Earnings Belief Risk and the Cross-Section of Stock Returns*

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June 12, 2016

Abstract

This paper examines whether the risk arising from stochastic fluctuations in the average belief of investors about future stock earnings is priced. We construct the earnings belief measure using analysts' EPS forecasts and an EPS forecasting model, which primarily captures the subjective opinions of institutional investors and represents a random source of commonality. The average return on stocks with high exposure to

*We thank Yakov Amihud, Tim Baldenius, Michael Brennan, Stephen Brown, Francois Degeorge, Jerome Detemple, Olivier Scaillet, Fabio Trojani, and Jeffrey Wurgler for helpful comments and discussions, as well as participants of the 2013 NFA Annual Conference and the finance seminar at Shanghai Jiao Tong University. The financial support of the Swiss National Science Foundation and the NCCR-Finrisk Project C1 "Credit Risk and Non-Standard Sources of Risk in Finance" is greatly acknowledged. All errors are ours.

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earnings belief risk is 6.35%/year higher than that for stocks with low exposure. This positive relation between earnings belief risk and expected stock returns holds after accounting for traditional risk factors and is prominent among large-cap stocks.

Keywords: Analysts' EPS Forecasts; Asset pricing; Earnings Belief Risk; Commonality.

JEL codes: G11; G12.

I Introduction

Heterogeneity in investor beliefs plays an important role in explaining the formation of stock prices and it is well known that asset pricing models incorporating such heterogeneity are able to better account for stylized facts characterizing stock returns and to rationalize the existence of trading volume and of stock market bubbles and crashes. So far, the dominant stream of the literature on heterogeneous beliefs has been studying the impact of the dispersion in investor beliefs and its ability to overcome the empirically documented limitations of representative agent pricing models.[1]

While individuals, whether they are investors, portfolio managers, or financial analysts, are known to disagree, it is also interesting to observe that financial markets thrive at conforming and relying on consensus forecasts (issued by financial analysts, for instance), to extract information regarding market aggregate pessimism or optimism for trading and portfolio allocation purposes. This explains the popularity of various investor sentiment measures developed both in academic (described in the literature review section below) and in business settings to guide investors buying and selling decisions. Hence, the first moment of the distribution of investors' heterogenous beliefs could affect asset prices as well, yet paradoxically this question has received much less attention in the academic literature. Indeed, a less explored stream of the literature on heterogeneous beliefs have theoretically examined the impact of the average belief of investors on asset pricing. In particular, Jouini and Napp (2007) develop a model in which investors possess heterogeneous beliefs about the

[1] The role of the dispersion in investor beliefs has been studied extensively in the literature and in particular by Harrison and Kreps (1978), Varian (1985), Harris and Raviv (1993), Detemple and Murthy (1994), Zapatero (1998), Basak (2000), Scheinkman and Xiong (2003), Buraschi and Jiltsov (2006), Li (2007), Pavlova and Rigobon (2007), Dumas, Kurshev, and Uppal (2009), Xiong and Yan (2010).

growth rate of aggregate wealth. They show that, in the heterogeneous beliefs setting, the equilibrium risky asset price positively depends on the weighted average of the individual subjective beliefs when investors are cautious: an optimistic average belief increases the equilibrium risky asset price. Likewise, Kurz and Motolese (2011) derive a similar result, namely that the price of a risky asset is a linear function of the equally-weighted average of individual investors' beliefs about the asset's future payoffs, with a positive beta coefficient for the average belief factor.

Let us define the earnings belief measure as the cross-sectional mean of the average beliefs of investors – beyond or below the predictions stemming from a statistical forecasting model – about the future earnings of all stocks. One could view this measure as representing the average level of optimism or pessimism currently held by market participants regarding the short-term earnings prospects of a representative stock. A natural extension of the findings of the existing literature on average or aggregate belief is to explore the existence and the role of unexpected shocks in this measure for asset pricing. For that purpose, we examine whether the earnings belief fluctuates randomly over time and secondly if it is a source of commonality and thus, a non-diversifiable source of risk. When combined, these two properties would jointly imply that innovations in the earnings belief should depress stock prices. In support of our conjecture, we find that individual investors' beliefs and thus the earnings belief indeed evolve stochastically over time. In the models of Jouini and Napp (2007) and Kurz and Motolese (2011), investor beliefs are assumed to follow stochastic processes. Empirically, this conjecture is also supported by the fact that sentiment indices developed by, for example, Baker and Wurgler (2006, 2007) and Barone-Adesi et al. (2013) fluctuate stochastically over time. Moreover, we document that the earnings belief represents a random source of commonality, thus affecting individual stocks' average beliefs in a systematic manner.

The finding that the earnings belief is a random source of commonality motivates us to then posit and test our main hypothesis, namely that earnings belief risk arising from stochastic fluctuations in the earnings belief is priced in stock returns:

The Earnings Belief Risk Hypothesis: *Stocks with Higher Exposure to Earnings Belief Risk Earn a Higher Expected Return.*

This work focuses on the U.S. stock market, and relies on the actual EPS data and the analyst EPS forecast data provided by the Institutional Brokers' Estimate System (I/B/E/S) to construct the earnings belief measure. First, we adopt the econometric model proposed by Brown and Rozeff (1979) to objectively forecast EPS, and then calculate the average belief of investors for each stock as the mean analyst EPS forecast minus the one derived from the Brown and Rozeff (1979) EPS forecasting model. The earnings belief is defined as the cross-sectional mean of the price-scaled average beliefs of investors across all stocks in the sample. Innovations in the earnings belief are then estimated as the residuals of an autoregressive model that simultaneously eliminates the macroeconomic components from the earnings belief evolution. To test our main hypothesis, we finally form portfolios based on the sensitivity of each stock's excess returns to innovations in the earnings belief.

There are two points worth emphasizing. First, the analysis in Section V.C.1 shows that the earnings-derived measure of belief risk differs from earnings risk associated with changes in analysts' EPS forecasts and thus, earnings risk does not explain the cross-sectional effect of earnings belief risk on stock returns. Second, while previous studies (cited in the literature review section) have examined the impact of the dispersion in investor beliefs (i.e. the second moment of the belief distribution) on the pricing of common stocks, ours is the first one to empirically examine the impact of innovations in the average belief of investors (i.e. the first moment of the belief distribution) on the pricing of common stocks.

Our main findings can be summarized as follows: the average monthly return delivered by stocks with high exposure to earnings belief risk is significantly higher than that by stocks with low exposure, this positive relation being particularly strong in magnitude for large-cap and low to middle book-to-market stocks. An investment strategy that is long in stocks with high exposure to earnings belief risk and short in stocks with low exposure to earnings belief risk yields a significant alpha of 6.23%/year with the Fama and French (1993) model and 6.10%/year with the Carhart (1997) model, suggesting that the traditional three- and four-factor models cannot fully explain this pattern in stock average returns. These results are robust to controlling for earnings risk, volatility risk, liquidity risk, dispersion in analysts' EPS forecasts, and momentum. We also perform a cross-sectional test using the Fama-Macbeth (1973) two-stage regression approach applied to individual stocks, which shows that the earnings belief risk premium is significantly positive.

This paper provides several contributions to the growing literature on the impact of investors' subjective beliefs on stock returns:

First, we show that stochastic fluctuations in the earnings belief is a priced source of risk distinct from other sources of systematic risk which have been accounted for by standard asset pricing models. The issue as to whether the risk arising from stochastic fluctuations in the earnings belief is cross-sectionally priced in stock returns, although economically important, has so far been neglected in the empirical asset pricing literature and this study attempts to bridge that gap.

Second, this paper provides yet another potential explanation for the equity premium puzzle documented first by Mehra and Prescott (1985): part of the excess equity premium may represent a compensation for investors who have to bear systematic earnings belief risk.

Finally, we argue that the earnings belief measure that we construct primarily reflects the average subjective opinions of an important category of investors, namely institutional investors. So far, most extant measures, for instance, the closed-end fund discount or the Baker and Wurgler (2006) sentiment index, were designed to capture the opinions of retail investors. O'Brien and Bhushan (1990) conjecture that sell-side research analysts act as information intermediaries for institutional investors. Previous studies such as Brown et al. (2012), Chen and Cheng (2006), Costelle and Hall (2011), Fang and Kosowki (2007), Franck and Kerl (2013), and Malmendier and Shanthikumar (2009) reveal that institutional investors indeed rely on the information provided by research analysts to make their investment decisions. Particularly, Franck and Kerl (2013) and Malmendier and Shanthikumar (2009) document a positive correlation between changes in institutional investors' equity holdings and changes in analysts' EPS forecasts. Based on these studies, it is reasonable to conjecture that the earnings belief measure that we construct using the actual EPS data and the analyst EPS forecast data captures the average subjective opinions of institutional investors rather than retail investors.

II Literature review

While an abundant literature has studied the effect of the dispersion in investors' subjective beliefs on stock prices, the focus on the impact of the average belief of investors remains quite limited.

Jouini and Napp (2007) show that the introduction of heterogeneous beliefs into an otherwise standard competitive complete market economy has two distinct effects: the first one is associated with a change of the objective expectation to the aggregate belief defined as a weighted average of the individual subjective beliefs, and the second one is represented by a discount factor proportional to the belief dispersion. In their heterogeneous beliefs setting, the equilibrium asset price is increasing in the aggregate belief about the growth rate of aggregate wealth when investors are cautious while the discount factor lowers the risky asset price.

Kurz and Motolese (2011) develop a model in which investors differ in their beliefs about future asset payoffs. By assuming that individual investors' beliefs follow a stochastic AR(1) process, they show that the equilibrium asset price is positively related to the average belief of investors about the future prospects of asset payoffs.

On the empirical side, Diether et al. (2002) show a negative cross-sectional relation between the dispersion in investor beliefs, approximated by the disagreement among analysts' earnings forecasts, and expected stock returns, supporting Miller's (1977) view that the dispersion in investor beliefs is priced at a premium in the presence of short-sale constraints. In a similar vein, Yu (2011) starts by postulating that portfolio disagreement can alternatively be constructed bottom-up by aggregating analysts' disagreements regarding the individual assets in the portfolio. Bottom-up measures of disagreement should provide a better signal-to-noise ratio than the top-down market disagreement measures. Yu shows that the ex-post market return is negatively related to the bottom-up disagreement measure, consistent with Miller's conjecture. Using the diversity in analysts' forecasts measure of BKLS (1998), Doukas et al. (2006) however obtain an opposite result, and their finding is consistent with the predictions of models of Williams (1977), Mayshar (1983), and Epstein and Wang (1994) that the dispersion in investor beliefs is a priced source of risk. Anderson et al. (2005) provide further evidence that heterogeneity in investor beliefs is a priced risk factor and show that incorporating heterogeneous beliefs can improve the performance of traditional asset pricing models. A more recent paper by Anderson et al. (2009) focuses on the pricing of uncertainty in equity markets. The authors argue that uncertainty about stock returns is essentially related to the uncertainty about their mean. They then estimate the uncertainty about stock mean returns by relying on the disagreement among professional forecasters. More specifically, they rely on professionals' forecasts of aggregate corporate profits and measure the uncertainty as the dispersion in the forecasts of aggregate corporate profits. The authors find that stocks that covary strongly with their uncertainty measure carry a higher premium than those that are only weakly correlated with it. What makes our paper different from all these studies is that we examine the pricing of the risk arising from stochastic fluctuations in the average belief of investors while these authors instead explore whether the dispersion in investor beliefs matters for asset pricing.

Baker and Wurgler (2006) examine how the aggregate sentiment of investors affects the cross-section of stock returns and find that the cross-section of future stock returns is conditional on the beginning-of-period investor sentiment. When sentiment is estimated to be high, stocks that are attractive to optimists and speculators and at the same time unattractive to arbitrageurs – small stocks, younger stocks, growth stocks, unprofitable stocks, non-dividend paying stocks, volatile stocks, and distressed stocks – tend to earn relatively low subsequent returns. Conditional on low sentiment, however, these cross-sectional patterns disappear. The difference between Baker and Wurgler (2006) and this study is twofold: first, as will be seen in Section VI, the sentiment index developed by Baker and Wurgler (2006) captures the aggregate opinions of retail investors while our earnings belief measure primarily expresses the opinions of institutional investors; second, and more importantly, Baker and Wurgler (2006) examine the cross-sectional predictability of stock returns conditional on investor sentiment, while our aim is to study whether the risk associated with stochastic fluctuations in the earnings belief of institutional investors is priced.

Ben-Rephael et al. (2012) also study the relation between investor sentiment and stock returns, but at the market level. Using the aggregate net flows from bond funds to equity funds in the USA as a proxy for investor sentiment, they identify a significantly positive contemporaneous relation between monthly aggregate net flows to equity funds and stock market excess returns and that about 85% of these price changes are reversed within four months while the rest is reversed within ten months. Edelen and Warner (2001) and Goetzmann and Massa (2003) have similar findings based on higher frequency (daily) data.

Antoniou et al. (2015) find that investor sentiment influences the beta-return relation. When sentiment is optimistic, noise traders will strongly participate in high beta stocks which are then overpriced, obscuring the positive pricing of covariance risk. But, during pessimistic periods, such traders will stay along the sidelines so that traditional beta pricing prevails. This finding implies that the security market line is upward sloping only during pessimistic periods.

Our study also relates to Lee et al. (1991) who show that stocks and closed-end funds with high sensitivity to investor sentiment earn an extra return as a compensation for this additional source of risk. In contrast to Lee et al. (1991), we construct and use a different measure of investor beliefs that primarily captures the average opinions of institutional investors. Moreover, the aim of Lee et al. (1991) is to solve the closed-end fund puzzle, an issue left unexplored in our paper.

III Data

In light of difficulties in collecting the data on investors' direct opinions, we use analysts' forecasts as a proxy for institutional investors' opinions.

The analyst forecast data are taken from the Institutional Brokers' Estimate System (I/B/E/S) Summary History database that contains summary statistics for analysts' forecasts and the date when the forecast was last confirmed to be accurate. These data are usually disclosed on the third Tuesday of each month.[2]

I/B/E/S collects two categories of analyst forecast data: one concerns EPS (Earnings Per Share) and another concerns DPS (Dividends Per Share). DPS is sensitive to a firm's dividend payout policy whose impact is not easy to handle in empirical studies. More importantly, the analyst DPS forecast data only have a short history and the analyst coverage for DPS forecasts is also low. For these reasons, we use the analyst EPS forecast data in the following empirical analysis.[3]

In order to construct the earnings belief measure, we also need the actual EPS data. The actual EPS data provided by I/B/E/S are called the 'Street' EPS since they are tracked by financial analysts and followed by investors. COMPUSTAT provides the data of another category of actual EPS known as the GAAP EPS that are reported in firms' financial state-

[2]Diether et al. (2002) provide a detailed description of the I/B/E/S database

[3]If the payout ratios of firms are stable over time, the empirical results obtained with either the EPS or the DPS forecasts should be similar.

ments. Bradshaw and Sloan (2002) find that there exists a large and growing gap between the 'Street' EPS data and the GAAP EPS data since the former excludes cost items such as 'non-recurring' and 'no-cash' charges.[4]

The 'Street' EPS data are quantitatively consistent with analysts' EPS forecasts and thus used to construct the earnings belief measure although the GAAP EPS data have a longer history. The actual EPS data and the analyst EPS forecast data reported by I/B/E/S have different periodicities: quarterly, semi-annually, annually, etc. This study relies on the quarterly EPS data for the following reasons: first, the analyst coverage for quarterly EPS forecasts is higher (hence reflecting the opinions of a broader community of analysts and investors); second, in the accounting literature, the econometric models developed to forecast earnings are mainly intended for quarterly EPS.

Stocks used to construct the earnings belief measure are those with fiscal quarters ending in the months of March, June, September, and December since the majority of stocks traded in financial markets belong to this category. To be included in the construction of the earnings belief measure, stocks should also meet other two criteria: i) have no less than 30 consecutive observations of quarterly EPS during the period March 1983 through June 2009; ii) have the analyst EPS forecast and the model-implied EPS forecast for at least one quarter during the period August 1990 through August 2009.

Stock data such as prices, returns, trading volumes, the number of outstanding shares, etc. are taken from the Center for Research in Securities Prices (CRSP) Monthly Stocks Combined File that includes all stocks traded on NYSE, AMEX, and Nasdaq. Only ordinary

[4]The difference between the 'Street' and GAAP earnings has been discussed in Ciccone (2002), Cote and Qi (2005), and Zhang and Zheng (2011)

common shares (with CRSP share code 10 or 11) are used in this study. Moreover, to be included in the following portfolio performance analysis, stocks should have more than 24 quarters of return observations during the period August 1991 through August 2009.[5] The accounting data and, in particular, the book values of stocks' equity, the asset values, the debt values, the dividends, and the sales are from the COMPUSTAT-CRSP merged database.

IV Empirical methodology

In this section, we first explain how to construct the earnings belief measure using the actual EPS data and the analyst EPS forecast data. We then show that it is a source of commonality and abstract from its macroeconomic and predictable components to construct the earnings belief risk factor. We also discuss the accuracy of the earnings belief measure. Finally, we show how to construct stock portfolios to test the *earnings belief risk hypothesis*.

A Econometric EPS forecasting models

In the accounting literature, forecasting earnings is an important research topic, and many models have been proposed to undertake this task. In this study, the benchmark model that we use to forecast quarterly EPS is the linear time-series model proposed by Brown and Rozeff (henceforth BR), which takes the following form:

$$E_{s-1}(Q_s) = \delta + Q_{s-4} + \phi(Q_{s-1} - Q_{s-5}) + \theta\epsilon_{s-4} \tag{1}$$

where Q_{s-k} is the EPS for quarter $s-k$ and ϵ_{s-4} is the EPS shock experienced over quarter $s-4$. Typically, the trend term δ and the coefficient ϕ are both positive, and the coefficient

[5] The sample period for the EPS data is longer because more historical data are needed for forecasting quarterly EPS.

θ is negative. An advantage of the BR model is that it contains an autoregressive component $Q_{s-1} - Q_{s-5}$ reflecting the positive autocorrelations in seasonal differences of quarterly earnings at the first three lags and a moving average component ϵ_{s-4} reflecting the negative autocorrelation at the fourth lag.[6] Furthermore, the BR model also captures the seasonality characteristics in quarterly earnings data. The main reason behind the choice of the BR model is that, as Bathke and Lorek (1984) and Callen et al. (1996) both show, it yields better earnings forecasts than other linear time-series models and neural network models despite the fact that quarterly earnings data are financial, seasonal, and non-linear.

For robustness purposes, we also use the Seasonal Random Walk with Drift (henceforth SRWD) model to forecast quarterly EPS:

$$E_{s-1}(Q_s) = \delta + Q_{s-4} \tag{2}$$

Despite its simplicity, the SRWD model has been often used in previous studies such as Sadka (2006) and Konchitchki et al. (2013) who use it to estimate unexpected earnings shocks.

In both models, for each stock, the forecast of the one-quarter ahead EPS is derived using the coefficients estimated with 30 quarters of actual EPS observations.

B Earnings belief measure

Let $\mathrm{E}_t^{i,j}(\mathrm{EPS}_s)$ denote investor j's forecast of the EPS of stock i for quarter s conditional on the information available up to time t and $\mathrm{E}_t^{i,e}(\mathrm{EPS}_s)$ denote the forecast derived from an econometric model, where t can be any time after the EPS for quarter $s-1$ is known and before the EPS for quarter s is publicly disclosed. We define investor j's **belief** $g_t^{i,j}$ about

[6] Griffin (1977) and Foster (1977) document the existence of these autocorrelations in seasonal differences of quarterly earnings at the first four lags.

the EPS of stock i for quarter s as the difference between $\mathrm{E}_t^{i,j}$ (EPS $_s$) and $\mathrm{E}_t^{i,e}$ (EPS$_s$):[7]

$$g_t^{i,j} = E_t^{i,j}(EPS_s) - E_t^{i,e}(EPS_s) \tag{3}$$

A positive $g_t^{i,j}$ implies that investor j is optimistic relative to an econometrician about the EPS of stock i for quarter s. The average of individual beliefs across investors, denoted by Z_t^i, is equal to:

$$\begin{aligned} Z_t^i &= \frac{1}{M}\sum_{j=1}^{M} g_t^{i,j} \\ &= \frac{1}{M}\sum_{j=1}^{M}\left[E_t^{i,j}(EPS_s) - E_t^{i,e}(EPS_s)\right] \\ &= \overline{E}_t^i(EPS_s) - E_t^{i,e}(EPS_s) \end{aligned} \tag{4}$$

where M is the number of investors for stock i and $\overline{E}_t^i(\mathrm{EPS}_s)$ is the average forecast of investors.[8] Even if provided with the same set of information, investors may still form distinct beliefs about future EPS since they treat the information in different ways, and Z_t^i reflects the average belief of the M investors: the higher Z_t^i, the more optimistic the investors. We use the average of analysts' EPS forecasts provided by I/B/E/S as a proxy for $\overline{E}_t^i(\mathrm{EPS}_s)$, and $\mathrm{E}_t^{i,e}(\mathrm{EPS}_s)$ is estimated with the time-series models proposed in Section IV. A.

For stocks with fiscal quarters that end in March, June, September, and December, the actual EPS are disclosed respectively in the second half of April, July, October, and January. Analysts' EPS forecasts are usually released in the middle of each month. For a stock, as time moves towards next quarter's EPS release date, analysts' forecasts will gradually contain more public information about next quarter's actual EPS of the stock so

[7] Jouini and Napp (2007) and Kurz and Motolese (2011) define an investor's belief in a similar way.

[8] In Jouini and Napp (2007) and Xiong and Yan (2010), Z_t^i is the risk tolerance or wealth-weighted average belief. However, data on the weights of individual risk tolerances and wealth are empirically difficult to collect and compute. Thus, we rely on the equally-weighted average belief.

that Z_t^i constructed with those forecasts is more likely to reflect objective information instead of analysts' subjective judgment. For this reason, we only use the analyst EPS forecast data released in February, May, August, and November, that is, when analysts possess the least information about next quarter's EPS. This procedure shall enable us to focus on studying the impact of the most subjective opinions regarding stocks' quarterly EPS.

To enable comparison across stocks, we scale Z_t^i by P_{t-1}^i – the stock price observed at the end of previous month. We define the **earnings belief**, denoted by Z_t^m, as the cross-sectional average of price-scaled Z_t^i for all stocks in the sample:

$$Z_t^m = \frac{1}{N} \sum_{i=1}^{N} \frac{Z_t^i}{P_{t-1}^i}$$

where N is the number of sample stocks.[9] By definition, Z_t^m can be interpreted as a measure of the average belief of investors about the earnings of a stock representative of the overall economy, a positive Z_t^m indicating that investors are optimistic. It is worth noting that Z_t^m does only capture investors' average subjective belief about short-term earnings.[10]

INSERT FIGURE 1

The top graphs in Fig. 1 plot the time series of Z_t^m constructed with the BR and SRWD models during the period August 1990 through August 2009. The earnings belief fluctuates over time and declines sharply during recession periods such as the dot.com bubble burst

[9]The number of stocks used to compute Z_t^m varies between 602 and 1629, with an increasing trend over time during the sample period due to the fact that more stocks have been covered by financial analysts. In order to avoid the impact of outliers, we exclude the top and bottom 5% of values of price-scaled Z_t^i in the computation of Z_t^m. We also conduct robustness checks with Z_t^m computed by excluding the top and bottom 2.5% of values of price-scaled Z_t^i and with Z_t^m computed as the median of price-scaled Z_t^i, and the corresponding empirical results, as shown in Appendix Tables A.1 and A.2, are qualitatively similar as those obtained with the benchmark Z_t^m.

[10]This excludes the possibility that the results we obtain below are driven by the long-run equity risk premium.

at the beginning of the 21^{st} century and the 2007-2009 subprime mortgage crisis. Panel A of Table 1 reports summary statistics of the earnings belief measure, which indicate that investors were mostly optimistic during the sample period and that the distribution of the earnings belief measure is left-tailed, meaning that investors can, as suggested by Fig. 1, sometimes also become very pessimistic.

INSERT TABLE 1

C Commonality in belief

An assumption made in this study for developing the *earnings belief risk hypothesis* is that the movement in Z_t^m is a source of commonality affecting individual stocks' average beliefs.

To test whether there exists commonality in average belief among individual stocks, following the Chordia et al. (2000) method, we regress changes in the average belief for each individual stock on changes in the earnings belief, i.e.

$$CZ_t^i = \alpha_i + \beta_{i,1} CZ_{t-1}^m + \beta_{i,2} CZ_t^m + \beta_{i,3} CZ_{t+1}^m + \beta_X^{'} X_{i,t} + \varepsilon_{i,t} \tag{5}$$

where CZ_t^i denotes, for stock i, the change from time $t-1$ to t in the average belief Z_t^i,[11] and CZ_t^m denotes the concurrent change in the cross-sectional average of the same variable (i.e. the earnings belief Z_t^m). One lag and one lead of change in the earnings belief are included to capture any lagged adjustment in commonality. $X_{i,t}$ is the vector of changes in the following variables: the growth rate in industrial production index, the growth rate in consumer price index, the growth rate in employment, the federal funds rate, and the NBER economic recession dummy that equals 1 when the real economy is in a recession or 0 otherwise. These

[11] Only stocks with as least 30 observations of Z_t^i are considered in the examination of commonality in belief.

variables are included as control variables in the regression to ensure that the covariation in Z_t^i, if it exists, is not driven solely by the associated macroeconomic information used by financial analysts to forecast quarterly EPS. In each individual regression, the dependent variable stock is excluded when computing the earnings belief Z_t^m.

INSERT TABLE 2

Cross-sectional averages of time-series slope coefficients reported in Table 2 imply the existence of commonality in individual stocks' average beliefs. For instance, in the BR case and when we control for macroeconomic variables, the average value of the estimated coefficients $\beta_{i,2}$'s for the contemporaneous change in the earnings belief is 0.737 with a t-statistic of 7.23. About two thirds of these individual $\beta_{i,2}$'s are positive, while 17.84% exceeds the 5% one-tailed critical value. The average value of $\beta_{i,1}$'s, although small in magnitude, is also significantly positive. As revealed by its t-statistic, the combined contemporaneous, lag, and lead beta coefficient, labeled 'Sum', is highly significant. Commonality in average belief among individual stocks is even stronger in the SRWD case.

D Earnings belief risk factor

When forecasting quarterly EPS, financial analysts are likely to use other publicly available information about macroeconomic factors driving variations in stocks' earnings besides the firm specific information contained in historical earnings data. If this conjecture is true, then Z_t^m is not a purely subjective belief measure and the empirical results obtained with Z_t^m about the pricing of earnings belief risk could be driven by the cross-sectional differences in the sensitivity of excess stock returns to fluctuations in macroeconomic factors. As displayed in Panel B of Table 1, Z_t^m is in fact correlated with a set of macroeconomic variables such as the growth rate in industrial production index, the growth rate in the consumer price index, the growth rate in employment, the federal funds rate, and the NBER economic recession dummy. The correlations conform to our expectations: increases in industrial production, consumer price, employment, and the federal funds rate are accompanied by positive earnings belief shocks, while the economic recession decreases the earnings belief.[12]

Another issue that prevents us from directly using Z_t^m in the analysis is that it is autocorrelated and thus partially predictable. Indeed, in both the BR and SRWD cases, the autocorrelations of Z_t^m at the first lags are statistically significantly positive.[13]

To remove the macroeconomic and predictable components of Z_t^m, we run the following linear regression:

$$Z_t^m = \alpha_z + \sum_{i=1}^{6} \varphi_i Z_{t-i}^m + \beta_1 IPI_t + \beta_2 CPI_t + \beta_3 EMPL_t + \beta_4 RATE_t + \beta_5 DUM_t + \varepsilon_{z,t} \quad (6)$$

where Z_{t-i}^m is the lagged earnings belief in quarter $t-i$,[14] IPI_t is the growth rate in industrial production index, CPI_t is the growth rate in consumer price index, $EMPL_t$ is the growth rate in employment, $RATE_t$ is the federal funds rate, DUM_t is the NBER economic recession dummy that equals 1 when the real economy is in a recession or 0 otherwise, and $\varepsilon_{z,t}$ is the normally distributed error term. In the following empirical analysis, we rely on innovations in Z_t^m estimated in Eq. (7), denoted by $\mathbf{B}_t$, as the variable of interest and we call this risk source **earnings belief risk**.

[12]Baker and Wurgler (2006) use similar macroeconomic variables, a difference is that we also use the federal funds rate – a factor that has been shown to strongly influence the state of the economy.

[13]These results are available upon request.

[14]The lag order of Z_t^m in Eq. (7) is determined by fitting the time-series observations of Z_t^m into an autoregressive model. As a robustness check, we also use innovations in Z_t^m estimated as the residuals of a linear regression (the following one) that only controls for the one-quarter lagged aggregate belief:

$$Z_t^m = \alpha_z + \varphi_1 Z_{t-1}^m + \beta_1 IPI_t + \beta_2 CPI_t + \beta_3 EMPL_t + \beta_4 RATE_t + \beta_5 DUM_t + \varepsilon_{z,t}$$

The corresponding empirical results are presented in Appendix Table A.3.

E Private information and biased analysts' forecasts

Analysts' EPS forecasts may reflect not only analysts' subjective opinions and the public information conveyed by historical earnings data and macroeconomic factors, but also the private information about future EPS possessed by financial analysts. Such private information, if it exists, would bias Z_t^m as a measure of investors' average subjective belief.

Fig. 2 plots the time series of the ratios of stocks used to construct Z_t^m from each of the ten size deciles (relative to all sample stocks). As can be seen from this figure, stocks from the large size deciles account for a high total percentage, for instance, the ratio of stocks from the top five size deciles exceeds 75% of the entire sample in each sample month.

INSERT FIGURE 2

The Securities and Exchange Commission (SEC) approved the Selective Disclosure and Insider Trading Regulation on August 10, 2000, which prohibits the selective disclosure of material non-public information by issuers to any privileged individuals. This regulation, called Regulation Fair Disclosure (FD), states that "when an issuer, or persons acting on its behalf, discloses material non-public information to certain enumerated persons (in general, securities market professionals and holders of the issuers securities who may well trade on the basis of the information), it must make public disclosure of that information". The public disclosure should be made "simultaneously" for an intentional selective disclosure and "promptly" for a non-intentional selective disclosure by filling out Form 8–K or through any other medium capable of mass and unbiased distribution.[15]

[15] Irani and Karamanou (2003) provide a detailed discussion of 'Regulation Fair Disclosure' and how it affects analysts'earnings forecasts.

The aforementioned two stylized facts should mitigate the impact of private information on Z_t^m. First, private information is much less of a concern for large-cap stocks. Second, under regulation FD, the probability that financial analysts act on the basis of private information about future EPS is greatly reduced. Consequently, the private information component of Z_t^m should be negligible, and Z_t^m can be considered as a reliable measure of investors' subjective average belief.

There is evidence in the literature that analysts issue systematically biased EPS forecasts. De Bondt and Thaler (1985, 1987), LaPorta (1996), Dechow and Sloan (1997), and Brown (2001) show that analysts are usually optimistic about annual and long-term EPS forecasts, and O'Brien (1988) and Matsumoto (2002) show that analysts become slightly pessimistic as the forecasting horizon declines. However, our empirical analysis relies on innovations in the earnings belief, which, by definition, are invariant to the impact of a persistent bias in analysts' EPS forecasts.

F Earnings belief risk sensitivity based stock portfolios

The empirical model that we examine is

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,m} MKT_t + \beta_{i,\mathbf{B}}\, \mathbf{B}_t + \varepsilon_{i,t} \qquad \forall i \tag{7}$$

where $r_{i,t}$ is the return of stock i, $r_{f,t}$ is the 1-month riskless interest rate, MKT_t is the excess market return, and $\mathbf{B}_t$ is the earnings belief risk factor. The coefficient $\beta_{i,\mathbf{B}}$, called **earnings belief beta**, measures the sensitivity of stock i's excess returns to innovations in the earnings belief (i.e. stock i's exposure to earnings belief risk). MKT_t is included as a control variable in the regression so that the empirical results about the pricing of earnings belief risk are obtained after controlling for stocks' exposure to pure stock market risk.

Previous empirical studies argue that there are other cross-sectional factors with explanatory power for the cross-section of stock returns, such as the size and value factors of the Fama and French (1993) model. We do not directly model these effects in Eq. (8) because controlling for other factors in constructing portfolios based on Eq. (8) may add a lot of noise. Although we keep the number of regressors in the earnings belief beta estimating regression to a minimum, we will carefully control for the Fama and French (1993) three factors and other cross-sectional factors when testing whether earnings belief risk is priced.

At the beginning of each month of March, June, September, and December during the period December 1997 through September 2009, stocks are sorted into five equal portfolios based on the coefficient $\hat{\beta}_{\mathbf{B}}$ estimated with data observed from the previous 24 quarters: stocks with $\hat{\beta}_{\mathbf{B}}$ in the first quintile are sorted into the first portfolio, stocks with $\hat{\beta}_{\mathbf{B}}$ in the second quintile are sorted into the second portfolio, and so forth.[16] Portfolios are held for three months, and the portfolio return is computed as the equally-weighted average of the returns of all stocks held in the portfolio.[17]

V Empirical results

In this section,[18] we first present the main empirical results about the cross-sectional effect of earnings belief risk on stock returns, and then conduct numerous robustness tests to provide further support on the pricing of earnings belief risk.

[16]The earnings belief beta in Eq. (8) is estimated with the preceding 24 quarters of the data on innovations in the earnings belief for the time period between February 1991 and August 2009, this means that the estimated earnings belief beta is available starting in December 1996, the date as of which we can form stock portfolios.

[17]The empirical results for the value-weighted portfolio returns are reported in Appendix Table A.4, and they are even more pronounced.

[18]We mainly report the empirical results obtained with the BR EPS forecasting model, the results obtained with the SRWD model are shown in Appendix Table A.5.

A Basic results

Panel A of Table 3 reports summary statistics of monthly returns delivered by portfolios formed on earnings belief beta: minimum, maximum, mean, standard deviation, skewness, and kurtosis. The returns on the highest and lowest earnings belief beta portfolios have similar volatilities. The return distribution of each portfolio is left-skewed with heavy tails, indicating that it suffers infrequent yet large losses.

INSERT TABLE 3

The relation between earnings belief risk and expected stock returns is strictly positive, and portfolios composed of stocks with higher earnings belief betas deliver higher returns. Specifically, the average return on the highest earnings belief beta portfolio is 0.989%/month, 0.529% (i.e. 6.35%/year) higher than the one on the lowest earnings belief beta portfolio and the difference is statistically significant at the 5% level. This result provides preliminary support for the *earnings belief risk hypothesis*.

A.1 Double-sorting by size and earnings belief beta

We double-sort stocks based on market capitalization and earnings belief beta in order to test whether the return pattern across earnings belief beta quintiles captures a size effect in stock returns. At the beginning of each month of March, June, September, and December during the period December 1997 through September 2009, stocks are sorted into five equal portfolios based on market capitalization at the end of previous month. Within each size quintile, we run a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor, and stocks are then sorted into five further equal portfolios based on earnings belief beta.

Panel B.1 of Table 3 shows that the positive relation between earnings belief risk and expected stock returns prevails within four out of the five size quintiles. Within the fourth size quintile, the average return on the highest-minus-lowest belief beta portfolio is 0.715%/month with a t-statistic of 2.09, and within the second and fifth size quintiles, the average returns are respectively 0.753%/month and 0.740%/month and statistically significant at the 1% level. These results suggest that the size effect cannot by itself explain the cross-sectional variations in the returns of portfolios formed on stock's exposure to earnings belief risk.

The cross-sectional effect of earnings belief risk is stronger for large-cap stocks. Within the two largest size quintiles, the average return on the highest earnings belief beta portfolio is more than 150% higher than the one on the lowest earnings belief beta portfolio, while the difference between the average returns on the highest and lowest earnings belief beta portfolios is smaller within the other three size quintiles and even negative within the smallest size quintile. Diether et al. (2002) find that stocks covered by financial analysts are mostly issued by large firms, and Fig. 2 also illustrates that the majority of stocks used to construct the earnings belief measure have large market capitalizations (75% of them belong to the five largest size deciles). Thus, the earnings belief measure constructed with the analyst EPS forecast data in this study primarily reflects investors' subjective belief about the earnings of large firms and should be more relevant for the analysis of the cross-sectional effect of earnings belief risk on the returns of large-cap stocks. Incidentally, these stocks are also the ones that are the most prevalent within the portfolios held by institutional investors.

A.2 Double-sorting by book-to-market ratio and earnings belief beta

We also test whether the return pattern across earnings belief beta quintiles captures a value effect in stock returns by double-sorting stocks based on book-to-market ratio and earnings belief beta. At the beginning of each month of March, June, September, and December during the period December 1997 through September 2009, stocks are sorted into five equal portfolios based on book-to-market ratio, and within each book-to-market quintile, stocks are then sorted into five further equal portfolios based on earnings belief betas estimated with observations in the preceding 24 quarters. The book value of equity is defined as the COMPUSTAT book value of stockholders' equity, plus the balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Depending on availability, we use redemption, liquidation, or par value (in that order) to estimate the book value of preferred stock. To ensure that the book value of equity is already known to the market before the returns that it is used to explain, we match the book value of equity for all fiscal years ending in calendar year $y-1$ with returns starting in July of year y. The book value of equity is then divided by the market value of equity at the end of previous month to form the book-to-market ratio.

We observe in Panel B.2 of Table 3 that the highest earnings belief beta portfolio earns a higher average return than the lowest earnings belief beta portfolio within all the book-to-market quintiles and the return pattern is more pronounced for stocks with low book-to-market ratios. The difference between the average returns on the highest and lowest earnings belief beta portfolios exceeds 0.5%/month within the first three book-to-market quintiles and is statistically significant at the 1% level within the second and third book-to-market quintiles. Finally, stocks with low book-to-market ratios usually tend to have large market capitalization, thus, the results in this subsection echo the findings in Section V.A.1.

B Regression results

Fama and French (1996) show that sorting stocks on variables such as the book-to-market ratio, the earnings-to-price ratio, or the cash-flow-to-price ratio produces a strong ordering of returns across deciles. However, they also argue that estimates of three-factor time-series regressions imply that the three-factor model captures these patterns in average returns. Along these lines, we conduct similar tests to see if the return patterns observed in Table 3 could be explained by conventional risk factors. Table 4 presents the risk-adjusted returns (i.e. alphas) of portfolios formed on earnings belief beta, evaluated respectively with the Fama and French (1993, FF) three-factor model and the Carhart (1997) four-factor model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,m} MKT_t + \beta_{i,s} SMB_t + \beta_{i,h} HML_t + \varepsilon_{i,t} \tag{8}$$

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,m} MKT_t + \beta_{i,s} SMB_t + \beta_{i,h} HML_t + \beta_{i,u} UMD_t + \varepsilon_{i,t} \tag{9}$$

where $r_{i,t}$ is the return of portfolio i, $r_{f,t}$ is the 1-month riskless interest rate, MKT_t is the excess market return, SMB_t is the excess return of small-cap stocks over large-cap stocks, HML_t is the excess return of value stocks over growth stocks, UMD_t is the excess return of prior month winning stocks over losing stocks, and $\varepsilon_{i,t}$ is the normally distributed error term.

INSERT TABLE 4

The alphas delivered by earnings belief beta portfolios exhibit a cross-sectional pattern similar to the one of those portfolios' average returns. Specifically, in the FF case, the alpha strictly increases in the portfolio's exposure to earnings belief risk. The lowest earnings belief beta portfolio delivers a marginally significant negative alpha of -0.245%/month, while the highest earnings belief beta portfolio delivers a positive alpha of 0.275%/month with a *t*-statistic of 1.85, and the alpha of the highest-minus-lowest earnings belief beta portfolio is 0.520%/month and statistically significant at the 1% level, meaning that an investment strategy that is long in the highest earnings belief beta portfolio and short in the lowest earnings belief beta portfolio delivers a significant yearly alpha of 6.24% that cannot be explained by the three factors of the FF model. The results in Panel B of Table 4 show that the pattern observed in the alphas persists in the presence of the Cahart momentum factor.

C Robustness checks

The above-presented results support the *earnings belief risk hypothesis* in that stocks with higher exposure to earnings belief risk earn higher expected and abnormal returns. However, it is possible that these results are driven by model mis-specifications or alternative explanations. To address these concerns, we next perform a series of robustness tests.[19]

C.1 Earnings Risk

Da and Warachka (2009) and Ball, Sadka, and Sadka (2009) show that earnings risk arising from changes in aggregate earnings is a priced risk factor and that stocks with higher sensitivities to aggregate earnings changes earn higher returns.[20] When estimating the earnings belief, we use data on analysts' EPS forecasts whose variations may drive changes in the

[19] Besides the robustness checks in Subsections V.C.1 –V.C.6, we also examine the cross-sectional effect of earnings belief risk over two sub-sample periods: one extends from December 1997 to November 2003 and the other extends from December 2003 to November 2009, and the results are reported in Appendix Table A.6

[20] Refer to Ball and Sadka (2015) for a review of the earnings risk literature.

earnings belief. Thus, one could argue that our results are simply attributable to the cross-sectional effect of earnings risk on stock returns. To examine this issue, we construct the earnings risk factor as changes in the aggregate analyst EPS forecast, which is defined as the equally-weighted average of the price-scaled average quarterly EPS forecasts of analysts for all stocks in the sample. We find that the correlation between this factor and the earnings belief risk factor $\mathbf{B}_t$ is very low and equals -0.048 (-0.043 in the SRWD case). This result implies that earnings belief risk is not in anyway subsumed by changes in expected aggregate earnings and thus it is unlikely that earnings risk could explain the cross-sectional effect of earnings belief risk on stock returns.

C.2 Volatility risk

Campbell (1993, 1996) develops a two-factor intertemporal capital asset pricing model in which an increase in market volatility predicts a decrease in optimal consumption and hence an unfavorable shift in the investment opportunity set. In this setting, risk-averse investors will demand more of a stock whose returns are more positively correlated with fluctuations in market volatility given that it is perceived as a hedging instrument against volatility risk. In other words, an increase in the covariance of returns with volatility risk leads to an increase in agents' hedging demand, which, in equilibrium, reduces the expected return required on these stocks. Ang, Hodrick, Xing, and Zhang (2006) find empirical evidence of a negative volatility risk premium: stocks with higher exposure to changes in the S&P index option implied volatility (VIX) deliver lower returns the next month. In practice, the VIX index is often used to measure investor sentiment. If the earnings belief measure that we construct is highly correlated with the VIX or any other volatility index, then the positive earnings belief risk premium may merely represent the compensation for investors holding stocks with low exposure to volatility risk.

INSERT TABLE 5

We address this possibility by double-sorting stocks into 5×5 portfolios based on volatility and earnings belief betas that are simultaneously estimated in a regression that is obtained by extending Eq. (8) using the volatility risk factor – changes (i.e. first-order differences) in the monthly VIX. Panel A of Table 5 displays the average monthly returns on the underlying portfolios. An investment strategy that is long in stocks with high exposure to earnings belief risk and short in stocks with low exposure to earnings belief risk delivers a positive average monthly return within each volatility beta quintile, which is further statistically significant at the 5% level within the third and fourth volatility beta quintiles. This result implies that the positive relation between earnings belief risk and expected stock returns cannot be attributed to volatility risk.

C.3 Liquidity risk

Pastor and Stambaugh (2003) test whether aggregate stock market liquidity is a state variable that is important for asset pricing and find that expected stock returns are related cross-sectionally to their sensitivity to stochastic fluctuations in aggregate liquidity. Stocks that are more sensitive to aggregate liquidity have substantially higher expected returns (7.5% per year), even after accounting for their exposure to the market return as well as to the size, value, and momentum factors.

We next control for liquidity risk when testing the earnings belief risk hypothesis. For this purpose, as in the volatility risk case, we double-sort stocks into 5×5 portfolios based on their liquidity and earnings belief betas. These betas are simultaneously estimated in a regression that is obtained by extending Eq. (8) with the Pastor and Stambaugh (2003) liquidity risk factor (innovations in aggregate liquidity). The results in Panel B of Table 5 show that double-sorting on liquidity and earnings belief betas does not alter the positive relation between earnings belief risk and expected stock returns, particularly for stocks with low to medium exposures to liquidity risk.

C.4 Divergence of opinion

Diether et al. (2002) identify a negative cross-sectional relation between the divergence of opinion across investors, approximated by the dispersion in analysts' earnings forecasts, and future stock returns, supporting Miller's (1977) view that the divergence of opinion is priced in the presence of short-sale constraints. Stocks with higher exposure to earnings belief risk might also have lower divergence of opinion so that the return pattern across earnings belief beta quintiles is attributed to the cross-sectional effect of the divergence of opinion on stock returns. We address this concern by double-sorting stocks into 5×5 portfolios based on the dispersion in analysts' EPS forecasts (scaled by the absolute value of the mean earnings forecast at the end of previous month) and on earnings belief beta. Stocks with zero mean earnings forecast are discarded.

When looking at Panel C of Table 5, we observe that the highest earnings belief beta portfolio generates a significantly higher average return than the lowest earnings belief beta portfolio within all but the fourth dispersion quintiles. Thus, the return pattern across earnings belief beta quintiles is not driven by the cross-sectional effect of the divergence of opinion. It can furthermore be observed in Panel C that unlike in Diether et al., there exists no clear return pattern across dispersion quintiles, this may be due to the different data and time periods used in this study.

C.5 Momentum

An issue that arises in computing the earnings belief Z_t^m as defined in Eq. (5) is that scaling Z_t^i by the stock price observed at the end of previous month P_{t-1}^i may generate artificial predictability because of the strong predictive power of past returns. We further address this concern. Panel D of Table 5 reports the results for portfolios formed based on the stock's cumulative return over the previous 12-month period and on earnings belief beta. While controlling for stocks with both strong and weak past performance, we see that the return pattern across earnings belief beta quintiles is much stronger and statistically significant for stocks with stronger past performance.

C.6 Different Holding Periods

We also examine the long-term predictability of stock returns conditional on earnings belief beta. The average returns and alphas of portfolios formed on earnings belief beta and held respectively for six, nine, and twelve months are reported in Table 6.

INSERT TABLE 6

Holding portfolios for a longer time clearly reduces the outperformance of the high-earnings belief-beta portfolio. The difference between the average monthly returns of the high- and the low-earnings belief-beta portfolios declines by over 15% and is reduced from 0.529% respectively to 0.389%, 0.452%, and 0.426% for portfolios held for six, nine, and twelve months. A similar result also holds for portfolios' alphas. A stock's exposure to earnings belief risk is supposed to change over time, stocks remaining in a portfolio for a longer time are then less likely to meet the portfolio selection criteria. Despite the drop in the outperformance over longer holding periods, portfolios with higher exposure to earnings belief risk still earn significantly higher expected returns, even in the case where portfolios are held for as long as twelve months, suggesting that stocks' compensation for bearing earnings belief risk is a rather persistent phenomenon.

D Cross-Sectional Regression Results

The empirical results displayed above show a strong and persistent return pattern related to the spread in earnings belief risk factor loadings. The conjecture that earnings belief risk is a priced factor in the cross-section of stock returns however still needs to be explicitly tested. Following Fama and Macbeth two stage approach (1973, FM henceforth),[21] we first use the following augmented FF model to estimate stocks' beta sensitivities:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{iMKT} MKT_t + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + \beta_{i\mathbf{B}} \mathbf{B}_t + \varepsilon_{i,t} \quad (10)$$

where $r_{i,t}$ is the return of stock i, $r_{f,t}$ is the 1-month riskless interest rate, MKT_t is the excess market return, SMB_t is the excess return of small-cap stocks over big-cap stocks, HML_t is the excess return of value stocks over growth stocks, and $\mathbf{B}_t$ is the earnings belief risk factor.

We then test cross-sectionally if stocks' excess returns are related to their risk factor betas:

$$r_{i,t} - r_{f,t} = \gamma_0 + \gamma_{MKT} \beta_{iMKT,t-1} + \gamma_{SMB} \beta_{iSMB,t-1} + \gamma_{HML} \beta_{iHML,t-1} + \gamma_{\mathbf{B}} \beta_{i\mathbf{B},t-1} + u_{i,t} \quad (11)$$

[21] Unlike FM, we use individual stocks rather than stock portfolios in the cross-sectional test of asset pricing. Ang et al. (2010) show that using portfolios does not necessarily lead to more accurate estimates of factor risk premiums, and some recent studies such as Chen and Petkova (2012) and Lin et al. (2011) use individual stocks or corporate bonds in their cross-sectional tests.

Stocks with higher systematic risks should earn higher expected returns. In particular, if earnings belief risk is a systematic risk factor priced in the cross-section of stock returns, $\gamma_{\mathbf{B}}$ should be significantly positive.

Betas are estimated over rolling prior 24-quarter periods for each stock and then used in the cross-sectional regression over the next three months.[22] A bias associated with the cross-sectional regression test is that beta estimates used in Eq. (12) are subject to measurement errors. We resolve this errors-in-variables problem using the Shanken (1992) method. Column I of Table 7 reports the time-series average values of the estimated risk premiums with robust t-statistics in underlying parentheses.

INSERT TABLE 7

Earnings belief risk yields a positive premium: $\hat{\gamma}_{\mathbf{B}}$ is 0.00287% and is statistically significant at the 5% level. Note that the magnitude of the earnings belief risk premium $\hat{\gamma}_{\mathbf{B}}$ depends on the arbitrary scaling of $\mathbf{B}_t$, but that scaling does not affect the t-statistic of $\hat{\gamma}_{\mathbf{B}}$ and the contribution of earnings belief risk to a stock's expected return. The spread in earnings belief betas between portfolios with high and low exposures to earnings belief risk is 178.03. Given the estimate of the price of earnings belief risk, the spread in the earnings belief risk factor loadings accounts for $178.03 \times 0.00287\% \approx 0.511\%$ of the difference in average returns, which is close to the average raw return difference of 0.529% per month previously observed on portfolios with high and low exposures to earnings belief risk. The estimated premiums associated with the MKT, SMB, and HML betas are positive but in-

[22]Note that we only have quarterly data of estimated belief betas $\hat{\beta}_{\mathbf{B}}$. A $\hat{\beta}_{\mathbf{B}}$ is used for three months subsequent to the month when it is estimated.

significant.[23] Note that Ang, Hodrick, Xing, and Zhang (2006) also find insignificant risk premium estimates for these risk factors.

When we add the momentum (UMD) factor in Eq. (11) and Eq. (12), the estimated earnings belief risk premium changes slightly. In this case, as shown in Column II of Table 7, $\hat{\gamma}_{\mathbf{B}}$ rises from 0.00287% to 0.00324% while its statistical significance remains. Similar results are obtained when the liquidity (LIQ) and volatility (VIX) risk factors are further added.

VI Earnings belief and investor sentiment measures: a discussion

A variety of investor sentiment measures have been proposed in the literature.[24] In this subsection, we discuss three well-known sentiment measures, and compare them with the earnings belief measure that we construct in this study.

Closed-end funds are investment companies issuing a fixed number of shares traded on stock exchanges. The closed-end fund discount is the first sentiment measure used for comparison, and it is calculated as the difference between the net asset value of a fund's actual security holdings and the fund's market price. Lee et al. (1991) argue that if closed-end funds are disproportionately held by retail investors, then the average discount on closed-end funds may represent a small investor sentiment measure, with the discount increasing when retail investors become bearish.

Mutual fund flows were also used as a sentiment measure in previous studies such as the ones by Brown et al. (2002) and by Ben-Rephael et al. (2012). Investors move their

[23] The value factor risk premium is significantly positive at the 5% level over the sub-sample period December 2003 through November 2009.

[24] Baker and Wurgler (2007) provide a detailed discussion of some of these sentiment measures.

money into and out of mutual funds with different levels of risk, and the changes in mutual fund flows should reflect investors' sentiment about market conditions. Following Baker and Wurgler (2007), and relying on the monthly net flows data of eight equity-oriented categories of mutual funds provided by the Investment Company Institute, we adopt the principal component analysis approach to extract two main components from the changes in mutual fund flows, which together can explain about 87% of variations in net flows within the eight categories of mutual funds.[25] These two principal components are then used as the second proxy for investor sentiment.

We use the Baker and Wurgler (2006) index as the third sentiment proxy. The authors construct their index based on the common variation in six underlying proxies for investor sentiment: the closed-end fund discount; the NYSE share turnover (the ratio of reported share volume to average shares listed from the NYSE Fact Book); the number of IPOs; the average first day returns on IPOs; the equity share in new issues; the dividend premium (the log difference of the average market-to-book ratios of payers and non-payers). They start by estimating the first principal component of the six proxies and their lags. This yields a first-stage index with 12 loadings, one for each of the current and lagged proxies. Then, they compute the correlation between the first-stage index and the current and lagged values of each of the proxies. Finally, they define the sentiment index as the first principal component of the correlation matrix of six variables – each respective proxy's lead or lag, whichever has the higher correlation with the first-stage index – rescaling the coefficients so that the index has unit variance.

[25] The eight equity-oriented categories of mutual funds include: "Aggressive Growth", "Growth", "Balanced", "Growth and Income", "Sector", "Income Equity", "Income Mixed", and "Asset Allocation". We thank Jeffrey Wurgler for sharing his mutual fund flows data (until May 2006) with us.

INSERT FIGURE 3

The graphs in Fig. 3 plot the time series of the earnings belief measures constructed with the BR model and the SRWD model and of the above cited sentiment measures, and they show that there is no clear common pattern to be distinguished in the pairwise evolution of the earnings belief and other sentiment measures over time. Indeed, the correlations between our earnings belief measure and the sentiment measures are rather low and vary from -0.152 (-0.223) to 0.016 (0.125) in the BR (SRWD) case.

The earnings belief measure and the above three sentiment measures differ along several dimensions although they have all been proposed to capture investors' subjective opinions. First, they are constructed with different data. We use analysts' EPS forecasts to construct the earnings belief measure, while the other sentiment measures are constructed with the closed-end fund discount, mutual fund flows, share turnover, etc. Second, the underlying estimation techniques are different. Third, and most importantly, the other sentiment measures capture the opinions of different categories of investors. Baker and Wurgler (2007), Ben-Rephael et al. (2012), and Lee et al. (1991) argue that their sentiment measures primarily express the opinions of retail investors or noise traders who, on average, are less sophisticated. As explained in Section I, the earnings belief measure that we construct, by contrast, captures the average opinions of institutional investors. Due to these differences, it is not surprising that the earnings belief measure and the other sentiment measures are only weakly correlated.

VII Conclusion

In this paper, we use the actual EPS data and the analyst EPS forecast data provided by I/B/E/S to construct the earnings belief measure as the cross-sectional mean of the average beliefs of investors about the future earnings of all sample stocks, with the average belief for each stock being defined as the mean analyst EPS forecast minus the forecast derived from an econometric EPS forecasting model. We then test the *earnings belief risk hypothesis* and examine whether earnings belief risk – the risk arising from stochastic fluctuations in the earnings belief – is priced in the cross-section of stock returns. We find that an investment strategy that is long in stocks with highest exposure to earnings belief risk and short in stocks with lowest exposure to earnings belief risk delivers an average yearly return of 6.35%. This positive relation between earnings belief risk and expected stock returns persists after accounting for traditional risk factors and for portfolios double-sorted on the basis of the stocks' size or book-to-market ratio characteristics. These findings are robust to controlling for earnings risk, volatility risk, liquidity risk, dispersion in analysts' EPS forecasts, and momentum. Moreover, the earnings belief risk premium is significantly positive for the cross-section of individual stock returns based on the Fama-Macbeth two stage testing procedure.

The question as to whether the risk arising from stochastic fluctuations in the average belief of institutional investors – the largest category of investors active in U.S. financial markets – is priced is economically relevant, but has so far not been addressed empirically. It would be interesting in the future to examine whether earnings belief risk is priced in other asset classes and in other countries. Finally, developing a theoretical model that endogeneizes earnings belief risk into an extended asset pricing framework seems a promising area for future research to shed light on its potential ability to rationalize some well-known asset pricing puzzles.

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Figure 1

The top graphs plot the time series of the earnings belief constructed respectively with the Brown and Rozeff (1979, BR) model and the Seasonal Random Walk with Drift (SRWD) model, and the bottom graphs plot innovations in the earnings belief estimated as the residuals of a linear regression model proposed in Section III.B. The data covers the sample period August 1990 through August 2009.

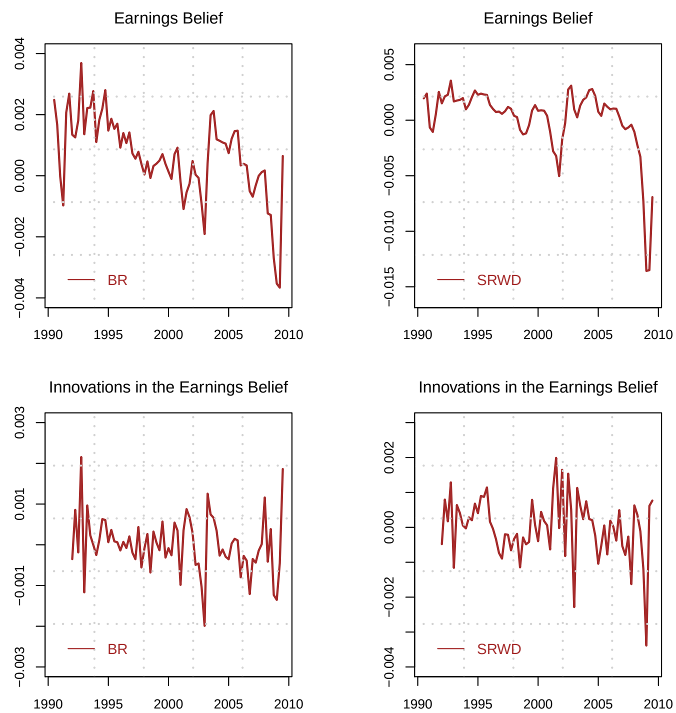

Figure 2
This figure plots the time series of the ratios of stocks that are used to construct the earnings belief measure from each of ten size deciles to all sample stocks. In each month for the earnings belief measure to be constructed, a stock is assigned to one of ten deciles based on its market capitalization at the end of previous month. Q1 denotes the decile of the smallest stocks and Q10 denotes the decile of the largest stocks.

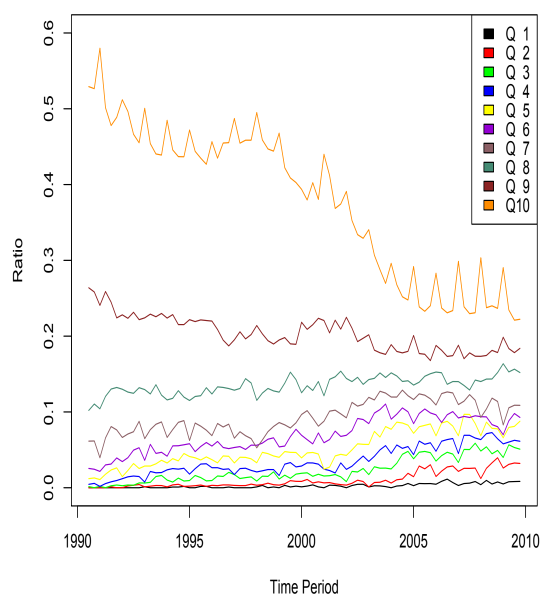

Figure 3

The graphs (from top left to bottom right) plot the time series of the earnings belief constructed with the Brown and Rozeff (1979, BR) model and the Seasonal Random Walk with Drift (SRWD) model, the Backer and Wurgler (2006) sentiment index, the closed-end fund discount, and the first two principal components of changes in mutual fund flows.

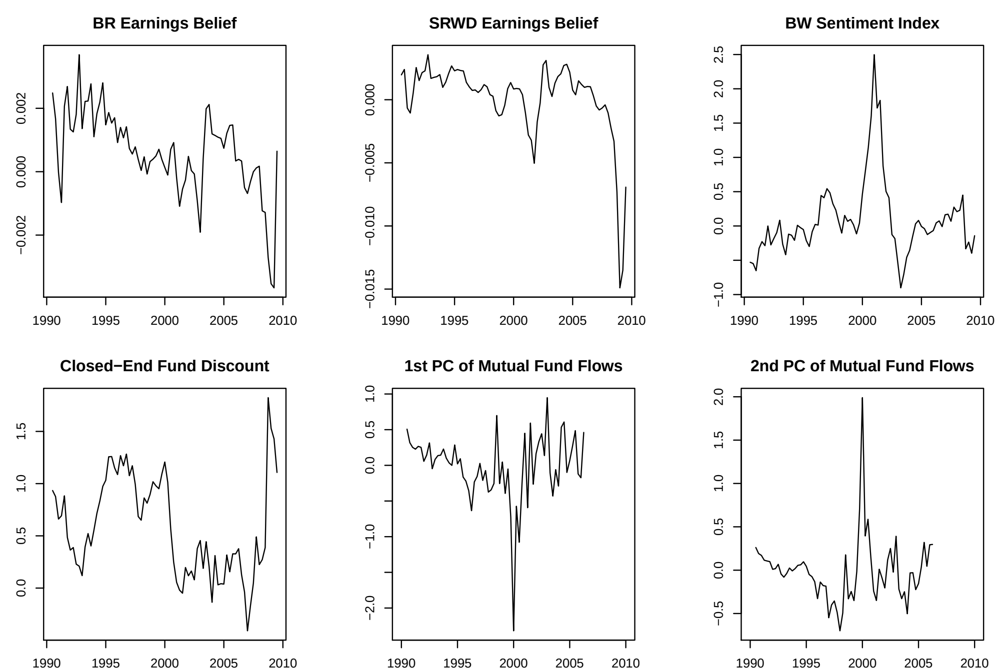

Table 1
Summary Statistics and Correlation Matrix

Panel A reports summary statistics of the earnings belief variables Z_{BR} and Z_{SRWD} constructed with the Brown and Rozeff (1979) model and the Seasonal Random Walk with Drift model: minimum, median, maximum, proportion of positive earnings belief (PPMB), standard deviation, skewness, and kurtosis. Panel B reports the correlation matrix of Z_{BR}, Z_{SRWD}, and the following macroeconomic variables: the growth rate in Industrial Production Index (IPI); the growth rate in Consumer Price Index (CPI); the growth rate in Employment (EMPL); the Federal Funds Rate (RATE); and the NBER economic recession dummy that equals 1 if the economy is in a recession or 0 otherwise (DUM).

Panel A: Summary Statistics

	Minimum (%)	Median (%)	Maximum (%)	PPMB (%)	Std Dev	Skewness	Kurtosis
$\mathbf{Z}_{BR}$	-0.367	0.070	0.369	74.026	0.133	-0.807	4.590
$\mathbf{Z}_{SRWD}$	-1.357	0.089	0.357	70.130	0.303	-2.808	12.321

Panel B: Correlations

	IPI	CPI	EMPL	RATE	DUM	$\mathbf{Z}_{BR}$	$\mathbf{Z}_{SRWD}$
IPI	1.000						
CPI	0.283	1.000					
EMPL	0.895	0.318	1.000				
RATE	0.531	0.490	0.612	1.000			
DUM	-0.640	0.174	-0.468	-0.150	1.000		
$\mathbf{Z}_{BR}$	0.559	0.285	0.495	0.297	-0.476	1.000	
$\mathbf{Z}_{SRWD}$	0.823	0.478	0.659	0.384	-0.594	0.7568	1.000

Table 2
Commonality in Belief

Changes in the average belief for each individual stock are regressed in time series on changes in the earnings belief for all stocks in the sample:

$$CZ_t^i = \alpha_i + \beta_{i,1}CZ_{t-1}^m + \beta_{i,2}CZ_t^m + \beta_{i,3}CZ_{t+1}^m + \varepsilon_{i,t}$$
$$CZ_t^i = \alpha_i + \beta_{i,1}CZ_{t-1}^m + \beta_{i,2}CZ_t^m + \beta_{i,3}CZ_{t+1}^m + \beta_X^{'}X_{i,t} + \varepsilon_{i,t}$$

where 'C' denotes a change in the variables it precedes, $X_{i,t}$ is the set of changes in macroeconomic variables used as controls, and $\varepsilon_{i,t}$ is the normally distributed error term. In each individual regression, the earnings belief excludes the dependent variable stock. Cross-sectional averages of time-series slope coefficients are reported with t-statistics in underlying parentheses. 'Concurrent', 'Lag', and 'Lead' refer, respectively, to the same, previous, and next quarter observations of the earnings belief. '% positive' reports the percentage of positive slope coefficients, while '% + significant' gives the percentage with t-statistics greater than +1.645 (the 5% critical level in a one-tailed test). 'Sum' aggregates coefficients for concurrent, previous, and next observations of the earnings belief. Coefficients for control variables are not reported.

	BR		SRWD	
Concurrent	0.657	0.737	0.703	0.653
	(7.14)	(7.23)	(10.16)	(8.63)
% positive	67.89	66.16	71.18	69.55
% + significant	19.67	17.84	32.79	24.85
Lag	0.242	0.280	0.158	0.106
	(2.75)	(3.00)	(2.57)	(1.37)
% positive	52.19	51.89	52.24	50.81
% + significant	8.46	7.85	10.49	9.78
Lead	0.092	0.101	0.086	0.081
	(1.03)	(0.99)	(1.52)	(1.35)
% positive	55.66	55.86	51.83	51.12
% + significant	9.58	9.68	11.10	9.88
Sum	0.990	1.117	0.948	0.840
	(6.35)	(6.47)	(8.64)	(6.75)
Control Variables		Yes		Yes
Adjusted R^2	0.039	0.047	0.072	0.087

Table 3
Earnings Belief Beta Portfolios and Characteristic Controls for Size and Value Factors

Panel A reports summary statistics of the monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor: minimum, maximum, mean, standard deviation, skewness, and kurtosis. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market ratio) at the end of previous month and then on earnings belief beta. Portfolios are held for three months, and portfolio return is computed as the equally-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	Panel A: Earnings Belief Beta Portfolios						
	1	2	3	4	5	5-1	*t* (5-1)
Minimum	-20.66	-19.03	-17.18	-19.61	-21.69		
Maximum	15.25	14.03	14.98	16.39	18.81		
Mean	0.460	0.672	0.735	0.753	0.989	0.529	2.51
Std Dev	5.897	4.765	4.605	4.929	6.223		
Skewness	-0.592	-0.945	-0.894	-0.918	-0.680		
Kurtosis	3.828	5.277	5.426	5.733	4.632		
	Panel B: Characteristic Controls						
	B.1: Double-Sort on Size and Earnings Belief Beta						
Size	1	2	3	4	5	5-1	*t* (5-1)
1	0.791	0.751	0.571	0.802	0.745	-0.046	-0.22
2	0.526	0.616	0.781	0.828	1.280	0.753	2.87
3	0.454	0.823	0.783	0.830	0.839	0.385	1.61
4	0.403	0.641	0.832	0.780	1.118	0.715	2.09
5	0.214	0.425	0.652	0.645	0.954	0.740	2.76
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta						
B/M	1	2	3	4	5	5-1	*t* (5-1)
1	0.065	0.367	0.408	0.590	0.588	0.523	1.47
2	0.530	0.516	0.779	0.576	1.249	0.719	2.70
3	0.541	0.690	0.746	0.707	1.176	0.635	3.02
4	0.756	0.723	0.853	0.878	0.942	0.186	0.95
5	0.707	0.788	0.762	0.982	1.013	0.306	1.50

Table 4
Regression Results

This table reports the risk-adjusted results (alphas) of earnings belief beta portfolios evaluated respectively with the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model. At the beginning of each month of March, June, September, and December during the period December 1997 through September 2009, we run a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor, and stocks are sorted into five portfolios based on earnings belief beta ($\beta_{\mathbf{B}}$). Portfolios are held for three months, and portfolio return is computed as the equally-weighted average of the returns of all stocks in a portfolio. Robust Newey-West (1987) t-statistics are reported in parentheses.

	Earnings Belief Beta Portfolios					
	Panel A: Fama and French (1993) Model					
	1	2	3	4	5	5-1
α (%)	-0.245	-0.023	0.050	0.070	0.275	0.520
	(-1.64)	(-0.22)	(0.43)	(0.60)	(1.85)	(2.74)
MKT	0.970	0.847	0.813	0.891	1.035	0.064
	(29.6)	(30.9)	(29.1)	(28.6)	(44.4)	(1.89)
SMB	0.609	0.372	0.378	0.369	0.641	0.032
	(8.75)	(5.58)	(5.85)	(4.53)	(11.5)	(0.71)
HML	0.304	0.531	0.513	0.475	0.272	-0.032
	(5.07)	(11.0)	(10.5)	(10.4)	(5.66)	(-0.57)
R^2	0.919	0.924	0.924	0.932	0.947	0.033
	Panel B: Carhart (1997) Model					
	1	2	3	4	5	5-1
α (%)	-0.194	0.024	0.097	0.109	0.314	0.508
	(-1.28)	(0.23)	(0.90)	(0.99)	(2.30)	(2.38)
MKT	0.920	0.800	0.767	0.852	0.996	0.076
	(25.0)	(31.5)	(27.0)	(24.6)	(26.5)	(1.61)
SMB	0.627	0.389	0.395	0.383	0.655	0.028
	(10.4)	(6.70)	(7.40)	(5.36)	(13.2)	(0.66)
HML	0.270	0.499	0.482	0.449	0.245	-0.025
	(5.32)	(12.9)	(11.4)	(9.98)	(5.36)	(-0.38)
UMD	-0.085	-0.079	-0.078	-0.066	-0.066	0.019
	(-1.65)	(-2.91)	(-3.76)	(-3.51)	(-3.07)	(0.31)
R^2	0.926	0.933	0.934	0.938	0.950	0.030

Table 5
Controlling for Volatility Risk, Liquidity Risk, Dispersion in Analysts' Forecasts, and Momentum

In Panel A, we first sort stocks into five equal portfolios based on volatility beta estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor, the volatility risk factor (i.e. innovations in the implied volatility of S&P 500 index options), and the earnings belief risk factor. Then, within each of these five portfolios, we sort stocks based on simultaneously estimated earnings belief beta into five further equal portfolios. In Panels B, C, and D, the similar analysis is conducted except that we instead control for exposures to liquidity risk (following Pastor and Stambaugh 2003), dispersion in analysts' forecasts scaled by the absolute value of the mean analyst forecast at the end of previous month, and momentum. Portfolios are held for three months, and portfolio return is computed as the equally-weighted average of the returns of all stocks in a portfolio. This table reports the average monthly returns of these portfolios and robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$						
	Panel A: Controlling for Volatility Risk						
Volatility	1	2	3	4	5	5-1	t (5-1)
1	0.521	0.640	0.626	0.705	0.846	0.325	1.41
2	0.520	0.643	0.733	0.673	0.898	0.378	1.80
3	0.590	0.782	0.748	0.690	1.058	0.468	2.37
4	0.370	0.619	0.747	0.713	1.034	0.664	2.24
5	0.722	0.386	0.915	0.976	0.919	0.197	0.79
	Panel B: Controlling for Liquidity Risk						
Liquidity	1	2	3	4	5	5-1	t (5-1)
1	0.271	0.572	0.817	0.790	1.220	0.949	3.05
2	0.239	0.641	0.700	0.664	1.149	0.910	3.94
3	0.486	0.698	0.767	0.750	0.895	0.409	2.06
4	0.702	0.567	0.666	0.694	0.973	0.271	1.44
5	0.718	0.665	0.725	0.915	0.756	0.038	0.12
	Panel C: Controlling for Dispersion in Analysts' Forecasts						
Dispersion	1	2	3	4	5	5-1	t (5-1)
1	0.917	0.914	1.014	1.039	1.688	0.772	3.20
2	0.120	0.664	0.417	0.478	0.562	0.442	2.43
3	0.281	0.384	0.674	0.685	1.077	0.797	2.71
4	0.516	0.414	0.671	0.421	0.922	0.406	1.37
5	0.133	0.466	0.602	0.864	1.184	1.051	2.04
	Panel D: Controlling for Momentum						
Momentum	1	2	3	4	5	5-1	t (5-1)
1	0.550	0.676	0.485	0.742	0.821	0.271	1.23
2	0.591	0.767	0.683	0.680	0.691	0.100	0.76
3	0.419	0.743	0.750	0.594	0.811	0.392	3.24
4	0.702	0.679	0.829	0.850	1.032	0.330	1.72
5	0.520	0.653	0.725	0.883	1.140	0.620	1.96

Table 6
Different Holding Periods

Panel A reports the average raw returns and alphas of earnings belief beta portfolios held for six months. Earnings belief betas are estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Portfolio return is computed as the equally-weighted average of the returns of all stocks in a portfolio, and alphas are estimated with the Fama and French (1993) model and the Carhart (1997) model. Panels B and C report the results for earnings belief beta portfolios held for nine and twelve months. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between portfolios 5 and 1.

	Earnings Belief Beta Portfolios						
	Panel A: 6 Months						
	1	2	3	4	5	5-1	t (5-1)
Mean	0.627	0.692	0.768	0.763	1.016	0.389	2.35
FF α	-0.080	-0.012	0.079	0.076	0.283	0.363	2.46
Carhart α	-0.004	0.049	0.132	0.126	0.336	0.340	2.17
	Panel B: 9 Months						
	1	2	3	4	5	5-1	t (5-1)
Mean	0.407	0.629	0.657	0.751	0.859	0.452	1.61
FF α	-0.268	-0.059	-0.036	0.069	0.152	0.420	1.67
Carhart α	-0.203	-0.008	0.009	0.108	0.203	0.406	1.81
	Panel C: 12 Months						
	1	2	3	4	5	5-1	t (5-1)
Mean	0.568	0.678	0.752	0.690	0.994	0.426	2.45
FF α	-0.149	-0.021	0.063	-0.010	0.261	0.410	2.85
Carhart α	-0.064	0.040	0.112	0.051	0.315	0.379	2.46

Table 7
Cross-Sectional Regression Test

This table reports the results of cross-sectional regression tests of individual stocks using the Fama-Macbeth (1973) methodology in which betas are estimated over rolling prior 24-quarter periods for each stock and then used in the cross-sectional regression over the next three months to estimate factor risk premiums. MKT is the excess stock market return, SMB and HML are the size and value factors, UMD is the momentum factor, LIQ is the liquidity risk factor (i.e. innovations in aggregate market liquidity) constructed by Pastor and Stambaugh (2003), VIX is the volatility risk factor (i.e. innovations in the implied volatility of S&P 500 index options), and **B** is the earnings belief risk factor. $\hat{\gamma}$ is the time-series average value of estimated coefficients of betas, and t-statistics that account for the errors-in-variables for the first-stage estimation in the factor loadings are reported in parentheses.

	I	II	III	IV
Intercept	0.232	0.191	0.184	0.190
	(0.75)	(0.66)	(0.62)	(0.64)
$\hat{\gamma}_{\mathbf{MKT}}$	0.107	0.130	0.136	0.131
	(0.49)	(0.60)	(0.62)	(0.62)
$\hat{\gamma}_{\mathbf{SMB}}$	0.033	-0.002	0.007	-0.001
	(0.19)	(-0.01)	(0.04)	(-0.00)
$\hat{\gamma}_{\mathbf{HML}}$	0.166	0.160	0.157	0.155
	(0.91)	(0.89)	(0.86)	(0.86)
$\hat{\gamma}_{\mathbf{UMD}}$		-0.068	-0.063	-0.070
		(-0.55)	(-0.50)	(-0.56)
$\hat{\gamma}_{\mathbf{LIQ}}$			-0.213	-0.193
			(-1.43)	(-1.30)
$\hat{\gamma}_{\mathbf{VIX}}$				-2.229
				(-0.19)
$\hat{\gamma}_{\mathbf{B}}$	0.00287	0.00324	0.00312	0.00298
	(2.07)	(2.39)	(2.22)	(2.11)

Appendix Table A.1

Earnings Belief Computed by Excluding Top and Bottom 2.5% of Individual Stocks' Average Beliefs

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market-ratio) at the end of previous month and then on earnings belief beta. To remove the impact of outliers, we exclude the top and bottom 2.5% of price-scaled individual stocks' average beliefs in computing the earnings belief used to construct the earnings belief risk factor. Portfolios are held for three months, and portfolio return is computed as the equally-weighted or value-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$													
	Equally-Weighted Portfolios							Value-Weighted Portfolios						
	Panel A: Single-Sort on Earnings Belief Beta													
	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
Mean	0.669	0.836	0.860	0.877	0.961	0.292	1.84	0.191	0.319	0.582	0.920	0.731	0.540	2.25
	Panel B: Characteristic Controls													
	B.1: Double-Sort on Size and Earnings Belief Beta													
Size	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.918	0.896	0.827	0.753	0.919	0.001	0.01	1.074	0.840	0.848	0.789	0.965	-0.109	-0.52
2	0.678	0.913	0.940	0.878	1.170	0.492	2.25	0.692	0.899	0.945	0.859	1.123	0.431	2.00
3	0.761	0.940	0.983	0.840	0.905	0.144	0.57	0.756	0.945	0.942	0.828	0.934	0.178	0.70
4	0.712	0.719	0.848	1.009	1.025	0.313	1.19	0.678	0.745	0.825	1.012	1.041	0.363	1.29
5	0.367	0.616	0.714	0.777	0.914	0.547	2.73	0.119	0.271	0.483	0.841	0.753	0.634	2.74
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta													
B/M	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.414	0.357	0.622	0.545	0.622	0.208	0.93	0.291	0.231	0.293	0.740	0.550	0.259	0.73
2	0.743	0.861	0.671	0.889	1.083	0.340	1.49	0.216	0.597	0.460	1.017	0.903	0.687	2.09
3	0.786	0.922	0.828	0.970	1.040	0.254	1.97	0.334	0.600	0.916	1.188	0.831	0.497	1.32
4	1.028	0.948	0.992	0.895	0.984	-0.044	-0.25	1.002	0.732	0.757	0.669	1.251	0.249	0.70
5	0.738	1.031	1.079	0.887	1.037	0.299	1.58	-0.426	0.530	0.605	0.817	0.995	1.421	2.13

Appendix Table A.2

Earnings Belief Computed as the Median of Individual Stocks' Average Beliefs

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market-ratio) at the end of previous month and then on earnings belief beta. The earnings belief used to construct the earnings belief risk factor is computed as the median of price-scaled individual stocks' average beliefs for all sample stocks. Portfolios are held for three months, and portfolio return is computed as the equally-weighted or value-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$													
	Equally-Weighted Portfolios							Value-Weighted Portfolios						
	Panel A: Single-Sort on Earnings Belief Beta													
	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
Mean	0.598	0.674	0.749	0.673	0.915	0.317	1.83	0.203	0.418	0.396	0.540	0.693	0.490	2.17
	Panel B: Characteristic Controls													
	B.1: Double-Sort on Size and Earnings Belief Beta													
Size	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.834	0.726	0.692	0.599	0.792	-0.042	-0.24	0.957	0.807	0.697	0.549	0.823	-0.134	-0.54
2	0.512	0.651	0.808	0.819	1.250	0.738	2.69	0.529	0.610	0.822	0.818	1.229	0.700	2.34
3	0.584	0.830	0.783	0.732	0.787	0.203	0.86	0.573	0.806	0.772	0.747	0.794	0.221	0.91
4	0.639	0.696	0.698	0.769	0.965	0.326	1.11	0.628	0.638	0.696	0.736	1.057	0.429	1.47
5	0.421	0.557	0.594	0.547	0.771	0.350	2.03	0.179	0.406	0.484	0.436	0.642	0.463	1.99
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta													
B/M	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.197	0.377	0.433	0.346	0.684	0.487	2.12	0.094	0.368	0.268	0.326	0.241	0.147	0.48
2	0.604	0.696	0.554	0.653	1.125	0.521	2.06	0.409	0.705	0.430	0.786	1.079	0.670	1.98
3	0.472	0.840	0.716	0.819	1.038	0.566	2.58	0.250	0.675	0.501	0.725	0.922	0.672	1.79
4	0.824	0.703	0.937	0.758	0.918	0.094	0.53	0.370	0.387	0.727	0.832	1.062	0.692	1.87
5	0.878	0.672	0.988	0.682	1.020	0.142	0.66	0.297	-0.113	0.366	0.827	1.174	0.877	1.67

Appendix Table A.3

A Different Model of Estimating Innovations in the Earnings Belief

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market-ratio) at the end of previous month and then on earnings belief beta. Innovations in the earnings belief used to estimate earnings belief betas are computed as the residuals of the following regression:

$$Z_t^m = \alpha_z + \varphi_1 Z_{t-1}^m + \beta_1 IPI_t + \beta_2 CPI_t + \beta_3 EMPL_t + \beta_4 RATE_t + \beta_5 DUM_t + \varepsilon_{z,t}$$

Variables in the regression are defined as in Section IV.D. Portfolios are held for three months, and portfolio return is computed as the equally-weighted or value-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$													
	Equally-Weighted Portfolios							Value-Weighted Portfolios						
	Panel A: Single-Sort on Earnings Belief Beta													
	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
Mean	0.644	0.895	0.910	0.938	1.086	0.442	2.33	0.138	0.507	0.580	0.995	1.000	0.862	4.53
	Panel B: Characteristic Controls													
	B.1: Double-Sort on Size and Earnings Belief Beta													
Size	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.997	0.813	0.983	0.801	0.931	-0.066	-0.32	1.148	0.774	0.991	0.837	0.962	-0.186	-0.88
2	0.723	0.873	0.881	1.062	1.267	0.544	2.25	0.713	0.873	0.874	1.007	1.276	0.563	2.32
3	0.598	1.116	1.042	0.943	1.023	0.425	1.71	0.589	1.101	1.033	0.953	1.038	0.449	1.81
4	0.599	0.901	0.917	0.963	1.157	0.558	1.68	0.600	0.900	0.897	0.932	1.193	0.593	1.76
5	0.439	0.668	0.696	0.949	1.036	0.597	3.07	0.192	0.393	0.589	0.943	0.931	0.739	3.71
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta													
B/M	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.131	0.471	0.684	0.709	0.640	0.509	1.71	-0.019	0.299	0.427	0.890	0.635	0.654	2.05
2	0.824	0.774	0.863	0.931	1.136	0.312	1.31	0.305	0.500	0.863	1.045	0.962	0.657	1.97
3	0.855	0.912	0.863	1.060	1.293	0.438	2.07	0.755	0.492	0.843	1.142	1.083	0.328	1.21
4	1.019	1.062	0.989	0.954	1.178	0.159	0.80	1.033	0.868	1.085	0.561	1.072	0.039	0.13
5	0.886	1.049	1.134	0.793	1.155	0.269	1.66	0.364	0.283	0.295	0.989	1.032	0.668	1.35

Appendix Table A.4
Value-Weighted Portfolios

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market ratio) at the end of previous month and then on earnings belief beta. Portfolios are held for three months, and portfolio return is computed as the value-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$						
	Panel A: Single-Sort on Earnings Belief Beta						
	1	2	3	4	5	5-1	t (5-1)
Mean	-0.002	0.093	0.627	0.681	0.846	0.848	2.74
	Panel B: Characteristic Controls						
	B.1: Double-Sort on Size and Earnings Belief Beta						
Size	1	2	3	4	5	5-1	t (5-1)
1	0.866	0.796	0.584	0.811	0.793	-0.073	-0.31
2	0.525	0.601	0.750	0.827	1.280	0.755	2.70
3	0.456	0.774	0.804	0.832	0.837	0.381	1.74
4	0.383	0.627	0.799	0.786	1.168	0.785	2.19
5	0.107	0.069	0.551	0.689	0.668	0.561	2.09
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta						
B/M	1	2	3	4	5	5-1	t (5-1)
1	0.102	0.074	0.321	0.405	0.663	0.561	1.09
2	-0.015	0.423	0.744	0.820	1.090	1.105	3.80
3	0.060	0.172	0.868	0.827	0.804	0.744	2.03
4	0.141	0.368	1.074	0.984	1.030	0.889	2.21
5	-0.057	-0.286	0.761	0.756	1.154	1.211	2.19

Appendix Table A.5
Seasonal Random Walk with Drift Model

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor. Panel B reports the average monthly returns of 5×5 portfolios double-sorted first on market capitalization (book-to-market-ratio) at the end of previous month and then on earnings belief beta. The earnings belief variable and the earnings belief risk factor are constructed using the Seasonal Random Walk with Drift model and the method proposed in Section IV. Portfolios are held for three months, and portfolio return is computed as the equally-weighted or value-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$													
	Equally-Weighted Portfolios							Value-Weighted Portfolios						
	Panel A: Single-Sort on Earnings Belief Beta													
	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
Mean	0.528	0.724	0.661	0.716	0.985	0.457	1.82	0.251	0.253	0.361	0.667	0.887	0.636	1.87
	Panel B: Characteristic Controls													
	B.1: Double-Sort on Size and Earnings Belief Beta													
Size	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.781	0.764	0.710	0.527	0.878	0.097	0.49	0.879	0.853	0.748	0.458	0.926	0.047	0.21
2	0.394	0.774	0.857	0.874	1.144	0.750	2.67	0.363	0.787	0.835	0.883	1.121	0.758	2.57
3	0.475	0.731	0.759	0.774	0.972	0.497	1.68	0.444	0.693	0.738	0.776	1.045	0.601	1.97
4	0.634	0.755	0.635	0.708	1.038	0.404	1.17	0.602	0.766	0.641	0.721	1.023	0.421	1.21
5	0.424	0.443	0.517	0.621	0.887	0.462	1.90	0.353	0.100	0.383	0.586	0.806	0.453	1.60
	B.2: Double-Sort on Book-to-Market Ratio and Earnings Belief Beta													
B/M	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.125	0.216	0.367	0.548	0.810	0.685	1.30	0.271	0.166	0.165	0.444	0.775	0.504	0.82
2	0.603	0.770	0.692	0.649	0.943	0.340	1.28	0.424	0.437	0.601	0.851	0.752	0.328	0.98
3	0.752	0.628	0.768	0.663	1.079	0.327	1.35	0.435	0.363	0.388	0.789	0.998	0.563	1.37
4	0.908	0.726	0.847	0.795	0.892	-0.015	-0.08	0.351	0.831	0.738	0.498	1.198	0.847	1.97
5	0.793	1.034	0.627	0.782	1.034	0.242	0.90	0.090	0.039	0.486	0.554	1.131	1.041	2.10

Appendix Table A.6
Sub-sample Analysis

Panel A reports the average monthly returns of five portfolios sorted on earnings belief beta ($\beta_{\mathbf{B}}$) estimated in a time-series regression of excess stock returns in the preceding 24 quarters on the market factor and the earnings belief risk factor for two sub-sample periods: one extends from December 1997 to November 2003 and another extends from December 2003 to November 2009. Panel B reports the average monthly returns during the two sub-sample periods of 5×5 portfolios double-sorted first on market capitalization (book-to-market ratio) at the end of previous month and then on earnings belief beta. Portfolios are held for three months, and portfolio return is computed as the equally-weighted average of the returns of all stocks in a portfolio. This table also reports robust Newey-West (1987) t-statistics for the difference in monthly returns between earnings belief beta portfolios 5 and 1.

	$\beta_{\mathbf{B}}$													
	December 1997 to November 2003							December 2003 to November 2009						
	Panel A: Single-Sort on Belief Beta													
	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
Mean	0.793	1.013	0.991	1.065	1.476	0.683	1.99	0.128	0.332	0.480	0.441	0.503	0.375	2.07
	Panel B: Characteristic Controls													
	B.1: Double-Sort on Size and Belief Beta													
Size	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	1.277	1.326	1.036	1.358	1.268	-0.009	-0.02	0.306	0.176	0.106	0.247	0.222	-0.084	-0.38
2	0.946	1.030	1.185	1.438	1.870	0.934	2.17	0.107	0.202	0.378	0.218	0.689	0.582	2.03
3	0.800	1.132	0.873	1.288	1.260	0.460	1.17	0.107	0.514	0.693	0.372	0.418	0.311	1.50
4	0.549	0.845	1.154	0.859	1.364	0.815	1.45	0.256	0.436	0.510	0.701	0.873	0.617	2.10
5	0.337	0.624	0.757	0.817	1.358	1.021	2.15	0.090	0.225	0.548	0.473	0.549	0.459	1.70
	B.2: Double-Sort on Book-to-Market Ratio and Belief Beta													
B/M	1	2	3	4	5	5-1	t (5-1)	1	2	3	4	5	5-1	t (5-1)
1	0.106	0.634	0.369	0.946	1.290	1.184	1.83	0.024	0.099	0.447	0.234	-0.114	-0.138	-0.79
2	0.722	0.715	0.982	0.682	1.816	1.095	2.55	0.338	0.316	0.576	0.470	0.681	0.343	1.31
3	0.945	0.878	1.004	0.982	1.488	0.543	2.07	0.138	0.502	0.488	0.433	0.865	0.727	2.18
4	1.263	1.200	1.289	1.325	1.279	0.016	0.05	0.249	0.247	0.416	0.431	0.604	0.355	1.69
5	1.310	1.437	1.002	1.338	1.563	0.253	0.65	0.103	0.139	0.522	0.626	0.462	0.359	1.99