Earnings Belief Risk and the Cross-Section of Stock Returns

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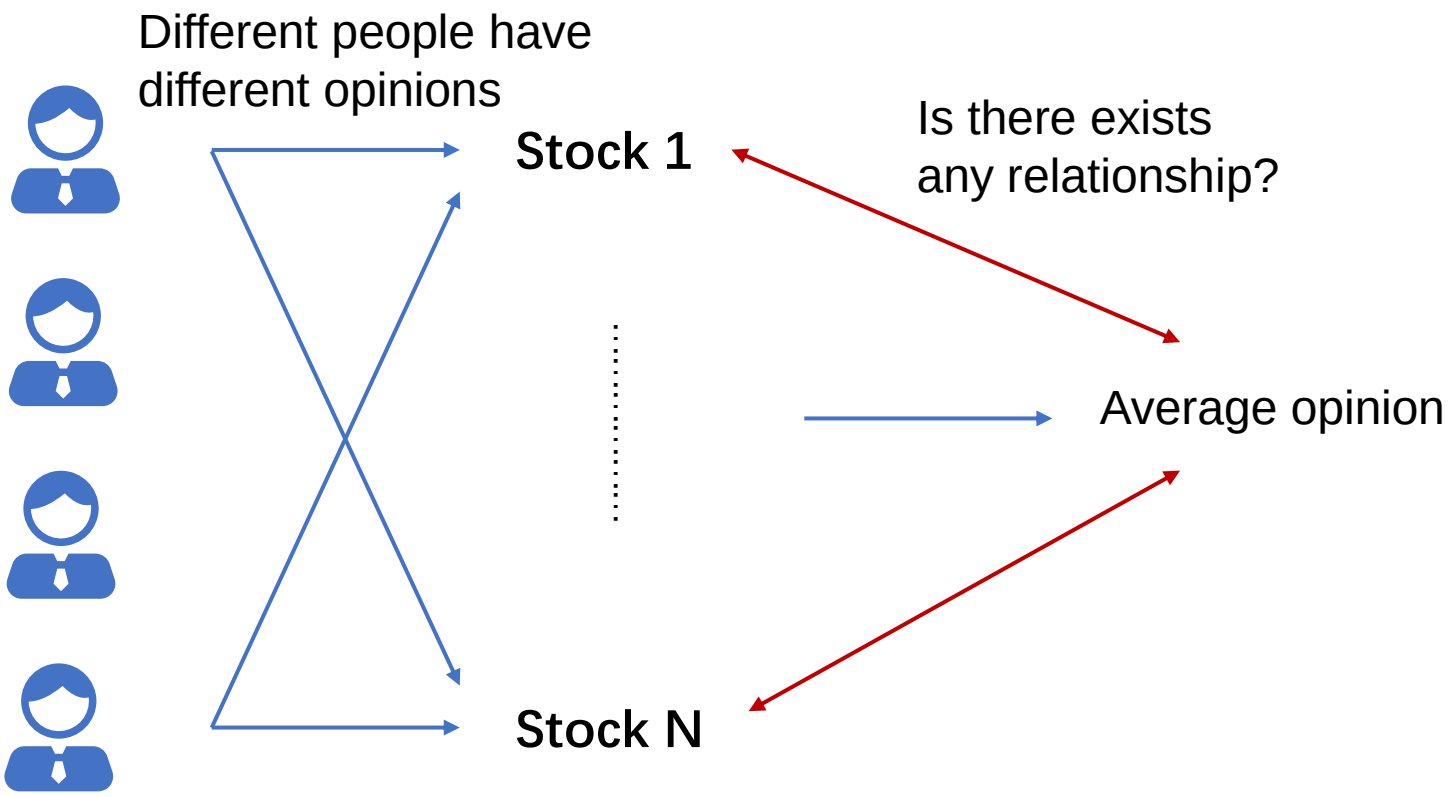
Contents

1.Introduction

- **Background**
- Rajnish Mehra and Prescott raised the equity premium puzzle in 1985;
- **What drives high stock yields?**
- In the objective world, CAPM models focused on the market portfolio
- In the subjective world, heterogeneity in investor beliefs plays an important role in explaining the formation of stock prices;
- Asset pricing models incorporating such heterogeneity are able to better account for stylized facts characterizing stock returns.

1.Introduction



1.Introduction

- **Literatures**
- Jouini and Napp (2007): 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;
- Kurz and Motolese (2011): the price of a risky asset is a linear function of the equally weighted average of investors' subjective beliefs about the asset's future payoffs, with a positive beta loading on the average belief.

1.Introduction

- **Literatures**
- Ben-Rephael, Kandel, and Wohl (2012): a significantly positive contemporaneous relation between monthly aggregate net flows to equity funds and excess stock market returns.
- Lee, Shleifer, and Thaler (1991): stocks and closed-end funds with high sensitivity to investor sentiment earn an extra return as a compensation for this additional source of risk.

1.Introduction

- **Motivations**
- There has not been any theoretical or empirical study of the impact of innovations in the average belief of investors on asset pricing.
- Do innovations in the average belief of investors systematically affect asset prices and if yes in what manner?

1.Introduction

- **Contributions**
- We show both theoretically and empirically that innovations in the average belief of investors are a priced source of systematic risk;
- We argue that the earnings belief measure constructed in this study primarily reflects the average subjective opinion of institutional investors(an important category);
- We provides another explanation for the equity premium puzzle: A part of the excess equity premium may represent a compensation for investors exposed to systematic earnings belief risk.

2.Theoretical basis

- Model used:
- Merton (1973) and Williams (1977)
- continuous-time model of consumption and portfolio choice
- investors are assumed to hold heterogenous stochastic beliefs about expected returns on risky assets.

2.Theoretical basis

- a riskless asset and N risky assets traded by I rational and risk-averse investors(initially endowed with an amount of wealth)
- frictionless; No restrictions are imposed on borrowing or short sales

2.Theoretical basis

- the riskless asset earns a constant return r per unit time
- instantaneous returns on risky assets：
  - $\frac{dP_n}{P_n}=\mu_n d_t+\sigma_n dz_n$ (n=1,2,…,N)
- μ_n: the expected return
- σ_n: the standard deviation of the return
- dz_n: a standard Wiener process with E(dz_n)=0 and Var(dz_n) $= dt$
  - $d\mu_n^i=\phi_n^i \mathrm{dt}+\varphi_n^i \mathrm{d}w_n^i$ (i=1,2,…,I)
- μ_n^i: the investor i’s estimate of the expected return on risky asset n
- dw_n^i: a standard Wiener process with E(dw_n^i)=0, Var(dw_n^i)=dt

2.Theoretical basis

- **Model assumptions:**
- The Earnings Belief Risk Hypothesis
- Stocks with higher exposure to earnings belief risk earn a higher (lower) expected return if the income (substitution) effect of changes in investors' subjective beliefs about future EPS on consumption dominates.

2.Theoretical basis

$b \approx -\frac{\partial C}{\partial u_m}$

- $\overline{u_n}$-r=a·σ_{nM}-b·$\sigma_{n\widetilde{u_M}}$

- σ_{nM}: the covariance between the return on risky asset n and the return on the market portfolio
- $\sigma_{n\widetilde{u_M}}$: the covariance between the return on risky asset n and d$\widetilde{u_M}$
- d$\widetilde{u_M}$: Investors' average belief in the expected return of representative assets
- a>0
- b>0 or b<0 depends on the empirical result

2.Theoretical basis

- Model conclusion:
- In equilibrium, the expected excess return on a risky asset consists of two components:
- ①the standard market risk premium;
- ②the asset's exposure to the risk arising from innovations in the average belief of investors about the expected return of a representative asset.
- Innovations in the earnings belief are **a non-diversifiable source of risk** and should affect stock prices.

3.Data

- The actual EPS data and the analyst EPS forecast data: I/B/E/S Summary History database
- frequencies: quarterly
- Stocks used to construct the earnings belief measure are those with fiscal quarters ending in the months of March, June, September, and December
- (1) have no less than 30 consecutive observations of quarterly EPS between March 1983 and September 2015; (2) have the analyst EPS forecast and the model implied EPS forecast for at least one-quarter between August 1990 and November 2015

3.Data

- Stocks:
- common stocks traded on the NYSE, AMEX, and Nasdaq
- eliminate stocks with a price per share less than $5
- CRSP Compustat database
- 1990.08~2015.11

4.Model


Forecasting EPS
Constructing Earnings Belief
Find Commonality in Belief
Get Pure Earnings Belief Risk
Find the Sensitivity of Stocks and the Risk
Constructing the Portfolio

4.Model

- **Forecasting EPS**
- BR model:
  - $E_{s-1}(Q_s)$=δ+Q_{s-4}+Φ(Q_{s-1}-Q_{s-5})+θε_{s-4}
- This model 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.
  - Foster: $E_{s-1}(Q_s)$=δ+Q_{s-4}+Φ(Q_{s-1}-Q_{s-5})
    - SRWD: $E_{s-1}(Q_s)$=δ+Q_{s-4}

4.Model

- **Constructing ‘earnings belief’**
  - $g_t^{n,i} = E_t^{n,i}(EPS_s) - E_t^{n,e}(EPS_s)$
  - $Z_t^n = \frac{1}{I} \sum_{i=1}^{I} g_t^{n,i}$

$$= \frac{1}{I} \sum_{i=1}^{I} [E_t^{n,i}(EPS_s) - E_t^{n,e}(EPS_s)]$$

$$= \overline{E_t^n}(EPS_s) - E_t^{n,e}(EPS_s)$$

- $\overline{E_t^n}(EPS_s)$: the average forecast of investors(the mean analyst EPS forecast)
- Z_t^n: the average belief of the I investors: the higher Z_t^n, the more optimistic the investors

4.Model

- **Constructing ‘earnings belief’**
- Scale Z_t^n:

$$Z_t^M = \frac{1}{N} \sum_{n=1}^{N} \frac{\frac{Z_t^n}{P_{t-1}^n}}{\sigma\left[\frac{Z_t^n}{P_{t-1}^n}\right]}$$

4.Model

- **Find Commonality in Belief**
  - $\Delta Z_t^n = \alpha_n + \beta_{n,1} \Delta Z_{t-1}^M + \beta_{n,2} \Delta Z_t^M + \beta_{n,3} \Delta Z_{t+1}^M + \beta_X' X_t + \varepsilon_{n,t}$
- ΔZ_t^n: for stock n, the change from time t–1 to t in the average belief Z_t^n
- ΔZ_t^M: the change in the market-wide average belief
- X_t: changes of some control variables

4.Model

- **Get Pure Earnings Belief Risk**
- ① Z_t^M is not a purely subjective belief measure;
- ② Z_t^M is autocorrelated
- $Z_t^M = \alpha_Z + \sum_{k=1}^{6} \phi_k Z_{t-k}^M + \beta_1 IP_t + \beta_2 CPI_t + \beta_3 UE_t + \beta_4 RATE_t + \beta_5 DUM_t + \varepsilon_{z,t}$
- B_t :innovations in Z_t^M estimated——**earnings belief risk**

4.Model

- **Find the Sensitivity of Stocks and the Risk**
  - $r_{n,t} = \alpha_n + \beta_{n,M}\mathrm{RMRF}_t + \beta_{n,B}\mathbf{B}_t + \varepsilon_{n,t}$
- $r_{n,t}$: the excess return on stock n
- RMRF: the market excess return(control variable)
- B: the earnings belief risk factor

- Window: data over the past 24 quarters
- sort stocks into five equal-sized portfolios

	BR		Foster		SRWD	
Concurrent	0.987	0.922	0.948	0.923	1.019	1.017
	(15.67)	(12.55)	(15.22)	(13.33)	(17.35)	(15.97)
% Positive	63.65	61.44	63.97	61.95	69.29	67.03
% + Significant	23.16	21.14	23.02	21.75	32.66	29.98
Lag	0.033	0.061	0.069	0.061	0.043	0.013
	(0.54)	(0.95)	(1.18)	(0.96)	(0.91)	(0.25)
% Positive	51.67	52.14	52.65	50.73	53.27	53.17
% + Significant	10.99	10.66	11.55	11.41	15.25	15.04
Lead	0.113	0.108	0.088	0.089	0.129	0.074
	(1.82)	(1.62)	(1.42)	(1.31)	(2.82)	(1.45)
% Positive	52.18	52.28	52.75	52.37	52.55	52.29
% + Significant	11.93	12.73	12.59	12.92	13.70	11.90
Sum	1.133	1.091	1.105	1.073	1.191	1.104
	(10.68)	(8.97)	(11.48)	(9.84)	(19.93)	(15.71)
Controls	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.058	0.076	0.060	0.080	0.125	0.150

- Cross-sectional averages of time-series slope coefficients indicate the existence of commonality in belief among individual stocks.

5.Results

- ①portfolios based on β

Panel A: Summary statistics for excess portfolio returns

	1	2	3	4	5	5–1	*t*(5–1)
Mean	0.400	0.742	0.761	0.777	0.995	0.595	2.96

- the relationship between earnings belief risk and expected return is strictly positive
- the return spread between portfolios 5 and 1 is statistically significant at the 1% level

5.Results

- ②Characteristics of stocks in each group

Panel B: Portfolio characteristics

	1	2	3	4	5	5–1	*t*(5–1)
Size	3,824	7,282	8,178	6,562	2,475		
B/M	0.525	0.563	0.582	0.588	0.599		
Ret1	0.026	0.012	0.010	0.010	0.018		
Ret2–12	0.236	0.173	0.164	0.177	0.252		
Profitability	0.324	0.357	0.345	0.356	0.133		
Investment	0.069	0.069	0.068	0.035	0.057		

- The average characteristics usually vary non-monotonically across earnings belief beta portfolios
- the positive relationship between earnings belief risk and expected return is unlikely to be driven by the cross-sectional difference in stock characteristics

5.Results

- ③check if the return pattern across earnings belief beta portfolios captures a size/value effect in stock returns
- The size/value effect does not drive the return pattern across earnings belief beta portfolios

Panel C: Controlling for size and book-to-market

C.1: Controlling for size

Size	1	2	3	4	5	5–1	t(5–1)
1	0.603	0.877	0.741	0.906	0.850	0.247	1.22
2	0.269	0.776	0.849	0.822	1.242	0.973	3.45
3	0.311	0.761	0.793	0.794	0.995	0.684	2.86
4	0.365	0.631	0.859	0.746	1.069	0.703	2.25
5	0.365	0.597	0.543	0.672	0.902	0.537	2.35

C.2: Controlling for book-to-market

B/M	1	2	3	4	5	5–1	t(5–1)
1	0.206	0.491	0.436	0.819	0.844	0.638	1.99
2	0.409	0.653	0.713	0.698	1.062	0.653	2.79
3	0.612	0.797	0.723	0.798	1.076	0.464	2.52
4	0.560	0.817	0.810	0.897	0.978	0.417	2.23
5	0.850	0.776	0.999	0.863	0.988	0.138	0.66

5.Results

- ①Risk-adjusted excess portfolio returns
- FF3/Q4/FF5 can’t explain the return of portfolio “5-1”

	5–1
α_{ff3}	0.571
	(3.26)
RMRF	–0.027
	(–0.49)
SMB	–0.044
	(–0.54)
HML	0.299
	(3.71)
Adj. R^2	0.137

	5–1
$\alpha_{carhart}$	0.569
	(2.58)
RMRF	–0.026
	(–0.38)
SMB	–0.045
	(–0.65)
HML	0.300
	(3.58)
UMD	0.002
	(0.04)
Adj. R^2	0.133

	5–1
α_{ff5}	0.434
	(2.09)
RMRF	0.049
	(0.90)
SMB	0.098
	(1.45)
HML	0.227
	(2.24)
RMW	0.354
	(2.87)
CMA	–0.113
	(–1.04)
Adj. R^2	0.212

5.Results

Other Robustness Check
By double-sorting

In these robustness tests, almost every cross group will have insignificant results, but the author thinks that **as long as there are significant results**, it means that **the first control variable can not explain the benefits of "earning belief beta"**

- earnings risk
- volatility risk
- liquidity risk
- short-term reversal and momentum
- Profitability
- Investment
- divergence of opinion
- unexpected earnings
- Different holding periods

5.Conclusions

- ①The average return on stocks with high exposure to earnings belief risk is significantly higher than the one on stocks with low exposure
- ②Conventional risk factors cannot fully explain the positive relationship between earnings belief risk and expected stock returns.
- ③It is true that earnings belief risk is one of the sources of systemic risk for stocks