expectations ($E_{t,k}[R_{m,t,t+12}]$), average stock market expectations ($\overline{E_{t,k}[R_{m,t,t+12}]}$), and stock market returns ($R_{m,t,t+12}$) are adjusted for sample size and autocorrelation according to the following formulas

$$var\big(E\big[E_{t,k}[R_{m,t,t+12}]\big]\big) = \frac{\widehat{var}_{N_k}\big(E_{t,k}[R_{m,t,t+12}]\big)}{N_k} \tag{6}$$
$$var\big(E\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big]\big) = \frac{\widehat{var}_{N_{k'}}\big(\overline{E_{t,k}[R_{m,t,t+12}]}\big)}{N_{k'}\big(1-\widehat{\rho}_{N_{k'}}\big(\overline{E_{t,k}[R_{m,t,t+12}]}, \overline{E_{t-1,k}[R_{m,t-1,t+11}]}\big)^2\big)}$$
$$var\big(E[R_{m,t,t+12}]\big) = \frac{\widehat{var}_{N_m}(R_{m,t,t+12})}{N_m\big(1-\widehat{\rho}_{N_m}\big(R_{m,t,t+12}, R_{m,t-1,t+11}\big)^2\big)}.$$

The constant N_k above is the size of the full UBS/Gallup sample, $N_{k'}$ is the size of the time series UBS/Gallup sample after averaging the cross-sectional dimension, and N_m is the size of the realized stock return sample. $\widehat{var}()$ is the sample variance and $\widehat{\rho}()$ is the sample first-order autocorrelation. The subscripts N_m, N_k, and $N_{k'}$ in the sample variances ($\widehat{var}()$) denote that sample averages of expectations, sample averages of average expectations, and sample averages of realized returns are respectively calculated in the full UBS/Gallup sample, the time series UBS/Gallup sample, and the realized stock return sample.

To test equality-in-means, I assume that the variances in the t-statistics reflect independence across the UBS/Gallup polls and the sample of realized returns. Hence, t-statistics for equality-in-means are given by

$$t - statistic_{full\ sample} = \frac{\widehat{E}_{N_m}[R_{m,t,t+12}] - \widehat{E}_{N_k}\big[E_{k,t}[R_{m,t,t+12}]\big]}{\sqrt{var\big(E[R_{m,t,t+12}]\big) + var\big(E\big[E_{k,t}[R_{m,t,t+12}]\big]\big)}} \tag{7}$$
$$t - statistic_{time\ series\ sample} = \frac{\widehat{E}_{N_m}[R_{m,t,t+12}] - \widehat{E}_{N_{k'}}\big[\overline{E_{k,t}[R_{m,t,t+12}]}\big]}{\sqrt{var\big(E[R_{m,t,t+12}]\big) + var\big(E\big[\overline{E_{k,t}[R_{m,t,t+12}]}\big]\big)}}.$$

Above, $\widehat{E}()$ is the the sample average operator and $var\big(E_{N_m}[R_{m,t,t+12}]\big)$, $var\big(E_{N_k}\big[E_{k,t}[R_{m,t,t+12}]\big]\big)$, and $var\big(E_{N_{k'}}\big[E_{k,t}[R_{m,t,t+12}]\big]\big)$ are calculated from equation (6). The assumption of independence across samples, which is reflected in the denominators of equation (7), stacks the tests in favor of the rational expectations hypothesis, i.e., equality-in-means between expected and realized returns. Even if I assume perfect positive correlation across samples and modify the denominators above by subtracting two times the product of standard deviations, the results remain qualitatively the same.

Results of the equality-in-means tests are reported in Table 5. Panel A shows results for the full UBS/Gallup sample and Panel B shows results for the time series version of the sample, where expected returns are averaged for each survey wave. The overall difference between average realized returns and average expectations in the UBS/Gallup survey is 17%. This difference is economically and statistically significant (t-stat: -2.12). Thus, equality-in-means and the weak form of rational expectations hypothesis are rejected both for the entire 2000 - 2003 period and across the annual subsamples. The only notable exception is 2002. For this year, the difference between average market returns and average market expectations is significant in magnitude (-11%). However, we cannot reject equality-in-means, i.e., rational expectations, due to large variances.

The equality-in-means test of equation (5) can also be used across different samples. Table 5 reports results of this test when stock market expectations in the 2000 - 2003 UBS/Gallup poll are compared against the unconditional average of realized stock market returns for the entire 1928 - 2003 sample. The overall difference between average realized returns over the 1928 - 2003 period and average expectations in the 2000 - 2003 UBS/Gallup survey is 1.2%. This difference is economically and statistically insignificant (t-stat: -0.74) and much smaller than the difference between average realized returns over the 2000 - 20003 period and average expectations in the UBS/Gallup survey. Based on these findings, we cannot reject the weak form of rational expectations since average stock market expectations over the entire 2000 - 2003 UBS/Gallup sample and its annual subsamples are statistically equal to the long-term average of stock market returns over the 1928 - 2003 period. The only exception is 2000 for which investors in the UBS/Gallup poll are characterized by much higher expectations for the return on the stock market (12.5%) than its unconditional average (7.6%).

The previous results are graphically summarized in Figure 1, which plots the kernel densities of realized and expected stock market returns. Panel A depicts the densities for the full UBS/Gallup sample and Panel B depicts the densities for the time series version of this sample. The solid line is the density of expected stock market returns and the dashed line is the density of realized stock market returns. If the rational expectations hypothesis were true, then, assuming normality or quasi-normality, the modes of the two distributions would be aligned. This is clearly not the case in Panel A of Figure 1 where we compare the densities of expected returns (solid lines) in the UBS/Gallup survey over the 2000 - 2003 sample to the densities of realized returns (dashed lines) over the same period.

In Panel B of Figure 1, we compare the densities of expected returns (solid lines) in the UBS/Gallup survey against the density of realized returns (dashed lies) during the 1928 - 2003 period. In this case, the two distributions are centered around the same point. This confirms the results of Table 5 where the unconditional average of realized stock market returns over the long-term sample (1928 - 2003) is statistically equal to the average expected stock market return in the UBS/Gallup poll (2000 - 2003) and its annual subsamples. These findings also suggest that irrespective of the recent stock market performance, which in the 2000 - 2003 period was quite poor, investors maintain almost constant expectations about stock market returns. These expectations are equal to the long-term (unconditional) averages of stock market returns. Based on all the above results, we conclude that even though the rational expectations hypothesis fails in a conditional sense, unconditionally, investor expectations seem to be aligned with average stock market returns calculated over long periods (e.g., 1928 - 2003).

These results are also confirmed by Figure 2, which plots the time series of average expected stock market returns in the UBS/Gallup poll. Specifically, Figure 2 illustrates that average expected returns in the 2000 - 20003 UBS/Gallup sample (solid line) fluctuate closely around the unconditional average of realized stock market returns over the 1928 - 2003 period (dotted line). Importantly, despite the poor stock market performance, average expected returns in the UBS/Gallup survey adjust very slowly to conditional information. This is evidenced by the huge discrepancies, in levels and comovement, between the time series of average expected returns (solid line) and realized returns (dash-dotted line). The differences between expected and realized returns remain quite pronounced even when I consider a smoothed time series of realized returns (dashed line), which is estimated using rolling twelve month averages of stock returns in the 2000 - 2003 sample.

Overall, the results in Figure 2 are perfectly aligned with the regressions from Tables 2 and 3 and the equality-in-means tests from Table 5. These tests indicate failure of the rational expectation in a conditional sense. However, unconditionally, average expectations in the UBS/Gallup survey estimated over the 2000 - 2003 period are statistically equal to long-term averages of stock market returns calculated over the 1928 - 2003 sample.

4.3 Tests with Fitted Stock Market Returns

In the previous tests, stock market expectations and average stock market expectations were compared to realized stock market returns. Following Adam et al. (2018), Tables A.3 and A.4 in the Appendix report the results of the strong (equation (2)) and weak (equation (5)) rational expectations tests when expectations in the UBS/Gallup poll are compared to fitted stock market returns instead of realized ones. In these tests, fitted stock market returns are derived from the following regression based on the market predictors used in the baseline empirical analysis

$$\widehat{R}_{m,t,t+12} = a + b_1\ R_{m,t-12,t} + b_2\ R_{f,t,t+12} + b_3\ (Div_{m,t-12,t}/Price_{m,t}) + b_4\ (YTM_{10yr,t} - YTM_{1yr,t}).$$

Fitted returns filter out noise terms from realized returns and decrease the probability that the rational expectations hypothesis is rejected. Nevertheless, according to the results in Tables A.3 and A.4 of the Appendix, the results from regressions and equality-in-means tests with fitted stock market returns are very similar to the ones with realized stock market returns from tables 2 and 5. Specifically, regression coefficients are negative and statistically significant while stock market expectations in the UBS/Gallup poll diverge from average fitted returns over the 2000 - 2003 period and its annual subsamples with an average difference of 17%. In sum, the rational expectations hypothesis is rejected when replacing realized returns with fitted returns. This happens because as reported in Table A.2 of the Appendix, fitted returns are driven by variables (e.g., dividend yield) that are ignored by the investors in the UBS/Gallup poll when forming stock market expectations (Tables 2 and 3).

5 Robustness: CFO Survey Sample

To verify the robustness of the baseline results, I repeat the empirical analysis in a completely different sample. Specifically, I use the CFO Survey from John Graham's website to gauge average CFO expectations about stock market returns.[5] In this quarterly survey, CFOs of major U.S. corporations are asked to fill out a questionnaire regarding a number of corporate policies as well as expectations about the future of the economy. In particular, I use the

[5] I would like to thank John Graham for making the survey data publicly available.

answer to the question "Over the next year, I expect the average annual S&P 500 return will be..." to derive average market expectations for each CFO survey.

The CFO survey reports average expectations and lacks the cross-sectional dimension of the UBS/Gallup poll, yet it covers an extended period from Q2.2004 to Q3.2022. The CFO sample used in the robustness tests starts in 2004 since this is the first available year on the survey's website. The sample ends in 2019 due to the missing stock market expectations questions in the Q1.2019, Q1.2020, and Q2.2020 CFO surveys. Each survey wave reports various averages of expected returns (winsorized, weighted by the revenue of the CFO's company, etc.). I use the non-winsorized, equal-weighted average.

For the empirical analysis, I merge the CFO data with a quarterly sample of stock market returns and predictors (previous four quarters stock market returns, risk-free rate, dividend yield, and term premium). Similar to the methodology for the monthly UBS/Gallup sample, I calculate rolling four-quarter S&P500 ex-dividend returns every quarter and merge these returns with CFO expectations. As in the baseline empirical analysis, I examine the rational expectations hypothesis using regressions and equality-in-means tests.

5.1 Strong Tests: Regressions

Table 6 reports the regression tests of the rational expectations hypothesis (equation(2)) in the CFO survey. As in the time series version of the UBS/Gallup survey, standard errors in the CFO sample are based on the small-sample and heteroscedacity correction of Davidson and MacKinnon (1993). Similar to the results for the UBS/Gallup poll, the regression coefficient in Panel A is negative (-2.39) and the intercept is large in magnitude (20.58). Contrary to the results in the UBS/Gallup survey, where the negative regression estimates were highly statistically significant (Tables 2 and 3), the regression estimates in Table 6 are statistically insignificant. This finding implies that CFOs expectations are almost acyclical, while UBS/Gallup expectations are countercyclical. Nevertheless, the rational expectations hypothesis is also rejected in the CFO sample since both the regression coefficient on expected returns and the R-square are statistically equal to zero. The low R-square (0.04) further confirms the acyclicality of CFO expectations.

To identify why tests of rational expectations fail in the VFO sample, Panel B of Table 6 reports the second-stage results when I regress the error term from the rational expectations regressions in Panel A on a set of valid stock market predictors (previous four quarters return, risk-free rate, dividend yield, term premium).[6] The results in Panel B reveal why the regressions tests fail in the CFO sample. In particular, the rational expectations hypothesis is rejected because, similar to the individuals in the UBS/Gallup survey, CFOs do not condition their expectations on past stock market returns, the risk-free rate, and the dividend yield.

5.2 Weak Tests: Equality in Means

Table 8 reports the results from the equality-in-means tests (equation (5)) in the CFO survey. As before, for these tests I use the means, variances, and autocorrelations for average stock market expectations ($\overline{E_{t,k}[R_{m,t,t+12}]}$ in Panel A) and realized stock market returns ($R_{m,t,t+12}$ in Panel B) in the t-statistic formula of equation (7). The results of the equality-in-means tests reveal that the statistical discrepancies between average expectations and average realized returns in the CFO sample are less pronounced than in the UBS/Gallup surveys. For instance, average CFO expectations over the entire 2004 - 2018 period are statistically equal to average realized returns over the same period with a divergence of 2.4%. Nevertheless, the differences between CFO expectations over the four-year subsamples of the 2004 - 2018 period and the corresponding conditional averages of stock market returns are economically meaningful with magnitudes ranging from -7.3% to 10.8%.

To the contrary, when I compare CFO expectations over the 2004 - 2018 period and its four-year subsamples to the unconditional average of realized stock market returns over the 1928 - 2018 sample, the differences between CFO expectations and realized returns decrease substantially with magnitudes ranging from 1.9% to 2.8%. These findings confirm the earlier results in the UBS/Gallup sample, and indicate that the average CFO tends to have almost constant stock market return expectations that are quite slow to adjust to new information. Further, these expectations are statistically equal to the unconditional averages of realized stock market returns calculated over long periods (e.g., 2004 - 2018 or 1928 - 2018).

The equality-in-means results are illustrated in Figure 3 that plots the time series of average expected stock market returns in the CFO sample. Similar to Figure 2 for the UBS/Gallup survey, CFO expected returns for the 2004 - 2018 period (solid line) exhibit small fluctuations around the unconditional average for stock market returns calculated over

[6] Table A.5 in the Appendix confirms the statistical significance of these covariates by regressing stock market returns on these predictors.

the 1928 - 2018 sample (dotted line). These expectations are quite different to the realized stock market returns over the 2004 - 2018 period (dashed-dotted line) or to the rolling four-quarter averages of stock market returns (dashed line) over the same period.

In sum, the statistical and graphical evidence indicate that CFOs do not take into account the conditional information in the various stock market predictors (e.g., past market returns, risk-free rate, dividend yield). As a result, the rational expectations hypothesis in the CFO sample is rejected in regression tests of realized stock market returns on stock market expectations. Rational expectations is also rejected in the weaker tests of examining equality-in-means between realized and expected stock market returns over short samples. Nevertheless, the equality-in-means tests reveal that market expectations in the CFO survey (2004 - 2018) are statistically equal to unconditional averages of realized market returns in the same period or over longer samples (e.g., 1928 - 2018).

Taken together the results from the two samples imply that investors and CFOs tend to form expectations that exhibit low time series variation. Although investors and CFOs fail to fully take into account conditional information in market predictors, their expectations are aligned with the long-term averages of realized market returns. Hence, even if the rational expectations hypothesis in rejected in a conditional sense, unconditionally, I cannot reject equality between investor and CFO expectations and average realized returns that are calculated over long horizons. In the next session, I study the implications of a heterogeneous agents model where a subset of investors (noise traders) have constant expectations about stock market returns even though dividends and prices are predictable.

6 Heterogeneous Agent Model with Constant Expectations

In my empirical analysis, I was unable to reject the rational expectation hypothesis in unconditional means, i.e., that investor expectations are equal to unconditional averages of realized stock market returns. To the contrary, the conditional rational expectations hypothesis, which was tested via regressions and shorter samples, was strongly rejected. To further study the effects of constant expectations on asset prices and portfolio performance, I use a simple heterogeneous agents model in which some investors fail to account for time-variation in dividends and asset prices. My model combines the noise traders framework of De Long et al. (1990) with the results of my empirical analysis according to which investors in both the UBS/Gallup and CFO surveys are characterized by almost constant stock market expectations. For the model, I assume a closed endowment economy where a risky asset, i.e., the stock market, is in limited fixed supply. The variable p_{t+1} is the price of the risky asset. The risky asset also pays a risky dividend denoted d_{t+1}. Dividends are predictable and homoscedastic. The conditional expectation of dividends depends on a state variable z_t that follows an autoregressive process with a zero unconditional mean.[7]

6.0.1 Model Equilibrium

The dynamics of the dividend growth process and the state variable in the model economy are respectively given by

$$d_{t+1} = \mu_d + \phi_d z_t + \epsilon_{d,t+1} \quad (8)$$

$$z_{t+1} = \phi_z z_t + \epsilon_{z,t+1}. \quad (9)$$

The shock terms $\epsilon_{d,t+1}$ and $\epsilon_{d,t+1}$ are i.i.d. standard normal variables with mean zero and variances σ_d^2 and σ_z^2 respectively. ϕ_z ($\in (-1,1)$) is the autoregressive coefficient in the dynamics of the state variable. μ_d is a constant associated with the unconditional mean of dividends, and ϕ_d is the exposure of dividends to the state variable z_t. A positive (negative) value for ϕ_d implies that dividends are positively (negatively) related to the state variable. Finally, in addition to the risky asset, there is a riskless asset whose supply is unlimited, its price is fixed at one, and at each point in time, it pays the (gross) risk-free rate $r_{f,t+1}$. For simplicity I assume that $r_{f,t}$ is constant and equal to r_f (> 1).

The economy is populated by overlapping generations of investors who live for two periods. There are two types of investors: the noise traders and the rational investors, with population masses μ and $1-\mu$, respectively ($\mu \in [0,1]$). In the first period, both types of investors receive an endowment, which can be invested in the dividend-paying risky asset and the risk-free technology. There is no consumption in the first period. In the second period, investors receive dividends, sell their investments, consume all their wealth, and die. Risk

[7] The zero-mean assumption is for tractability. All the results would still go through if the unconditional mean of z_t is a non-zero constant.

preferences over terminal wealth (W_{t+1}) are described by an exponential utility function, which is characterized by the same degree of risk aversion, γ, for both types of investors:

$$U(W_{t+1}) = -e^{-\gamma W_{t+1}}. \tag{10}$$

Importantly, I assume that noise traders exhibit perturbed conditional expectations. Specifically, similar to De Long et al. (1990), I assume that noise traders' expectations, $E_t^{no}[p_{t+1} + d_{t+1}]$, are equal to rational expectations, $E_t^{ra}[p_{t+1} + d_{t+1}]$, perturbed by a term ρ_t.

$$E_t^{no}[p_{t+1} + d_{t+1}] = E_t^{ra}[p_{t+1} + d_{t+1}] + \rho_t. \tag{11}$$

In De Long et al. (1990), the perturbation term ρ_t is a generic stochastic variable. Motivated by my empirical results, I impose additional structure on ρ_t, and assume that despite the predictive aspect of the economy (equations (8) and (9)), noise traders have constant expectations about future prices and dividends. Further, I assume that these expectations are equal to long-term averages. Based on these assumptions, the perturbation term ρ_t from De Long et al. (1990) becomes

$$\rho_t = E[p_{t+1} + d_{t+1}] - E_t[p_{t+1} + d_{t+1}], \tag{12}$$

where $E[p_{t+1} + d_{t+1}]$ and $E_t[p_{t+1} + d_{t+1}]$ are the unconditional and conditional expectations for cum-dividend market prices, respectively. Given the above assumptions for the model economy, I can obtain an explicit solution for the pricing function of the risky asset that depends on the state variable z_t.

Proposition 1. In the model economy, the pricing function of the risky asset satisfies

$$p_t = \mu_p + \phi_d z_t \tag{13}$$

$$\mu_p = \frac{\mu_d - \gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)}{r_f - 1} \tag{14}$$

$$\phi_p = \frac{(1-\mu)\phi_d}{r_f - (1-\mu)\phi_z} \tag{15}$$

Proof. See Section A.1.

The constant μ_p in the pricing function of equation (13) is the long-term average of the price of the risky asset. It is equal to the long-term average of the dividend process μ_d adjusted for risk ($\gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)$) and capitalized at the risk-free rate (r_f) as a perpetuity (equation (14)). The coefficient ϕ_p in the pricing function captures the sensitivity of the risky price to the state variable z_t. The sign of the pricing parameter ϕ_p depends on the sign of the dividend coefficient ϕ_d since the rest of the terms in equation (15) are positive.[8] If the dividend coefficient is positive (negative), then the pricing function depends positively (negatively) on the state variable. If dividends are unpredictable, i.e., ϕ_d is zero in equation (8), the sensitivity of the pricing function to the state variable is zero.

The sensitivity of the pricing function on the state variable ϕ_p also depends on the fraction of rational investors. When rational investors constitute 100% of the population ($\mu = 0$), ϕ_p attains its largest value. When noise investors constitute 100% of the population ($\mu = 1$), ϕ_p is zero because noise traders ignore the predictability of dividends and set their conditional expectations equal to the unconditional means.

6.0.2 Performance differential for investors with constant expectations

The solution for the pricing function in equation (13) allows me to draw portfolio performance implications for noise traders. To this end, I calculate the performance differential of noise traders relative to rational investors.

Proposition 2. The performance differential of the portfolios of noise traders relative to that of the rational investors, ΔR_{t+1}^{no}, satisfies

$$\Delta R_{t+1}^{no} = (\lambda_t^{no} - \lambda_t^{ra})(p_{t+1} + d_{t+1} - r_f p_t) \quad (16)$$

$$E[\Delta R_{t+1}^{no}] = -\frac{\mu \; r_f^2 \; \phi_d^2 \; \sigma_z^2}{\gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)(r_f - (1-\mu)\phi_z)^2} \quad (17)$$

$$E_t[\Delta R_{t+1}^{no}] = \frac{-\gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)\frac{r_f \; \phi_d}{r_f - (1-\mu)\phi_z} z_t - \frac{\mu \; r_f^2 \; \phi_d^2}{(r_f - (1-\mu)\phi_z)^2} z_t^2}{\gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)} \quad (18)$$

Proof. See Section A.2.

The relative performance of noise traders ΔR_{t+1}^{no} in equation (16) is the product of the

[8] The fraction or rational investors $1 - \mu$ is between 0 and 1, r_f is greater than 1, ϕ_z is between -1 and 1. Thus, the denominator in equation (15) is strictly positive.

differences in optimal portfolio holdings, $\lambda_t^{no} - \lambda_t^{ra}$, multiplied by the term $p_{t+1} + d_{t+1} - r_f p_t$, which captures the returns of the risky asset over the risk-free rate. According to Proposition 2, the unconditional expectation of the noise trader performance is negative (equation (17)). This is because noise traders fail to recognize predictability patterns in state variables, dividends, and ultimately, prices and expected returns. Unlike the negative unconditional expected performance, the conditional expected performance of noise traders over rational investors could be positive (equation (18)). The range of values of the state variable z_t for which noise traders are expected to outperform rational investors depends on the sign of the dividend coefficient ϕ_d. Specifically, when the state variable z_t is between 0 and $-\frac{\gamma(\phi_p^2\sigma_z^2+\sigma_d^2)(r_f-(1-\mu)\phi_z)}{\mu r_f \phi_d}$, that is, during moderate bad (good) times for positive (negative) ϕ_d, the conditional expectation of noise trader performance over rational investors is positive. When z_t is outside this range of values, i.e., during good (bad) times or extremely bad (good) times for positive (negative) ϕ_d, noise traders are conditionally expected to lose money.[9]

Importantly, the size of the conditional expected performance differential between noise traders and rational investors depends on the population mass of noise traders, μ. When the fraction of noise traders is zero there is no performance differential. As the fraction of noise traders increases, the conditional expected performance differential also increases in favor of the rational investors. When μ is large, rational investors are able to exploit their accurate predictions and trade against a sizeabe population of noise traders. Overall, the model highlights that unconditionally, noise traders lose money because they fail to incorporate the time-variation of expected returns in their demand for the risky asset. Conditionally, noise traders are sometimes expected to outperform rational investors provided that the state variable falls within a range of values (moderate economic scenarios). Outside these values, i.e., during very good or very bad times, noise traders are conditionally expected to lose money to rational investors.

In the Delong et al. (1990) model, it is not clear that noise traders would lose money to rational investors. This is because the relative performance differential between noise traders and rational investors depends on the average value of the expectations perturbation parameter, $E[\rho_t]$, which in Delong et al. (1990) is quite generic. To the contrary, I parametrize the expectation perturbation parameter based on my empirical evidence, which shows that

[9] I loosely define good and bad times depending on whether the state variable z_t is above or below its zero mean.

investors tend to have constant expectations. Specifically, in my framework, the belief perturbation is given by equation (12) and thus $E[\rho_t] = 0$. This restricts the states of the world where noise traders outperform rational investors. Importantly, since $E[\rho_t] = 0$ in my model, the unconditional expected performance of noise traders is always negative. A corollary of this discussion is that in noise trader-type models when perturbations of expectations are calibrated using empirically plausible deviations from rational expectations, investors who deviate from rationality are expected to lose money to rational investors.

6.0.3 Survival of investors with constant expectations

A question that naturally arises from both my empirical and theoretical results is related to the survival of investors with constant expectations in an economy where fundamentals are predictable. To answer this question, I study a version of the model where the population fraction of noise traders with constant expectations is allowed to change over time based on the last period's performance differential between noise traders and rational investors.

Following De Long et al. (1990), I assume that the time-varying fraction (μ_t) of noise traders with constant expectations may change over time depending on the relative performance between noise traders and rational investors, ΔR^{no}_{t+1} from equation (16). In particular, I assume the following performance imitation dynamics for μ_t

$$\mu_{t+1} = max\{0, min\{1, \mu_t + \zeta \Delta R^{no}_{t+1}\}\}. \tag{19}$$

The constant ζ above is the rate at which additional new investors become noise traders as a fraction of the performance differential ΔR^{no}_{t+1}.

Following the arguments in De Long et al. (1990), if ζ in equation (19) is close to zero, i.e., the imitation factor is relatively weak, then we can study the survival of noise traders by simply replacing μ with μ_t in equations (13) through (18). In this case, the time-varying version of equation (17) for the unconditional average of the performance differential before noise traders and rational investors becomes

$$E[\Delta R^{no}_{t+1}] \;=\; -\frac{\mu_t \, r_f^2 \, \phi_d^2 \, \sigma_z^2}{\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)(r_f - (1-\mu_t)\phi_z)^2}. \tag{20}$$

We can then consider the above expression as a function of μ_t and solve the equation

$E[\Delta R^{no}_{t+1}(\mu_t)] = 0$ for μ_t. The only solution for setting equation (20) equal to zero is $\mu_t = 0$. This means that contrary to De Long et al. (1990) where noise traders survive in the long run, in my model, noise traders eventually disappear because they start imitating the behavior of rational investors, who, unconditionally, are expected to outperform noise traders with constant expectations (equations (17) and (20)).

In my model noise traders cannot survive in the long run since the unconditional average of the expectations perturbation term $E[\rho_t]$ is zero. This is because the expectations perturbation term ρ_t in equation (12) is parameterized based on the empirical findings that investors tend to have constant expectations. To the contrary, in De Long et al. (1990) $E[\rho_t]$ is positive. This guarantees that in their model the unconditional average of the performance differential $E[\Delta R^{no}_{t+1}]$ is most likely positive and thus, some noise traders will always survive. Hence, another corollary of this discussion is that when perturbations of expectations are calibrated using empirically plausible deviations from rational expectations, investors who deviate from rationality cannot survive in the long run.

7 Conclusion

In this paper, I test the rational expectations hypothesis focusing on stock market returns. My main empirical tests consist of regressing realized stock market returns on expectations from the UBS/Gallup Investor Optimism Survey over the 2000 - 2003 period. The results of these tests indicate that the rational expectations hypothesis is rejected. Further empirical analysis explain why rational expectations are rejected. Namely, when forming expectations, investors do not take into account important information in stock market predictors such as past stock market returns, the risk-free rate, and the dividend yield.

A second set of tests of the rational expectations hypothesis examines equality-in-means between expectations in the UBS/Gallup sample and realized returns over the same period (2000 - 2003) as well as over longer samples (1928 - 2003). Despite the conditional failure of the rational expectations hypothesis, the equality-in-means tests highlight that unconditionally, we cannot reject equality between investor expectations in the UBS/Gallup survey (2000 - 2003) and average stock market returns calculated over long periods (1928 - 2003). I verify the robustness of the findings in the UBS/Gallup survey by repeating the empirical analysis in a completely different sample of CFO expectations during the 2004 - 2018 period.

Taken together, the results in the two samples imply that investor expectations of stock market returns exhibit very low time series variation and are statistically equal to long-term averages of realized market returns.

Motivated by these findings, I develop a heterogeneous agents model where despite the predictability in dividends and asset prices, a fraction of investors (noise traders) are characterized by constant expectations, which are equal to unconditional averages of dividends and prices. The remaining investors in the model are rational, and their expectations take into account predictability in dividends and prices. I show that in this economy there are some states of the world (moderate economic scenarios) where noise traders are expected to outperform rational investors. Yet, in extreme good or extreme bad times, noise traders are always expected to lose money. Further, over long periods of time, noise traders are expected to lose money to rational investors and disappear. This model is one of the first attempts to formalize how empirically plausible deviations from rational expectations can affect asset prices and the portfolio performance of individual investors in a predictable economic environment.

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Appendix

A.1 Proof of ***Proposition 1***

Let W_t^k be the initial wealth, λ_t^k the holdings in shares of the risky assets, and $\lambda_{r_f,t}^k$ the holdings in shares of the risk-free asset for $k \in \{no(ise), ra(tional)\}$. To prove *Proposition 1*, I derive optimal asset demands for the two sets of investors, and then aggregate them imposing market clearing.

Rational Investors

During the first period, wealth is equal to the initial endowment, which is received by both noise traders and rational investors. The first-period budget constraint for the rational investors is

$$W_t^{ra} = \lambda_{r_f,t}^{ra} 1 + \lambda_t^{ra} p_t.$$

The second-period budget constraint reads

$$W_{t+1}^{ra} = \lambda_{r_f,t}^{ra} r_f + \lambda_t^{ra}(p_{t+1} + d_{t+1}).$$

Using the first-period budget constraint, I can write the second-period budget constraint as

$$W_{t+1}^{ra} = W_t^{ra} r_f + \lambda_t^{ra}(p_{t+1} + d_{t+1} - r_f p_t).$$

Since there is no intermediate consumption, the rational investors maximize expected utility of second-period wealth w.r.t. λ_t^{ra}

$$max_{\lambda_t^{ra}} E_t[U(W_{t+1}^{ra})] = max_{\lambda_t^{ra}} E_t[-e^{-\gamma W_{t+1}^{ra}}]. \tag{21}$$

I can either assume normality of second-period wealth, which I must later verify from the equilibrium pricing function of the risky asset, or I can approximate the exponential utility with a quadratic one to transform the maximization problem into

$$max_{\lambda_t^{ra}} E_t[W_{t+1}^{ra}] - \frac{1}{2}\gamma Var_t(W_{t+1}^{ra}). \tag{22}$$

In this case, the optimal demand for the risky asset by the rational investors is equal to

$$\lambda_t^{ra} = \frac{E_t^{ra}[p_{t+1} + d_{t+1}] - r_f p_t}{\gamma Var_t\big(p_{t+1} + d_{t+1}\big)}, \tag{23}$$

where $Var_t()$ is the conditional variance operator.

Noise Traders

Noise traders' demand for the risky asset is derived in a similar way. The key difference is that conditional expectations for cum-dividend prices are perturbed by the term

$$\rho_t = E[p_{t+1} + d_{t+1}] - E_t[p_{t+1} + d_{t+1}].$$

In other words, noise traders maximize

$$max_{\lambda_t^{no}} E_t[W_{t+1}^{no}] + \lambda_t^{no}\rho_t - \frac{1}{2}\gamma Var_t(W_{t+1}^{no}).$$

As in De Long et al. (1990), I assume that noise traders misperceive expected prices but can accurately calculate conditional volatility.[10] Based on the above, the optimal demand for the risky asset by noise traders is given by

$$\lambda_t^{no} = \frac{E[p_{t+1} + d_{t+1}] - r_f p_t}{\gamma Var_t\big(p_{t+1} + d_{t+1}\big)}. \tag{24}$$

Equilibrium

At any point of time, the new generation of rational investors and noise traders buys the assets owned by the old generation. Therefore, when markets clear the sum of the population-

[10]See footnote 2 in De Long et al. (1990)

weighted asset holdings of the new generation is equal to 1, the supply of the risky asset

$$1 = (1 - \mu)\lambda_t^{ra} + \mu\lambda_t^{no}.$$

Replacing the expressions for optimal asset holdings from equations (23) and (24) and solving for the period-one price of the risky asset, we get

$$p_t = \frac{1}{r_f}\big[(1-\mu)(E_t[d_{t+1}] + E_t[p_{t+1}]) + \mu(E[d_{t+1}] + E[p_{t+1}]) - \gamma Var_t(p_{t+1} + d_{t+1})\big]. \tag{25}$$

To derive the pricing function, I follow the guess and verify method. The guess consists of the linear pricing function

$$p_t = \mu_p + \phi_p z_t. \tag{26}$$

In verifying the above conjecture, I first derive the conditional and unconditional means for dividends, d_t, and the state variable, z_t, according to equations (8) and (9):

$$E_t[z_{t+1}] = \phi_z z_t, \quad E[z_{t+1}] = 0 \tag{27}$$

$$E_t[d_{t+1}] = \mu_d + \phi_d z_t, \quad E[d_{t+1}] = \mu_d. \tag{28}$$

Similarly, based on my guess for the pricing function, the conditional and unconditional means of the pricing function are

$$E_t[p_{t+1}] = \mu_p + \phi_p\phi_z z_t, \quad E[p_{t+1}] = \mu_p. \tag{29}$$

Next, the conjecture for the pricing function and the dynamics of the state variable and dividends imply that the conditional variance of cum-dividend prices is constant

$$Var_t\big(p_{t+1} + d_{t+1}\big) = Var_t\big(\mu_p + \phi_p(\phi_z z_t + \epsilon_{z,t+1}) + \mu_d + \phi_d z_t + \epsilon_{d,t+1}\big) = \phi_p^2\sigma_z^2 + \sigma_d^2. \tag{30}$$

Finally, I substitute the expressions for the pricing function and the conditional volatility back in equation (25) to get

$$\begin{aligned}\mu_p + \phi_p z_t &= \frac{1}{r_f}\big[(1-\mu)E_t[\mu_d + \phi_d z_t + \epsilon_{d,t+1}] + (1-\mu)E_t[\mu_p + \phi_p z_{t+1}] + \\ \mu E[\mu_d + \phi_d z_t + \epsilon_{d,t+1}] &+ \mu E[\mu_p + \phi_p z_{t+1}] - \gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)\big].\end{aligned}$$

Plugging the dividend and state dynamics, the equilibrium condition becomes

$$\mu_p + \phi_p z_t = \frac{1}{r_f}\big[(1-\mu)(\mu_d + \phi_d z_t + \mu_p + \phi_p\phi_z z_t) + \mu\mu_d + \mu\mu_p - \gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)\big]. \tag{31}$$

Collecting z_t terms, I conclude that ϕ_p satisfies the equation

$$\phi_p = \frac{(1-\mu)\phi_d}{r_f - (1-\mu)\phi_z}.$$

Replacing the expression for ϕ_p back in equation (31) and collecting constant terms, I obtain the expression for μ_p

$$\mu_p = \frac{1}{r_f - 1}\big[\mu_d - \gamma(\phi_p^2\sigma_z^2 + \sigma_d^2)\big].$$

The above solutions for ϕ_p and μ_p verify the homoscedasticity assumption for p_t and d_t in equation (30). Also, for the pricing function in equation (26) and normally distributed dividend and state variable shocks in equations (8) and (9), investor wealth is normally distributed. Thus, maximizing the exponential utility function in equation (21) is equivalent to maximizing the quadratic expression in equation (22).

A.2 Proof of ***Proposition 2***

Using the solution for the pricing function, the conditional expectation of risky returns in excess of the risk-free rate is

$$E_t[p_{t+1} + d_{t+1} - r_f p_t] = \gamma(\phi_p^2\sigma_z^2 + \sigma_d^2) + (\phi_p\phi_z + \phi_d - r_f\phi_p)z_t.$$

Plugging the solution for ϕ_p, I conclude that

$$E_t[p_{t+1} + d_{t+1} - r_f p_t] \quad = \quad \gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2) + \frac{\mu \; r_f \; \phi_d}{r_f - (1-\mu)\phi_z} z_t.$$

The assumption that $E[z_t]$ is zero implies that unconditional expected returns are

$$E[p_{t+1} + d_{t+1} - r_f p_t] = \gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2) > 0.$$

Relative Performance of Noise Traders

Let ΔR_{t+1}^{no} denote the noise trader performance relative to the rational arbitrageurs. Its conditional expectation is

$$E_t[\Delta R_{t+1}^{no}] = (\lambda_t^{no} - \lambda_t^{ra}) E_t[p_{t+1} + d_{t+1} - r_f p_t].$$

The first term above is the difference in asset holdings and the second terms is the conditional expected return. From equations (23) and (24), the holdings differential is

$$\lambda_t^{no} - \lambda_t^{ra} = \frac{E[p_{t+1} + d_{t+1}] - E_t[p_{t+1} + d_{t+1}]}{\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)}.$$

Hence,

$$E_t[\Delta R_{t+1}^{no}] = \frac{\big(E[p_{t+1} + d_{t+1}] - E_t[p_{t+1} + d_{t+1}]\big) E_t[p_{t+1} + d_{t+1} - r_f p_t]}{\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)}.$$

Substituting the solutions for prices and dividend dynamics, the above equation becomes

$$E_t[\Delta R_{t+1}^{no}] = \frac{-\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2) \frac{r_f \; \phi_d}{r_f - (1-\mu)\phi_z} z_t - \frac{\mu \; r_f^2 \; \phi_d^2}{(r_f - (1-\mu)\phi_z)^2} z_t^2}{\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)}.$$

The unconditional expected performance of noise traders can be easily calculated if we consider the unconditional expectation of the above expression

$$E[\Delta R_{t+1}^{no}] \quad = \quad -\frac{\mu \; r_f^2 \; \phi_d^2 \; \sigma_z^2}{\gamma(\phi_p^2 \sigma_z^2 + \sigma_d^2)(r_f - (1-\mu)\phi_z)^2}.$$

Table A.1 Summary Statistics for Realized Portfolio Returns and Expected Portfolio and Market Returns by Year

This table reports the summary statistics for the realized and expected portfolio returns and expected market returns, including, mean, standard deviation (Std. Dev), minimum and maximum. Expected stock market returns are calculated based on the survey question "What overall rate of return do you think the stock market will provide investors during the coming twelve months?" Expected portfolio returns are calculated based on the survey question "What overall rate of return do you expect to get on your portfolio in the next twelve months?" Previous twelve months portfolio returns are based on the survey question "What was the overall percentage rate of return you got on your portfolio in the past twelve months?" The sample is the UBS/Gallup Investor Optimism Survey from February 1999 to April 2003. For this table, I do not impose any additional filters (e.g., delete missing observations, etc.).

	Mean	Std. Dev.	Min	Max	N
Year: 1999 (starting in February)					
Expected Stock Market Return (%)	13.345	10.708	0.5	100	8,856
Expected Portfolio Return (%)	15.898	14.184	0.5	100	9,454
Previous 12 Months Portfolio Return (%)	17.632	14.782	0.5	100	8,671
Year: 2000					
Expected Market Return	12.910	11.586	-70	110	9,494
Expected Portfolio Return	14.764	13.609	-85	500	10,034
Previous 12 Months Portfolio Return	16.400	16.932	-65	500	9,113
Year: 2001					
Expected Stock Market Return	8.344	10.131	-74	93	9,549
Expected Portfolio Return	9.573	10.778	-80	90	9,929
Previous 12 Months Portfolio Return	2.639	17.874	-90	90	8,862
Year: 2002					
Expected Stock Market Return	7.449	14.128	-65	500	9,382
Expected Portfolio Return	8.759	18.575	-90	800	9,745
Previous 12 Months Portfolio Return	-1.205	28.752	-95	990	8,491
Year: 2003 (ending in April)					
Expected Stock Market Return	6.378	12.471	-100	256	2,790
Expected Portfolio Return	6.419	11.943	-80	125	3,327
Previous 12 Months Portfolio Return	-3.878	18.967	-90	350	2,845

Table A.2 Testing the Predictors for Market Returns: Regressions in the Time Series UBS/Gallup Sample

This table reports estimation results from regressing stock market returns on a set of predictors. The dependent variable is the next twelve months stock market return, $R_{m,t,t+12}$. The key independent variables are the previous twelve months market return, the risk-free rate, the dividend yield, and term premium. Market (S&P500) returns from CRSP are rolling ex-dividend twelve month returns computed every month to match the monthly frequency of the UBS/Gallup survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). I further control for average realized and expected investor portfolio returns and average investor optimism. The t-statistics are reported in parenthesis and are based on the small-sample and heteroscedasticity correction of Davidson and MacKinnon (1993). The key variables are described in Section 4. The sample runs from January 2000 to April 2003.

	(1)	(2)	(3)	(4)
Previous 12 Months Market Return, $R_{m,t-12,t}$	-1.058	-0.778	-0.760	-0.901
	(-1.61)	(-2.05)	(-1.90)	(-2.18)
Risk-free rate, $R_{f,t,t+12}$	11.203	7.208	7.767	2.248
	(2.35)	(1.97)	(1.98)	(0.35)
Dividend Yield, $Div_{m,t-12,t}/Price_{m,t}$		78.576	78.630	79.930
		(5.53)	(5.48)	(5.36)
Term Premium, $YTM_{10yr,t} - YTM_{1yr,t}$			1.370	-2.238
			(0.36)	(-0.44)
Ave. Expected Portfolio Return, $\overline{E_{k,t}[R_{k,t,t+12}]}$				1.865
				(0.78)
Ave. Previous 12 Months Portfolio Return, $\overline{R_{k,t-12,t}]}$				1.00
				(0.64)
R-squared	0.64	0.89	0.89	0.90
Adj. R-squared	0.19	0.82	0.83	0.83
N		40		

Table A.3 Testing the Rational Expectations Hypothesis for Market Returns: Fitted Market Returns

This table reports estimation results for testing the rational expectations hypothesis for investor expectations regarding the next twelve months stock market return. In Panel A, the dependent variable is the next twelve months fitted the market return, $\widehat{R}_{m,t,t+12}$, and the explanatory variable is investor expectations for the next twelve months stock market return, $E_{t,k}[R_{m,t,t+12}]$. The test of rational expectations is given by

$$E[\widehat{R}_{m,t,t+12}] = a + b\ E\big[E_{t,k}[R_{m,t,t+12}]\big].$$

The rational expectations hypothesis implies that $a = 0$ and $b = 1$ above. In Panel B, the dependent variable is the fitted next twelve months stock market return, $\widehat{R}_{m,t,t+12}$, and the explanatory variable is average investor expectations about the next twelve months market return, $\overline{E_{t,k}[R_{m,t,t+12}]}$. The test of rational expectations in Panel B is given by

$$E[\widehat{R}_{m,t,t+12}] = a + b\ E\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big].$$

$\widehat{R}_{m,t,t+12}$ is the fitted market return from the expanding regression

$$R_{m,t,t+12} = a + b_1\ R_{m,t-12,t} + b_2\ R_{f,t,t+12} + b_3\ (Div_{m,t-12,t}/Price_{m,t}) + b_4\ (YTM_{10yr,t} - YTM_{1yr,t}) + \epsilon_t.$$

in the corresponding corresponding sample period (e.g., 2000, 2001, etc.). This expanding regression is conducted from January 2000 to April 2004 with an initial window of 12 observations. $R_{m,t,t+12}$ is the next twelve months stock market return, $R_{m,t-12,t}$ is the previous twelve months market return, $R_{f,t,t+12}$ is the risk-free rate, $Div_{m,t-12,t}/Price_{m,t}$ is the dividend yield, and $(YTM_{10yr,t} - YTM_{1yr,t})$ is the term premium. In Panel A, the t-statistics in parenthesis are based on standard errors that are double clustered by survey year-month and cohort, i.e., year of initial investment in the stock market based on the experience variable and the survey wave year. In Panel B, the t-statistics are based on the small-sample and heteroscedasticity correction of Davidson and MacKinnon (1993). The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003.

Panel A: Dependent Variable is Fitted Market Return in Full Sample, $\widehat{R}_{m,t,t+12}$

Ave. Expected Market Return, $E_{t,k}[R_{m,t,t+12}]$	-0.177
	(-3.21)
Constant	-7.966
	(-3.02)
R-squared	0.016
N	22,069

Panel B: Dependent Variable is Fitted Market Return in Time Series Sample, $\widehat{R}_{m,t,t+12}$

Expected Market Return, $\overline{E_{t,k}[R_{m,t,t+12}]}$	-2.563
	(-2.94)
Constant	13.667
	(1.61)
R-squared	0.22
Adj. R-squared	0.20
N	40

Table A.4 Testing the Rational Expectations Hypothesis for Average Portfolio Returns: Equality in Fitted Means

This table reports results for testing the rational expectations hypothesis for investor expectations regarding the next twelve months stock market return. In Panel A, I use the full UBS/Gallup sample, and test rational expectations using

$$E_{period}[\widehat{R}_{m,t,t+12}] - E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big] = 0.$$

In Panel B, I use the time series sample, and test rational expectations using

$$E_{period}[\widehat{R}_{m,t,t+12}] - E_{period}\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big] = 0.$$

$E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big]$ is the average expectation for the next twelve months stock market return in the corresponding sample period for the full UBS/Gallup sample. $\overline{E_{t,k}[R_{m,t,t+12}]}$ is the average expectation per survey wave for the next twelve months stock market return. $E_{period}[\widehat{R}_{m,t,t+12}]$ is the average fitted stock market return from the expanding regression

$$R_{m,t,t+12} = a + b_1\ R_{m,t-12,t} + b_2\ R_{f,t,t+12} + b_3\ (Div_{m,t-12,t}/Price_{m,t}) + b_4\ (YTM_{10yr,t} - YTM_{1yr,t}) + \epsilon_t.$$

in the corresponding corresponding sample period (e.g., 2000, 2001, etc.). This expanding regression is conducted from January 2000 to April 2004 with an initial window of 12 observations. $R_{m,t,t+12}$ is the next twelve months stock market return, $R_{m,t-12,t}$ is the previous twelve months stock market return, $R_{f,t,t+12}$ is the risk-free rate, $Div_{m,t-12,t}/Price_{m,t}$ is the dividend yield, and $(YTM_{10yr,t} - YTM_{1yr,t})$ is the term premium. In Panel C, I report summary statistics for the fitted market returns, $\widehat{R}_{m,t,t+12}$. The means, standard errors, and sample sizes for the equality-in-means tests are from Table 4. The t-statistics for the equality-in-means tests are reported in parenthesis (unequal variances t-test). t-statistics are calculated assuming that the means are uncorrelated across the UBS/Gallup sample and the stock market returns sample (equation (7)). In Panel A, the standard errors of $E_{period}[R_{m,t,t+12}]$ are corrected for first-order autocorrelation as in equation (6). In Panel B, all standard errors are corrected for first-order autocorrelations. Autocorrelations are reported in Table 4 and in Panel C. The numbers in brackets are the number of observations in the calculation of the two means. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003. The sample of market returns consists of the S&P500 returns for the January 2000 - April 2003 period. S&P500 returns are twelve month returns calculated on a rolling monthly basis.

Panel A: Testing the Rational Expectations in Fitted Means for the Full Sample

	2000	2001	2002	2003 (Jan. - Apr.)	Jan. 2000 - Apr. 2003
$E_{period}[\widehat{R}_{m,t,t+12}] - E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big]$	-28.630	-20.017	-16.049	16.446	-17.846
	(-11.790)	(-12.224)	(-1.31)	(2.15)	(-3.19)
	[12; 6,852]	[12; 6,833]	[12; 6,484]	[4; 1,900]	[40; 22,069]

Panel B: Testing the Rational Expectations in Fitted Means for the Time Series Sample

	2000	2001	2002	2003 (Jan. - April)	Jan. 2000 - Apr. 2003
$E_{period}[\widehat{R}_{m,t,t+12}] - E_{period}\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big]$	-28.597	-20.039	-16.016	16.444	-17.751
	(-11.60)	(-12.050)	(-1.30)	(2.15)	(-3.16)
	[12; 12]	[12; 12]	[12; 12]	[4; 4]	[40; 40]

Panel C: Summary Statistics for Next Twelve Months Fitted Market Returns

	Mean	Std. Dev.	Min	Max	Autocorrelation	N
			Year: 2000			
$\widehat{R}_{m,t,t+12}$	-16.067	7.323	-28.399	-1.220	0.49	12
			Year: 2001			
$\widehat{R}_{m,t,t+12}$	-12.142	5.281	-21.679	0.294	0.36	12
			Year: 2002			
$\widehat{R}_{m,t,t+12}$	-9.047	17.563	-29.862	22.138	0.91	12
			Year: 2003 (Jan. - Apr.)			
$\widehat{R}_{m,t,t+12}$	22.442	9.897	9.006	31.836	0.76	4
			Jan. 2000 - Apr. 2003			
$\widehat{R}_{m,t,t+12}$	-8.932	15.405	-29.862	31.836	0.90	40

Table A.5 Testing the Predictors for Market Returns: Regressions in the CFO Sample

This table reports estimation results from regressing stock market returns on a set of predictors. The dependent variable is the next four quarter stock market return, $R_{m,t,t+12}$. The key independent variables are the previous twelve months market return, the risk-free rate, the dividend yield, and term premium. Market (S&P500) returns from CRSP are rolling ex-dividend four quarter returns computed every quarter to match the quarterly frequency of the CFO survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). The t-statistics are reported in parenthesis and are based on the small-sample and heteroscedasticity correction of Davidson and MacKinnon (1993). The key variables are described in Section 4. The sample runs from March 2004 to December 2018.

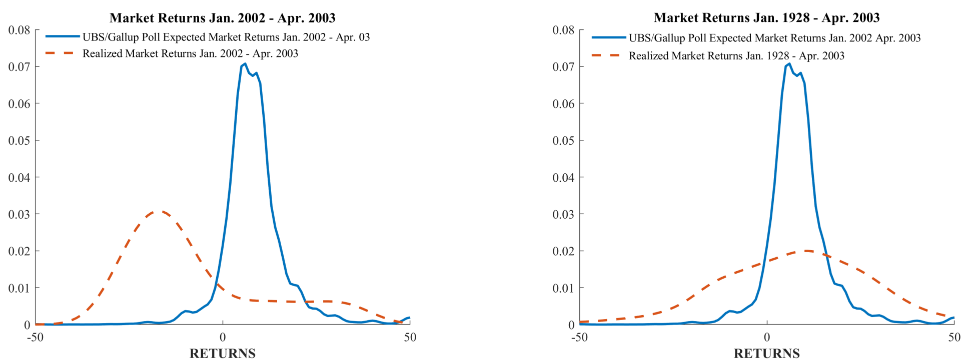
	(1)	(2)	(3)
Previous 4 Quarters Market Return, $R_{m,t-4,t}$	-0.078	0.728	0.723
	(-0.41)	(2.70)	(2.67)
Risk-free Rate, $R_{f,t,t+4}$	-1.680	1.950	2.049
	(-1,50)	(1.33)	(1.08)
Dividend Yield, $Div_{m,t-4,t}/Price_{m,t}$		48.875	48.669
		(4.25)	(4.28)
Term Premium, $YTM_{10yr,t} - YTM_{1yr,t}$			0.297
			(0.11)
R-squared	0.04	0.30	0.30
Adj. R-squared	0.00	0.26	0.25
N		60	

Figures

Figure 1 Testing the Rational Expectations Hypothesis in Means: Kernel Densities

This figure illustrates the results of the rational expectation tests in Table 5. Panel A plots the kernel density (smooth line) for expected market returns in the full UBS/Gallup sample from Jan. 2000 to Apr. 2003. Panel A also plots the kernel density (dash-dotted line) for realized market returns in Jan. 2000 - Apr. 2003 and Jan. 1928 - Apr. 2003. Panel B plots the kernel density (smooth line) for average expected market returns in the full UBS/Gallup sample from Jan. 2000 to Apr. 2003. In Panel B, expected market returns are averaged across respondents for each survey wave. Panel B also plots the kernel density (dash-dotted line) for realized market returns in Jan. 2000 - Apr. 2003 and Jan. 1928 - Apr. 2003. Summary statistics for the variables are reported in Table 4. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003. The sample of market returns consists the S&P500 returns for the January 1928 - April 2003 period. S&P500 returns are twelve month returns calculated on a rolling monthly basis.

Panel A: Densities for Expected and Realized Market Returns



Panel B: Densities for Average Expected and Realized Market Returns

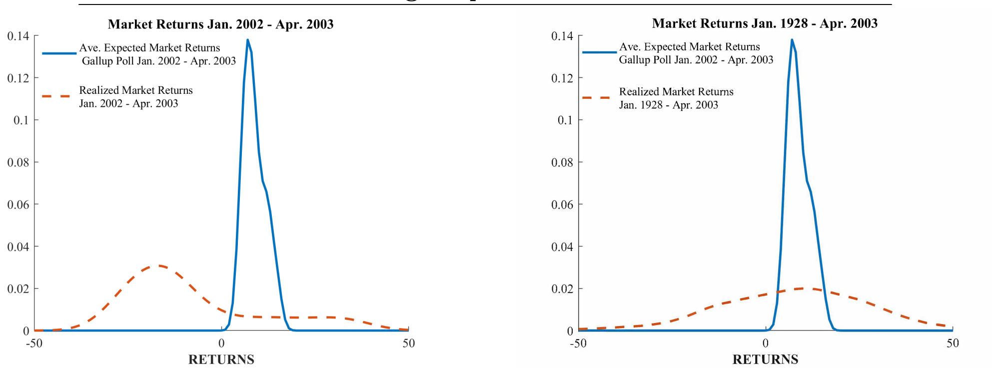


Figure 2 Testing the Rational Expectations Hypothesis in Means: Time Series of Expectations

This figure plots the time series of market expectations from January 2000 to April 2003. The solid line is the average expected market return from the UBS/Gallup sample. The dashed line is the expected market return from averaging the rolling 12-month forward realized market returns. The dash-dotted line is the realized market return. The dotted horizontal line is the unconditional mean for the stock market return over the Jan. 1928 - Apr. 2003 period. Summary statistics for the variables are reported in Table 4. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003. S&P500 returns are returns for the next twelve months calculated on a rolling monthly basis.

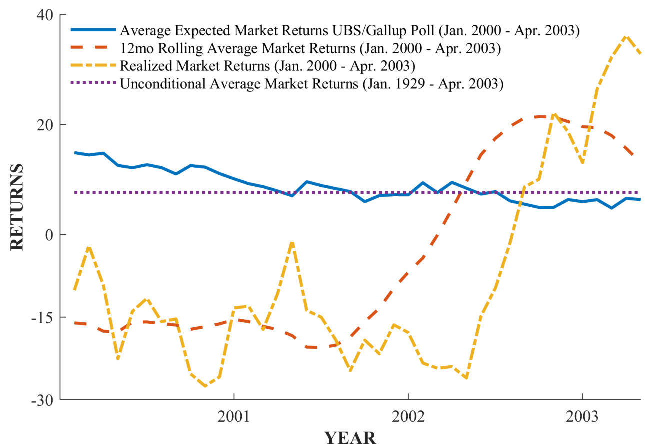
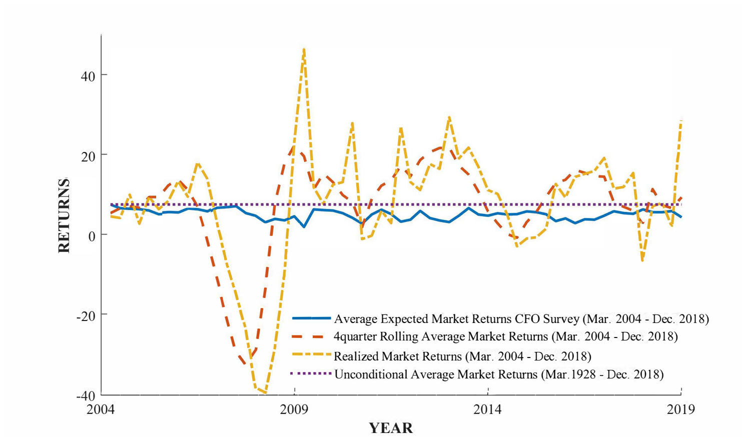


Figure 3 Testing the Rational Expectations Hypothesis in Means: Time Series of Expectations from CFO Survey

This figure plots the time series of market expectations from March 2004 to December 2018. The solid line is the average expected market return from the CFO Survey. The dashed line is the expected market return from averaging the rolling 4-quarter forward realized market returns. The dash-dotted line is the realized market return. The dotted horizontal line is the unconditional mean for the stock market return over the March 1928 - December 2018 period. Summary statistics for the variables are reported in Table 7. The sample is the CFO Survey from March 2004 to December 2018. S&P500 returns are returns for the next four quarters calculated on a rolling quarterly basis.



Tables

Table 1 Summary Statistics

This table reports the summary statistics for key variables in our sample, including, mean, median, standard deviation (St. Dev), minimum and maximum. The last row reports the number of observations, N. In panel A, I report the summary statistics for the full sample. Panel B reports the summary statistics for the time series sample. In the time series sample, I average the answers to the UBS/Gallup survey across respondents in each survey wave to construct a time series measure of average expectations, returns, and optimism. Education categories include: high-school (1), some college (2), college graduate (3), post-graduate (4). Assets indicator is an indicator for asset holdings greater than $100,000. Optimism indexes are based on a scale of 1 through 5, and refer to next-year economic variables. The investments goals variable is for a five year horizon. Market (S&P500) returns from CRSP are rolling ex-dividend annual returns computed every month to match the monthly frequency of the survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). Panel C reports the correlations across variables for the full sample. Panel D reports the correlation matrix across variables for the time series sample. Variables are described in Section 4. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003.

Panel A: Full Sample

	Mean	Median	St. Dev.	Min	Max
Expected Market Return (%)	8.914	8	10.350	-100	256
Expected Portfolio Return (%)	10.500	9	12.420	-80	300
Previous 12 Months Portfolio Return (%)	4.986	6	19.690	-95	300
Age (years)	48.360	47	12.760	18	85
Experience (years)	15.190	14	9.587	1	65
Education (categories)	2.822	3	0.985	1	4
White Indicator	0.900	1	0.300	0	1
Male Indicator	0.634	1	0.482	0	1
Income ($10,000's)	9.898	10	4.187	2	15
Assets Indicator	0.464	0	0.499	0	1
Investment Targets Optimism	3.509	4	1.172	1	5
Inv. Goals Optimism (5 years)	4.009	4	0.974	1	5
Income Optimism	3.941	4	1.081	1	5
Economic Growth Optimism	3.332	4	1.081	1	5
Unemployment Optimism	3.214	3	1.152	1	5
Stock Market Optimism	3.194	3	1.120	1	5
Inflation Optimism	3.312	3	1.083	1	5
N			22,069		

Panel B: Time Series Sample (portfolio, expectations, and optimism variables are averaged for each survey wave)

	Mean	Median	St. Dev.	Min	Max
Expected Market Return (%)	8.819	8.103	2.847	4.784	14.860
Next 12 Months Market Return (%)	-7.668	-13.890	18.130	-27.540	36.120
Previous 12 Months Market Return (%)	-9.179	-13.580	14.060	-27.540	19.530
Expected Portfolio Return (%)	10.390	9.623	3.253	6.028	18.030
Previous 12 Months Portfolio Return (%)	4.700	1.220	8.688	-7.213	21.920
Risk-free Rate (%)	2.878	2.034	1.827	0.954	6.020
Dividend Yield (%)	1.394	1.329	0.243	1.106	1.939
Term Premium (%)	1.427	1.660	1.218	-0.370	2.880
Investment Targets Optimism	3.497	3.485	0.346	2.890	4.112
Inv. Goals Optimism (5 years)	4.002	4.058	0.160	3.693	4.257
Income Optimism	3.935	3.929	0.157	3.598	4.204
Economic Growth Optimism	3.324	3.207	0.318	2.839	4.059
Unemployment Optimism	3.205	3.055	0.420	2.623	4.073
Stock Market Optimism	3.184	3.168	0.306	2.609	3.888
Inflation Optimism	3.311	3.305	0.109	3.116	3.688
N			40		

Panel C: Full Sample Correlations

	Expected Market Return	Expected Portfolio Return	Previous 12 Months Portfolio Return	Age	Experience	Education	White	Male	Income	Assets	Investment Targets Optimism	Investment Goals Optimism	Income Optimism	Economic Growth Optimism	Unemployment Optimism	Stock Market Optimism
Exp. Portfolio Return	0.605															
Previous 12 Months Portfolio Return	0.393	0.506														
Age	-0.078	-0.083	-0.068													
Experience	-0.085	-0.068	-0.044	0.607												
Education	-0.094	-0.085	-0.059	-0.088	0.071											
White	-0.079	-0.094	-0.050	0.121	0.120	-0.029										
Male	-0.075	-0.042	-0.076	0.000	0.041	0.034	0.001									
Income	-0.048	-0.013	-0.034	-0.133	0.081	0.316	-0.005	0.100								
Assets	-0.053	-0.024	-0.018	0.287	0.379	0.169	0.074	0.050	0.345							
Investment Targets Optimism	0.239	0.262	0.297	-0.014	0.021	-0.022	0.002	0.025	0.038	0.039						
Inv. Goals Optimism (5 years)	0.149	0.167	0.153	-0.067	0.012	0.058	0.012	0.049	0.130	0.089	0.569					
Income Optimism	0.138	0.168	0.157	-0.115	-0.041	0.037	-0.003	0.044	0.138	0.032	0.400	0.405				
Economic Growth Optimism	0.250	0.218	0.177	0.013	0.010	-0.020	0.012	0.058	0.007	0.026	0.431	0.363	0.301			
Unemployment Optimism	0.212	0.195	0.197	-0.014	-0.013	-0.018	0.038	0.044	0.016	0.016	0.353	0.282	0.248	0.555		
Stock Market Optimism	0.288	0.244	0.181	0.022	0.018	-0.028	0.011	0.050	0.004	0.042	0.449	0.378	0.293	0.604	0.447	
Inflation Optimism	0.078	0.071	0.012	0.041	0.051	0.049	0.043	0.131	0.092	0.084	0.214	0.231	0.175	0.364	0.353	0.328

Panel D: Time Series Correlations (portfolio, expectations, and optimism variables are averaged for each survey wave)

	Expected Market Return	Next 12 Months Market Return	Previous 12 Months Market Return	Expected Portfolio Return	Previous 12 Months Portfolio Return	Risk-free Rate	Dividend Yield	Term Premium	Investment Targets Optimism	Investment Goals Optimism	Income Optimism	Economic Growth Optimism	Unemployment Optimism	Stock Market Optimism
Next 12 Months Market Return	-0.505													
Previous 12 Months Market Return	0.922	-0.480												
Expected Portfolio Return	0.986	-0.469	0.927											
Previous 12 Months Portfolio Return	0.963	-0.482	0.925	0.969										
Risk-free Rate	0.924	-0.436	0.907	0.943	0.977									
Dividend Yield	-0.730	0.833	-0.677	-0.728	-0.771	-0.756								
Term premium	-0.742	0.408	-0.751	-0.771	-0.828	-0.900	0.742							
Investment Targets Optimism	0.949	-0.614	0.877	0.938	0.919	0.881	-0.772	-0.727						
Inv. Goals Optimism (5 years)	0.830	-0.686	0.683	0.808	0.807	0.780	-0.800	-0.692	0.917					
Income Optimism	0.922	-0.608	0.824	0.907	0.907	0.880	-0.787	-0.761	0.952	0.918				
Economic Growth Optimism	0.902	-0.446	0.886	0.892	0.865	0.802	-0.595	-0.538	0.891	0.703	0.809			
Unemployment Optimism	0.915	-0.376	0.924	0.928	0.931	0.904	-0.648	-0.714	0.862	0.660	0.821	0.943		
Stock Market Optimism	0.857	-0.521	0.756	0.839	0.768	0.707	-0.579	-0.468	0.922	0.832	0.838	0.889	0.767	
Inflation Optimism	0.388	-0.148	0.397	0.409	0.321	0.269	-0.131	0.021	0.406	0.265	0.287	0.630	0.485	0.614002655

Table 2 Testing the Rational Expectations Hypothesis for Market Returns: Regressions in the Full Sample

This table reports estimation results for testing the rational expectations hypothesis for investor expectations regarding next twelve months stock market returns. In Panel A, the dependent variable is next twelve market return, $R_{m,t,t+12}$, and the explanatory variable is investor expectations about next twelve months market returns, $E_{t,k}[R_{m,t,t+12}]$. The test of rational expectations in Panel A is given by

$$E[R_{m,t,t+12}] = a + b\ E\big[E_{t,k}[R_{m,t,t+12}]\big].$$

The rational expectations hypothesis implies that $a = 0$ and $b = 1$ above. In Panel B, the dependent variable is the residual from the specification in Panel A. The key independent variables are the previous twelve months market return, the risk-free rate, the dividend yield, and the term premium. Market (S&P500) returns from CRSP are rolling ex-dividend twelve month returns computed every month to match the monthly frequency of the survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). I further control for investor realized and expected portfolio returns, investor demographics (age, education, race, gender, income, wealth) as well as investor optimism. t-statistics are reported in parenthesis and are based on standard errors that are double clustered by survey year-month and cohort, i.e., year of initial investment in the stock market based on the experience variable and the survey wave year. All specifications also include cohort fixed effects. The key variables are described in Section 4. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003.

Panel A: Dependent Variable is Realized Market Return, $R_{m,t,t+12}$

Expected Market Return, $E_{t,k}[R_{m,t,t+12}]$	-0.221
	(-3.19)
Constant	-6.558
	(-2.02)
R-squared	0.018
N	22,069

Panel B: Dependent Variable is Residual from Rational Expectations Test in Panel A

	(1)	(2)	(3)	(4)
Previous 12 Month Market Return, $R_{m,t-12,t}$	-0.996	-0.807	-0.731	-0.736
	(-3.87)	(-4.98)	(-4.38)	(-4.42)
Risk-free Rate, $R_{f,t,t+12}$	14.523	13.984	11.629	11.45
	(5.38)	(10.16)	(5.57)	(5.52)
Dividend Yield, $Div_{m,t-12,t}/Price_{m,t}$		68.143	68.888	68.948
		(8.18)	(9.60)	(9.62)
Term Premium, $YTM_{10yr,t} - YTM_{1yr,t}$			-4.152	-4.215
			(-1.71)	(-1.74)
Expected Portfolio Return, $E_{k,t}[R_{k,t,t+12}]$				0.101
				(12.27)
Previous 12 Month Portfolio Return, $R_{k,t-12,t}$				0.009
				(2.25)
Demographic Controls	Yes	Yes	Yes	Yes
Optimism Controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
R-squared	0.62	0.86	0.87	0.88
N		22,069		

Table 3 Testing the Rational Expectations Hypothesis for Market Returns: Regressions in the Time Series Sample

This table reports estimation results for testing the rational expectations hypothesis for investor expectations regarding next year's stock market returns in the time series sample. In Panel A, the dependent variable is next twelve months market return, $R_{m,t,t+12}$, and the explanatory variable is average investor expectations about next twelve months market return, $\overline{E_{t,k}[R_{m,t,t+12}]}$. The test of rational expectations in Panel A is given by

$$E[R_{m,t,t+12}] = a + b\ E\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big].$$

The rational expectations hypothesis implies that $a = 0$ and $b = 1$ above. In Panel B, the dependent variable is the residual from the specification in Panel A. The key independent variables are last year's market return, the risk-free rate, the dividend yield, and the term premium. Market (S&P500) returns from CRSP are rolling ex-dividend twelve month returns computed every month to match the monthly frequency of the survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). I further control for average realized and expected investor portfolio returns and average investor optimism. In this sample, I average the answers to the UBS/Gallup survey across respondents in each survey wave to construct a time series measure of average expectations, portfolio realized returns, and optimism. t-statistics are reported in parenthesis and are based on the small-sample and heteroscedasticity correction of Davidson and MacKinnon (1993). The key variables are described in Section 4. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003.

Panel A: Dependent Variable is Market Return, $R_{m,t,t+12}$

Average Expected Market Return, $\overline{E_{t,k}[R_{m,t,t+12}]}$	-3.215
	(-3.11)
Constant	20.690
	(2.05)
R-squared	0.25
Adj. R-squared	0.24
N	40

Panel B: Dependent Variable is Residual from Rational Expectations Test in Panel A

	(1)	(2)	(3)	(4)
Previous 12 Month Market Return, $R_{m,t-12,t}$	-0.923	-0.643	-0.597	-0.854
	(-1.35)	(-1.47)	(-1.32)	(-2.03)
Risk-free Rate, $R_{f,t,t+12}$	12.665	8.675	10.098	1.625
	(2.56)	(2.08)	(2.30)	(0.24)
Dividend Yield, $Div_{m,t-12,t}/Price_{m,t}$		78.461	78.599	80.350
		(4.70)	(4.81)	(4.83)
Term Premium, $YTM_{10yr,t} - YTM_{1yr,t}$			3.487	-2.276
			(0.81)	(-0.43)
Ave. Expected Portfolio Return, $\overline{E_{k,t}[R_{k,t,t+12}]}$				1.256
				(0.75)
Ave. Previous 12 Month Portfolio Return, $\overline{R_{k,t-12,t}}$				3.967
				(1.61)
Average Optimism Controls	Yes	Yes	Yes	Yes
R-squared	0.48	0.82	0.82	0.87
Adj. R-squared	0.32	0.76	0.75	0.80
N			40	

Table 4 Summary Statistics for Realized and Expected Market Returns by Year

This table reports the summary statistics for the realized and expected market returns, including, mean, standard deviation (Std. Dev), minimum and maximum from the UBS/Gallup Poll. Expected market returns, $E_{t,k}[R_{m,t,t+12}]$, are calculated based on the survey question "What overall rate of return do you think the stock market will provide investors during the coming twelve months?" Panel B reports summary statistics for the same variables as in Panel A averaged by each monthly survey wave ($\overline{E_{t,k}[R_{m,t,t+12}]}$). In Panel C, I report summary statistics for the realized market returns, $R_{m,t,t+12}$. In Panels A and B, the sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003. In Panel C, the sample consists of the S&P500 returns for the January 1928 - April 2003 period. S&P500 returns are twelve month returns calculated on a rolling monthly basis.

Panel A: Summary Statistics for Expected Market Returns (Full Sample)

	Mean	Std. Dev.	Min	Max	N
			Year: 2000		
$E_{t,k}[R_{m,t,t+12}]$	12.563	10.306	-60	110	6,852
			Year: 2001		
$E_{t,k}[R_{m,t,t+12}]$	7.875	8.733	-74	93	6,833
			Year: 2002		
$E_{t,k}[R_{m,t,t+12}]$	7.002	10.355	-65	150	6,484
			Year: 2003 (Jan. - Apr.)		
$E_{t,k}[R_{m,t,t+12}]$	5.996	12.128	-100	256	1,900
			Jan. 2000 - Apr. 2003		
$E_{t,k}[R_{m,t,t+12}]$	8.914	10.346	-100	256	22,069

Panel B: Summary Statistics for Average Expected Market Returns by Survey Wave (Time Series Sample)

	Mean	Std. Dev.	Min	Max	Autocorrelation	N
				Year: 2000		
$\overline{E_{t,k}[R_{m,t,t+12}]}$	12.530	1.507	10.101	14.860	0.73	12
				Year: 2001		
$\overline{E_{t,k}[R_{m,t,t+12}]}$	7.897	1.069	5.952	9.574	0.52	12
				Year: 2002		
$\overline{E_{t,k}[R_{m,t,t+12}]}$	6.969	1.598	4.907	9.456	0.64	12
				Year: 2003 (Jan. - Apr.)		
$\overline{E_{t,k}[R_{m,t,t+12}]}$	5.998	0.816	4.784	6.551	-0.46	4
				Jan. 2000 - Apr. 2003		
$\overline{E_{t,k}[R_{m,t,t+12}]}$	8.819	2.846	4.784	14.860	0.92	40

Panel C: Summary Statistics for Next 12-Months Market Returns

	Mean	Std. Dev.	Min	Max	Autocorrelation	N
			Year: 2000			
$R_{m,t,t+12}$	-16.067	7.779	-27.536	-2.040	0.49	12
			Year: 2001			
$R_{m,t,t+12}$	-15.838	6.008	-24.736	1.115	0.46	12
			Year: 2002			
$R_{m,t,t+12}$	-4.280	18.270	-26.077	22.162	0.93	12
			Year: 2003 (Jan. - Apr.)			
$R_{m,t,t+12}$	31.865	4.045	26.380	36.116	0.87	4
			Jan. 2000 - Apr. 2003			
$R_{m,t,t+12}$	-7.667	18.130	-27.536	36.116	0.93	40
			Jan. 1928 - Apr. 2003			
$R_{m,t,t+12}$	7.619	21.192	-70.128	146.27	0.91	904

Table 5 Testing the Rational Expectations Hypothesis for Average Portfolio Returns: Equality in Means

This table reports results for testing the rational expectations hypothesis for investor expectations regarding next year's stock market returns. In Panel A, I use the full UBS/Gallup sample and test rational expectations using

$$E_{period}[R_{m,t,t+12}] - E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big] = 0.$$

In Panel B, I use the time series sample and test rational expectations using

$$E_{period}[R_{m,t,t+12}] - E_{period}\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big] = 0.$$

$E_{period}[R_{m,t,t+12}]$ is the average market returns in the corresponding corresponding sample period (e.g., 2000, 2001, etc.). $E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big]$ is the average expectation for next twelve months market returns in the corresponding sample period for the full UBS/Gallup sample. $\overline{E_{t,k}[R_{m,t,t+12}]}$ is the average expectation for next twelve months market returns per survey wave. The means, standard errors, and sample size for the equality-in-means tests are from Table 4. The t-statistics for the equality-in-means tests are reported in parenthesis (unequal variances t-test). t-statistics are calculated assuming that the means are uncorrelated across the UBS/Gallup sample and the stock market returns sample (equation (7)). In Panel A, the standard errors of $E_{period}[R_{m,t,t+12}]$ are corrected for first-order autocorrelation as in equation (6). In Panel B, all standard errors are corrected for first-order autocorrelations. Autocorrelations are reported in Table 4. The number in brackets are the number of observations in the calculation of the two means. The sample is the UBS/Gallup Investor Optimism Survey from January 2000 to April 2003. The sample of market returns consists of the S&P500 returns for the January 1928 - April 2003 period. S&P500 returns are annual returns for the next 12 months calculated on a rolling monthly basis.

Panel A: Testing the Rational Expectations in Means for the Full Sample

	2000	2001	2002	2003 (Jan. - Apr.)	Jan. 2000 - Apr. 2003
$E_{period}[R_{m,t,t+12}] - E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big]$	-28.630	-23.713	-11.282	25.869	-16.581
	(-11.10)	(-12.12)	(-0.78)	(6.29)	-2.12)
	[12; 6,852]	[12; 6,833]	[12; 6,484]	[4; 1,900]	[40; 22,069]

	2000	2001	2002	2003 (Jan. - Apr.)	Jan. 2000 - Apr. 2003
$E_{1928-2003}[R_{m,t,t+12}] - E_{period}\big[E_{t,k}[R_{m,t,t+12}]\big]$	-4.943	-0.255	0.617	1.623	-1.294
	(-2.83)	(-0.14)	(0.35)	(0.92)	(-0.74)
	[904; 6,852]	[904; 6,833]	[904; 6,484]	[904; 1,900]	[904; 22,069]

Panel B: Testing the Rational Expectations in Means for the Time Series Sample

	2000	2001	2002	2003 (Jan. - April)	Jan. 2000 - Apr. 2003
$E_{period}[R_{m,t,t+12}] - E_{period}\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big]$	-28.597	-23.735	-11.249	25.867	-16.486
	(-10.94)	(-12.00)	(-0.78)	(6.27)	(-2.11)
	[12; 12]	[12; 12]	[12; 12]	[4; 4]	[40; 40]

	2000	2001	2002	2003 (Jan. - Apr.)	Jan. 2000 - Apr. 2003
$E_{1928-2003}[R_{m,t,t+12}] - E_{period}\big[\overline{E_{t,k}[R_{m,t,t+12}]}\big]$	-4.910	-0.277	0.650	1.621	-1.199
	(-2.73)	(-0.15)	(0.36)	(0.90)	(-0.66)
	[904; 12]	[904; 12]	[904; 12]	[904; 4]	[904; 40]

Table 6 Testing the Rational Expectations Hypothesis for Market Returns: Regressions in the CFA Survey Sample

This table reports estimation results for testing the rational expectations hypothesis for investor expectations regarding next year's stock market returns in regressions from the CFO Survey. In Panel A, the dependent variable is next four quarters market return, $R_{m,t,t+4}$, and the explanatory variable is average investor expectations about next four quarters market return, $\overline{E_{t,k}[R_{m,t,t+4}]}$. The test of rational expectations in Panel A is given by

$$E[R_{m,t,t+4}] = a + b\ E\big[\overline{E_{t,k}[R_{m,t,t+4}]}\big].$$

The rational expectations hypothesis implies that $a = 0$ and $b = 1$ above. In Panel B, the dependent variable is the residual from the specification in Panel A. The key independent variables are last year's market return, the risk-free rate, the dividend yield, and the term premium. Market (S&P500) returns from CRSP are rolling ex-dividend four quarter returns computed every quarter to match the quarterly frequency of the survey. The risk-free rate is the one-month treasury yield bill from Eugene Fama's database. The dividend yield is the S&P500 dividend yield from CRSP. The term premium is the difference in the rates of a one- and ten-year Treasury bond from the Federal Reserve, H15 report (WRDS). In this sample, the answers to the CFO Survey are averaged across respondents in each survey wave to construct a time series measure of average expectations. The t-statistics are reported in parenthesis and are based on the small-sample and heteroscedasticity correction of Davidson and MacKinnon (1993). The key variables are described in Section 4. The sample is the CFO Survey from March 2004 to December 2018.

Panel A: Dependent Variable is Market Return, $R_{m,t,t+4}$

Average Expected Market Return, $\overline{E_{t,k}[R_{m,t,t+4}]}$	-2.395
	(-1.09)
Constant	20.584
	(1.57)
R-squared	0.04
Adj. R-squared	0.02
N	60

Panel B: Dependent Variable is Residual from Rational Expectations Test in Panel A

	(1)	(2)	(3)
Previous 4 Quarter Market Return, $R_{m,t,t-4}$	0.000	0.749	0.739
	(0.00)	(2.65)	(2.59)
Risk-free Rate, $R_{f,t,t+4}$	-1.034	2.340	2.569
	(-0.93)	(1.55)	(1.33)
Dividend Yield, $Div_{m,t,t-4}/Price_{m,t}$		45.415	44.936
		(3.80)	(3.78)
Term Premium, $YTM_{10yr,t} - YTM_{1yr,t}$			0.688
			(0.26)
R-squared	0.02	0.24	0.24
Adj. R-squared	-0.02	0.21	0.21
N		60	

Table 7 Summary Statistics for Realized and Expected Market Returns by Year: CFO Survey

This table reports the summary statistics for the realized and expected market returns, including, mean, standard deviation (Std. Dev), minimum and maximum from the CFO Survey. Expected market returns, $E_{t,k}[R_{m,t,t+4}]$, are calculated based on the survey question "What overall rate of return do you think the stock market will provide investors during the coming twelve months?" Panel A reports expected market returns, $E_{t,k}[R_{m,t,t+4}]$, averaged by each monthly survey wave ($\overline{E_{t,k}[R_{m,t,t+4}]}$). In Panel C, I report summary statistics for the realized market returns, $R_{m,t,t+4}$. In Panel A, the sample is the CFO Survey from March 2004 to December 2018. In Panel C, the sample consists of the S&P500 returns for the March 1928 - December 2018 period. S&P500 returns are four quarter returns calculated on a rolling quarterly basis.

Panel A: Summary Statistics for Expected Market Returns (CFO Survey)

	Mean	Std. Dev.	Min	Max	Autocorrelation	N
			Mar. 2004 - Dec. 2008			
$\overline{E_{t,k}[R_{m,t,t+4}]}$	5.866	1.203	3.340	7.790	0.75	20
			Mar. 2009 - Dec. 2013			
$\overline{E_{t,k}[R_{m,t,t+4}]}$	4.961	1.335	2.180	6.900	0.12	20
			Mar. 2014 - Dec. 2018			
$\overline{E_{t,k}[R_{m,t,t+4}]}$	5.202	0.939	3.130	6.570	0.59	20
			Mar. 2004 - Dec. 2018			
$\overline{E_{t,k}[R_{m,t,t+4}]}$	5.343	1.214	2.180	7.790	0.48	60

Panel B: Summary Statistics for Next 4-Quarters Market Returns

	Mean	Std. Dev.	Min	Max	Autocorrelation	N
			Mar. 2004 - Dec. 2008			
$R_{m,t,t+4}$	-1.529	18.453	-39.678	23.454	0.80	20
			Mar. 2009 - Dec. 2013			
$R_{m,t,t+4}$	15.793	11.226	-0.856	46.568	0.16	20
			Mar. 2014 - Dec. 2018			
$R_{m,t,t+4}$	9.092	8.514	-6.237	28.878	0.26	20
			Mar. 2004 - Dec. 2018			
$R_{m,t,t+4}$	7.785	15.011	-39.678	46.568	0.68	60
			Mar. 1928 - Dec. 2018			
$R_{m,t,t+4}$	7.807	21.218	-70.128	146.275	0.65	364

Table 8 Testing the Rational Expectations Hypothesis for Average Portfolio Returns: Equality in Means from CFO Survey

This table reports results for testing the rational expectations hypothesis for investor expectations regarding next year's stock market returns. I use the CFO Survey, and test rational expectations using

$$E_{period}[R_{m,t,t+4}] - E_{period}\left[\overline{E_{t,k}[R_{m,t,t+4}]}\right] = 0.$$

$E_{period}[R_{m,t,t+4}]$ is the average market returns in the corresponding corresponding sample period (e.g., 2000, 2001, etc.). $E_{period}\left[\overline{E_{t,k}[R_{m,t,t+4}]}\right]$ is the average expectation for next four quarters market returns in the corresponding sample period for the CFO Survey. $\overline{E_{t,k}[R_{m,t,t+4}]}$ is the average expectation for next four quarter market returns per survey wave. The means, standard errors, and sample size for the equality-in-means tests are from Table 7. The t-statistics for the equality-in-means are reported in parenthesis (unequal variances t-test). t-statistics are calculated assuming that the means are uncorrelated across the CFO and stock market return samples (equation (7)). t-statistics are based on standard errors corrected for first-order autocorrelations as in equation (6), which are also reported in Table 7. The numbers in brackets are the number of observations in the calculation of the two means. The sample is the CFO Survey from March 2004 to December 2018. The sample of market returns consists of the S&P500 returns for the January 1928 - December 2018 period. S&P500 returns are four quarter returns calculated on a rolling quarterly basis.

	March 2004 - Dec. 2008	March 2009 - Dec. 2013	March 2014 - Dec. 2018	March 2004 - Dec. 2018
$E_{period}[R_{m,t,t+4}] - E_{period}\left[\overline{E_{t,k}[R_{m,t,t+4}]}\right]$	-7.395	10.832	3.890	2.442
	(-1.06)	(4.23)	(1.96)	(0.92)
	[20; 20]	[20; 20]	[20; 20]	[60; 60]

	March 2004 - Dec. 2008	March 2009 - Dec. 2013	March 2014 - Dec. 2018	March 2004 - Dec. 2018
$E_{1928-2018}[R_{m,t,t+4}] - E_{period}\left[\overline{E_{t,k}[R_{m,t,t+4}]}\right]$	1.941	2.846	2.605	2.464
	(1.30)	(1.90)	(1.76)	(1.67)
	[364; 20]	[364; 20]	[364; 20]	[364; 60]