Question：ESG disagree and stock return

ESG invest:

ESG → **Asset return(stock)**

In theory：	Value↑ Risk↓（Pastor et al.,2021）：—
In practice：	Lots of mixed evidence: (Avramov et al., 2022, Pastor et al., 2022)

Why? Researchers use ESG ratings from different agencies. In reality, ratings can disagree, and investors may be affected

answer

- **Avramov et al.(2022)** : ESG disagree→invest demand, stock return, ESG premium

Other stock return reaction：

- 张伟伟等(2024) : ESG disagree→股票错误定价
- **Serafeim et al.(2022)** : ESG disagree→ESG news-market reaction

Sustainable investing with ESG rating uncertainty

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Motivation

- **投资者配置重视 ESG 目标，但投资者无法知晓公司真实 ESG，面临极大不确定性。，ESG 投资者往往面临关于企业真实 ESG 状况的大量不确定性。在缺乏可靠衡量企业真实 ESG 表现的指标时，任何量化尝试都必须应对不完整且不透明的 ESG 数据，以及缺乏结构化的方法论 Sustainable invest grown rapidly, with capital focus on ESG.**
  - UN PRI AUM rose from $21T in 2010 to $103T in 2020
- **Challenge: investors face firm's true ESG performance uncertainty.**
  - Significant disagreement among rating agencies——avg corr: 0.48
- Exist studies assume ESG are deterministic, ignore impact of ESG uncertainty on investment decision and asset pricing (Pástor et al., 2021).
- ESG uncertainty can mislead investors on 'green' assets, impacting capital allocation and social welfare.

Question

- What is the impact of ESG rating uncertainty on:
  - Investors' asset demand:for green prefer investor,ESG score↑ → risk asset demand↑ ,ESG uncertainty↑ → risk asset demand↓
  - Cross-sectional stock returns:ESG uncertainty↑ → ex return(alpha),ESG↓。

Contribution

- contributes to literature on ESG profile in equilibrium asset pricing:
  - prior: focus on investors' ESG preferences (Pástor et al., 2021)
  - extend: highlight ESG uncertainty when analyzing sustainable invest.
- contributes to literature on cross-sectional return predictability of ESG profile.
  - prior: weak return predictability of ESG (Pedersen, 2021) and mixed evidence from different ESG proxies (Edmans, 2011; Bolton & Kacperczyk, 2020).
  - extend: ESG uncertainty could tilt the ESG-performance relation and serve as a potential mechanism to explain the opposing findings.

Design

What is the impact of ESG rating uncertainty on: **Investor demand** | **alpha** | **beta**

One risky asset: single-period, market portfolio and a riskless asset.

Investor demand

excess market return: $\widetilde{r_M} = \mu_M + \widetilde{\epsilon_M}$, ESG score: $\widetilde{g_M} = \mu_{g,M} + \widetilde{\epsilon_{g,M}}$, $\sigma_{g,M}, \rho_{g,M}$

CARA function(Pástor et al. 2021): $V(\widetilde{W_1}, x) = -e^{-AW_1 - BW_0 x \widetilde{g_M}}$

$$x^* = \frac{1}{\gamma}\frac{\mu_M + b\mu_{g,M}}{\sigma^2_{M,U}}, \mathrm{b} = \frac{B}{A}, \gamma = AW_0, \sigma^2_{M,U} = \sigma^2_M + b^2\sigma^2_{g,M} + 2b\sigma_{g,M}\rho_{g,M}$$

Finance + ESG return | $\sigma^2_{M,U} > \sigma^2_M$, **uncertainty→risk, x* ↓**

alpha

Equilibrium: $x^* = \frac{1}{\gamma}\frac{\mu_M + b\mu_{g,M}}{\sigma^2_{M,U}} = 1$, $\mu^U_M = \gamma\sigma^2_M - b\mu_{g,M} + \gamma(\sigma^2_{M,U} - \sigma^2_M)$

ESG prefer→alpha ↓ , Uncertainty →alpha ↑ | **Maybe explain mixed studies**

Design

What is the impact of ESG rating uncertainty on: **Investor demand** | **alpha** | **beta**

multi-asset economy

beta

$$X_i^* = \frac{1}{\gamma_i}\frac{\mu_r + b_i\mu_g}{\Sigma_{i,U}}, \Sigma_{i,U} = \Sigma_r + b_i^2\Sigma_g + 2b_i\Sigma_{r,g}$$

$$\beta = \frac{Cov(r,r_M)}{Var(r_M)} = \frac{\Sigma_r X_M}{\sigma_M^2}, \quad \sigma_M^2 = X_M'\Sigma_r X_M$$

Excluding ESG uncertainty

$$\mu_r = \beta\mu_M - b_M(\mu_g - \beta\mu_{g,M})$$

alpha adjustment term

beta remains CAPM beta

Consider ESG uncertainty

$$\mu_r = \beta\mu_M + (\beta_{eff} + \beta)\mu_M - b_M(\mu_{g,U} - \beta_{eff}\mu_{g,M,U})$$

$$\beta_{eff} = \frac{\Sigma_{M,N}X_M}{\sigma_{M,U}^2} = \frac{\sigma_M^2}{\sigma_{M,U}^2}\boldsymbol{\beta} + \frac{b^2\sigma_{g,M}^2}{\sigma_{M,U}^2}\boldsymbol{\beta_g} + \frac{2b\sigma_{r,g}}{\sigma_{M,U}^2}\boldsymbol{\beta_{r,g}}$$

$$\beta_{eff,j} = \frac{\sigma_M^2}{\sigma_{M,U}^2}\boldsymbol{\beta_j} + \frac{\boldsymbol{b^2}\sigma_{g,M}^2}{\sigma_{M,U}^2}\frac{\boldsymbol{X_j\sigma_{g,j}^2}}{\boldsymbol{\sigma_{g,M}^2}} + \frac{2b\sigma_{r,g}}{\sigma_{M,U}^2}\frac{\boldsymbol{X_j\sigma_{rg,j}}}{\boldsymbol{\sigma_{rg,M}^2}}$$

beta ↑

Design-empirical

ESG rating uncertainty↑

Risk asset demand ↓

Y: institutional ownership

ESG prefer

high	norm-constrained
M	other mutual funds
low	hedge funds

ESG rating \ **ESG uncertainty**	
	5×5

alpha↑, beta ↑

Y: ex return

ESG rating \ **ESG uncertainty**	
	5×5

ESG rating—Y ↓

High uncertainty—Y ↓ ×

Y: ex return

FM reg:

$$rt_{i,m} = \alpha_0 + \beta_1 ESG_{i,m-1} + \boldsymbol{\beta_2} ESG_{i,m-1} \times Low\ ESG\ uncertainty_{i,m-1} + \beta_3 Low\ ESG\ uncertainty_{i,m-1} + control_{i,m-1} + e_{i,m}$$

$\boldsymbol{\beta_2}$**<0**

Design-data

- Data sources:
  - Stock data: Daily and monthly common stock returns CRSP
  - ESG ratings: Six vendors –Asset4 (Refinitiv), MSCI KLD, MSCI IVA, Bloomberg, Sustainalytics, RobecoSAM.
  - Institutional holdings: Thomson-Reuters 13F database

- ESG rating measures:
  - (AAA-CCC),(0-100),(-11 - +19)
  - rank,to (0-1)
  - pairwise comparison: $U_{j,t}^{A,B} = \frac{|g_{j,t,A} - g_{j,t,B}|}{\sqrt{2}}$
  - firm level: $U_{j,t} = \text{mean}\left(U_{j,t}^{A,B}\right)$——mean:0,48

Result-H1:green prefer investor.esg disagree–risk asset demand ↓

Panel A: Norm-constrained institutions

ESG rating	ESG uncertainty							
	Low	2	3	4	High	HML-U	*t*-stat	All
Low	0.170	0.183	0.187	0.178	0.179	0.009	(0.80)	0.177
2	0.185	0.192	0.207	0.209	0.184	−0.001	(−0.23)	0.195
3	0.189	0.215	0.210	0.212	0.191	0.002	(0.40)	0.200
4	0.211	0.211	0.211	0.215	0.211	0.000	(0.04)	0.211
High	0.228	0.236	0.238	0.225	0.181	−0.047***	(−2.73)	0.230
HML-R	0.058***	0.053***	0.050***	0.047***	0.002			0.053***
	(10.21)	(12.00)	(8.33)	(8.51)	(0.08)			(11.39)

Panel B: Hedge funds

ESG rating	ESG uncertainty							
	Low	2	3	4	High	HML-U	*t*-stat	All
Low	0.157	0.157	0.160	0.156	0.130	−0.027***	(−3.70)	0.157
2	0.143	0.147	0.155	0.153	0.149	0.006	(1.31)	0.149
3	0.153	0.144	0.144	0.149	0.153	−0.000	(−0.08)	0.150
4	0.148	0.144	0.140	0.142	0.141	−0.006*	(−1.96)	0.142
High	0.127	0.124	0.128	0.128	0.119	−0.008	(−1.33)	0.127
HML-R	−0.031***	−0.033***	−0.032***	−0.029***	−0.011			−0.030***
	(−6.14)	(−8.15)	(−6.30)	(−5.57)	(−1.25)			(−8.06)

Panel C: Other institutions

ESG rating	ESG uncertainty							
	Low	2	3	4	High	HML-U	*t*-stat	All
Low	0.347	0.367	0.357	0.363	0.317	−0.030**	(−2.57)	0.356
2	0.343	0.374	0.387	0.390	0.354	0.010	(1.43)	0.370
3	0.370	0.373	0.371	0.384	0.360	−0.011	(−1.66)	0.368
4	0.382	0.375	0.378	0.369	0.360	−0.022***	(−3.25)	0.370
High	0.363	0.368	0.363	0.357	0.328	−0.035	(−1.63)	0.363
HML-R	0.016	0.001	0.006	−0.005	0.011			0.007
	(1.28)	(0.13)	(0.59)	(−0.37)	(0.35)			(0.71)

Result-H2:esg disagree–ex rt,alpha ↑

ESG rating	Panel A: Return						Panel B: CAPM-adjusted return					
	ESG uncertainty						ESG uncertainty					
	Low	2	3	4	High	All	Low	2	3	4	High	All
Low	1.235***	1.113***	0.767**	0.875**	0.760**	0.923**	0.168	0.064	−0.311*	−0.141	−0.101	−0.101
	(2.95)	(2.99)	(1.98)	(2.30)	(2.32)	(2.58)	(0.93)	(0.40)	(−1.82)	(−0.89)	(−0.58)	(−0.84)
2	1.245***	1.026***	1.093***	1.043***	1.095***	0.963***	0.187	0.076	0.115	0.042	0.151	−0.008
	(3.36)	(2.84)	(3.30)	(2.74)	(2.91)	(2.85)	(1.16)	(0.38)	(0.77)	(0.29)	(0.77)	(−0.07)
3	1.096***	0.965***	1.050***	1.104***	0.949***	1.021***	0.040	−0.031	0.002	0.064	0.079	0.053
	(2.69)	(2.83)	(2.86)	(2.89)	(3.15)	(3.11)	(0.23)	(−0.20)	(0.02)	(0.46)	(0.42)	(0.64)
4	0.730**	0.695*	1.105***	1.019***	0.990***	1.017***	−0.192	−0.389***	0.108	0.040	0.006	0.095
	(2.09)	(1.81)	(2.90)	(2.96)	(2.68)	(3.42)	(−1.24)	(−3.28)	(0.55)	(0.34)	(0.03)	(1.32)
High	0.642*	0.842**	0.855***	1.184***	0.854***	0.805**	−0.230*	−0.063	−0.012	0.245*	−0.001	−0.095
	(1.97)	(2.53)	(3.06)	(3.62)	(2.81)	(2.57)	(−1.95)	(−0.55)	(−0.10)	(1.83)	(−0.01)	(−1.49)
LMH-R	0.594***	0.271	−0.088	−0.309	−0.094	0.118	0.398*	0.128	−0.299	−0.387*	−0.100	−0.006
	(2.72)	(1.30)	(−0.39)	(−1.43)	(−0.42)	(0.78)	(1.86)	(0.58)	(−1.25)	(−1.75)	(−0.42)	(−0.04)
ESG rating	ESG uncertainty						ESG uncertainty					
	Low	2	3	4	High	HML-U	Low	2	3	4	High	HML-U
All	0.753**	0.875***	0.935***	1.083***	0.940***	0.187	−0.155**	−0.090	−0.003	0.120*	0.071	0.226*
	(2.31)	(2.61)	(3.07)	(3.28)	(3.29)	(1.40)	(−1.98)	(−1.20)	(−0.04)	(1.72)	(0.84)	(1.67)

Result-H3:esg disagree–beta ↑

Stock returns regressed on lagged ESG rating and uncertainty

	Excess return				CAPM-adjusted return			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
ESG	0.002	0.098	0.062	0.199	0.042	0.139	0.162	0.301
	(0.01)	(0.65)	(0.33)	(1.03)	(0.23)	(0.91)	(0.77)	(1.65)
ESG × Low ESG Uncertainty			−0.163*	−0.223*			−0.254**	−0.312**
			(−1.91)	(−1.75)			(−2.26)	(−2.36)
Low ESG Uncertainty			0.114*	0.109			0.125**	0.114
			(1.86)	(1.38)			(2.20)	(1.61)
Log(Size)	−0.100	−0.036	−0.101	−0.038	−0.044	0.111	−0.044	0.111
	(−1.28)	(−0.27)	(−1.30)	(−0.29)	(−0.59)	(0.77)	(−0.60)	(0.77)
Log(BM)	0.001	0.009	−0.001	0.008	−0.021	0.019	−0.024	0.017
	(0.01)	(0.14)	(−0.01)	(0.12)	(−0.19)	(0.18)	(−0.21)	(0.17)
6M Momentum	0.336	0.188	0.335	0.194	0.275	0.105	0.276	0.111
	(0.70)	(0.40)	(0.69)	(0.42)	(0.50)	(0.20)	(0.50)	(0.21)
Log(Illiquidity)		0.056		0.056		0.103**		0.103**
		(1.00)		(1.03)		(2.17)		(2.15)
Gross Profitability		0.178		0.180		0.355*		0.359*
		(0.99)		(1.00)		(1.83)		(1.85)
Corporate Investment		0.037		0.037		−0.005		−0.007
		(0.49)		(0.50)		(−0.08)		(−0.09)
Leverage		−0.037		−0.037		−0.034		−0.034
		(−0.78)		(−0.79)		(−0.73)		(−0.73)
Log(Analyst Coverage)		−0.019		−0.019		−0.174		−0.175
		(−0.15)		(−0.14)		(−1.40)		(−1.41)
Analyst Dispersion		−0.536***		−0.539***		−0.828***		−0.831***
		(−2.67)		(−2.71)		(−4.37)		(−4.37)
Constant	2.309*	1.800	2.281*	1.775	0.591	−0.555	0.533	−0.614
	(1.71)	(1.09)	(1.70)	(1.09)	(0.46)	(−0.31)	(0.42)	(−0.34)
Obs	283,671	254,873	283,671	254,873	272,728	245,451	272,728	245,451
R-squared	0.045	0.080	0.048	0.082	0.043	0.076	0.045	0.078

《估值修复还是信息混淆? ——基于多方 ESG 评级与股票错误定价的研究》（金融研究，2024）

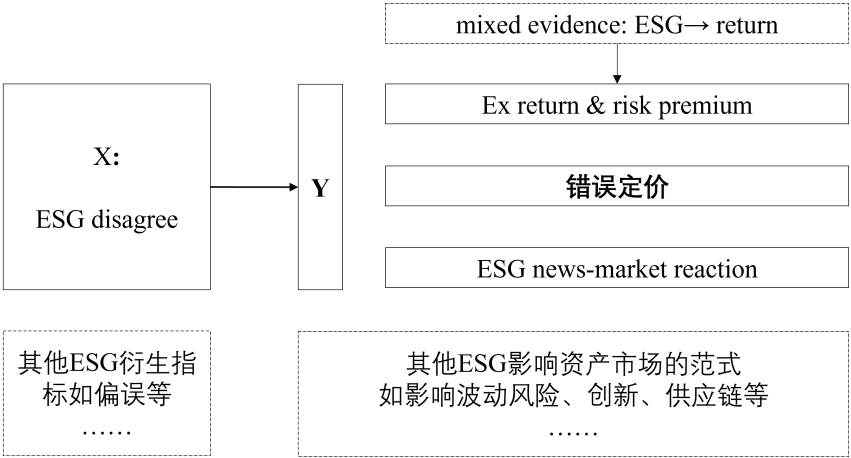
- H1: 在**异质信念**理论模型下,ESG 评级分歧加剧了股票错误定价
- H2: ESG 评级分歧通过影响**信息透明度**和**噪声交易者**进而加剧股票错误定价
- H3: ESG 评级分歧主要导致股价被高估

$$\mathrm{MisPi}_{i,t} = \beta_0 + \beta_1 \,\mathrm{DivESG}_{i,t-1} + \gamma \boldsymbol{X}_{i,t-1} + \lambda_t + \mu_i + \varepsilon_{i,t}$$

Idea

- 替换 X: 其他 ESG 不确定性?
  - 国内 v.s. 国际
  - 公司与评级机构的内幕联系
- 替换 Y:ESG 分歧的其他市场影响?
  - 股价波动风险? 下行风险?
- 进一步:
  - 分析师有偏? ——ESG 是否会有偏?
  - 如何

Thanks!


mixed evidence: ESG→ return
X:
ESG disagree
Y
Ex return & risk premium
错误定价
ESG news-market reaction
其他ESG衍生指标如偏误等
……
其他ESG影响资产市场的范式
如影响波动风险、创新、供应链等
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