The Cost of ESG Investing

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Introduction

ESG integration is challenging

- Rapidly growing client demand for ESG investing:
  - Fund managers are increasingly looking for ways to integrate ESG goals
  - However, the implications of doing so are unclear
- Widespread disagreement on the return predictability of ESG characteristics:
  - Yes: Fabozzi et al. [2008], Luo and Balvers [2017], Pedersen et al. [2020], Zerbib [2020], Glossner [2021], Baker et al. [2018], Bolton and Kacperczyk [2020], and Pastor et al. [2021b]
  - No: Hartzmark and Sussman [2019], Pedersen et al. [2020], Gorgen et al. [2020]
  - Cheap-talk: Kim and Yoon [2020], Brandon et al. [2021].
- Costs and benefits of ESG integration:
  - Kim and Yoon [2020], Brandon et al. [2021], Ceccarelli et al. [2021], Aragon et al. [2020]
- *This paper:* Can we form ESG portfolios "for free", and if yes, why?

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What we do

Methodology and Contributions

1. We use IPCA (instrumented PCA) to extract aggregate risks that better-capture the mean-variance-efficient frontier (see Kelly et al. [2019, forthcoming]):
   - Best-possible depiction of systematic risks when we evaluate effect of ESG on average returns
   - Avoid inappropriately attributing them to an alpha because one's factor model is poor
2. Explicitly allow for ESG measures and other firm characteristics to drive cross-sectional and time-series variation in alphas, betas, or both.
   - Do ESG ratings identify systematic (conditional) risk exposures or exploitable mispricing?
3. Take into account a large amount of the conditioning information investors have at their disposal *already* in addition to ESG scores.
4. Use data from four major ESG providers (and evaluate both aggregate and subcomponent performance) in our empirical analysis

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Take aways

- Can adjust systematic portfolio to achieve ESG mandate with minimal effect on profits
  - Simple ESG screens or model-implied optimal portfolios

  (of course depends on strength of ESG screening)

- Why? ESG measures do not predict returns
  - Not α
  - Not β

  within the context of *rich* conditioning information available to investors

- Consistent with equilibrium theory
  - as different ESG-minded investors use different ESG measures, and those measures disagree

The IPCA model

Conditional, time-varying alpha, beta

$$r_{n,t+1} = \alpha_{n,t} + \beta'_{n,t} f_{t+1} + \varepsilon_{n,t+1}, \quad \text{where } \alpha_{n,t} = \Gamma'_{\alpha} z_{n,t} \text{ and } \beta_{n,t} = \Gamma'_{\beta} z_{n,t}$$

$z_{n,t}$ vector of firm-characteristics ($L \times 1$)

$\beta_{n,t}$ instrument for with characteristics ($\Gamma'_{\beta} z_{n,t}$) $\Rightarrow$ *conditional exposures*

$\alpha_{n,t}$ instrument for with characteristics ($\Gamma'_{\alpha} z_{n,t}$) $\Rightarrow$ *conditional alpha*

f_t *estimated* factors ($K \times 1$) $\Rightarrow$ Kelly et al. [2019, 2021, forthcoming] show that estimating factors produces arge gains relative to well-known factors [Hou et al., 2015, Fama and French, 2015] for stocks and bonds

- Output: $\beta_{n,t}$, moments of $f, \epsilon \Rightarrow$ tangency portfolio, model-implied moments of r_{t+1}

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ESG strategies in practice

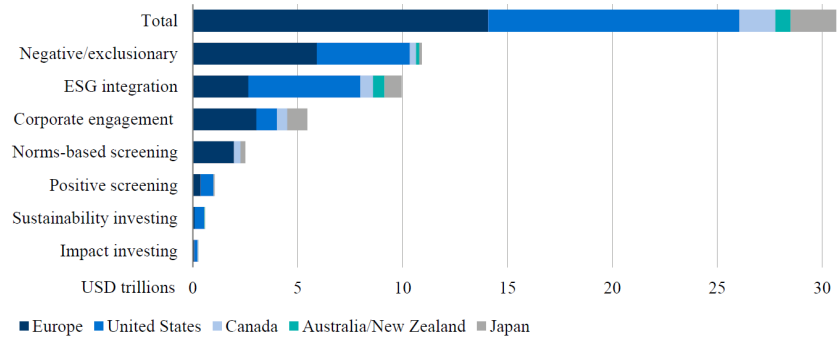

Figure: From Dimson et al. [2020]

ESG strategies in the IPCA framework

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Tilted systematic portfolios: impose $\Gamma_\alpha = 0$ IPCA ESG Overlay

- Adjust portfolio for an ESG mandate, *after* model estimation $\Leftrightarrow$ ESG screening

1. (Tangency ptf) + (Screen "bad" or "good" ESG) = ESG-tilted tangency ptf
2. (Model-implied moments of r_{t+1}) +(Responsible-investing model) = ESG-tilted Markowitz ptf

Use Pedersen et al. [2020] and Pastor et al. [2021a]

Non-systematic portfolios: Allow $\Gamma_\alpha \neq 0$ ESG in IPCA model

- Include ESG in $z_{n,t}$ in model like other firm characteristics $\Leftrightarrow$ ESG integration

1. $\Gamma_\alpha = 0$ and β(other chars, ESG): better mean-variance frontier?
2. α(other chars, ESG): *pure-alpha portfolio* performance [Kelly et al., 2019]?
3. β(other chars), α(ESG): profitable *beta-neutral portfolio*?

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Data

- Non-ESG data: CRSP and Compustat via the codes provided by Jensen et al. [forthcoming]. ⏩ Non-ESG Data
  - 50 characteristics, based on those that provide the greatest firm-month coverage.
  - In robustness check: subset of 17 that are "slow" (small time-series vol)

- ESG data: 4 major ESG data providers (KLD, Asset4, Sustainalytics, RepRisk).
  - Coverage varies widely across data providers and time ⏩ ESG Data 1
  - ESG data availability much better for large firms ⏩ ESG Data 2 ⏩ ESG Data 3
  - Main tests focus on sample of *large firms* (Kelly et al. [2019] show lower systematic-investment profits in large firms $\Rightarrow$ more stringent test of effects of ESG)

- All measures (ESG and Non-ESG) rank-demeaned to $[-0.5, 0.5]$ so mean/median equals 0

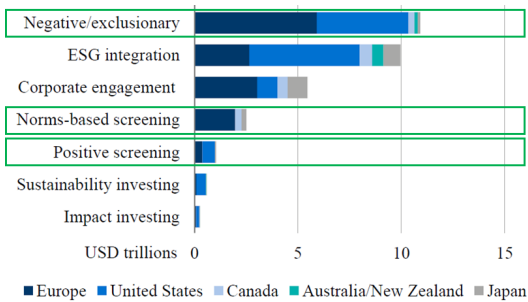
Results: ESG as a tilt

Tangency portfolio of large firms, no ESG overlay:

- Result consistent with Kelly et al. [2019]
- Annualized Sharpe ratio and mean, and excess kurtosis and skewness of the monthly returns for tangency portfolio (large firms only, t-Statistics in parentheses)

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18

Results: ESG as a tilt



Results: ESG as a tilt

- ESG Mandate: Negative Screening #1 $\Rightarrow$ exclude firms below given ESG score

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18
Exclude firms below p_{25} ESG score:						
KLD	1.48	(2.34)	14.79	(7.35)	2.36	0.46
Asset4	1.39	(2.19)	13.84	(6.70)	2.70	0.03
Sustainalytics	1.42	(2.25)	14.22	(7.04)	2.04	0.19
RepRisk	1.53	(2.42)	15.31	(7.63)	2.21	0.45

Results: ESG as a tilt

- ESG Mandate: Negative Screening #2 $\Rightarrow$ do not go long 'bad' ESG firms

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18
Exclude firms below p_{25} ESG score in long-leg only:						
KLD	1.43	(2.25)	14.26	(7.06)	2.21	0.39
Asset4	1.40	(2.21)	13.98	(6.79)	2.33	0.37
Sustainalytics	1.41	(2.22)	14.07	(6.90)	2.24	0.19
RepRisk	1.50	(2.37)	15.01	(7.45)	2.20	0.45

Results: ESG as a tilt

- ESG Mandate: Positive Screening $\Rightarrow$ only invest in 'good' ESG firms (i.e. zero-out firms with missing ESG scores)

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18
Exclude firms not-above p_{50} ESG score:						
KLD	1.14	(1.81)	11.41	(6.71)	1.99	0.09
Asset4	0.59	(0.93)	5.85	(2.96)	7.47	0.25
Sustainalytics	0.65	(1.02)	6.45	(3.40)	14.03	2.21
RepRisk	0.62	(0.98)	6.17	(3.36)	7.03	0.35

Results: ESG as a tilt

Responsible-investment model: Pedersen et al. [2020]

- Firms with ESG score above targeted average ESG score ($\bar{s}$) receive higher ptf weight
- Portfolio weights: $w_{PFP,t} = \Sigma_t^{-1}\left(\mu_t + \pi_t(s_t - \iota_{N_t}\bar{s})\right)$

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18
Missing ESG as 0, $\bar{s} = 0.25$ *:*						
KLD	1.49	(2.25)	14.86	(7.26)	1.87	−0.05
Asset4	1.17	(1.33)	11.71	(4.50)	1.68	−0.45
Sustainalytics	1.83	(1.45)	18.24	(6.23)	0.68	0.19
RepRisk	1.17	(1.15)	11.66	(3.90)	1.47	−0.48

Results: ESG as a tilt

Responsible-investment models: Pastor et al. [2021a]

- Investor's 'taste' for ESG ($d \geq 0$) determines weight of firm in portfolio
- Portfolio weights: $w_{PST,t} = \Sigma_t^{-1}(\mu_t + ds_t)$

	SR		Mean		Kurtosis	Skewness
No ESG Tilt	1.46	(2.30)	14.58	(7.29)	1.96	0.18
Missing ESG as 0, $d = 0.001$:						
KLD	1.36	(2.15)	13.60	(7.11)	1.12	−0.16
Asset4	1.36	(2.14)	13.54	(7.13)	1.59	−0.14
Sustainalytics	1.42	(2.24)	14.20	(7.45)	1.53	0.01
RepRisk	1.47	(2.31)	14.65	(7.65)	1.09	0.03

Robustness

ESG as an overlay

- Alternative ESG thresholds, model parameters ⏩ Tilts ⏩ Pedersen et al. (2020) ⏩ Pastor et al. (2021a)
- Subcomponents (E, S, G) ⏩ Robustness E, S, G
- Only nonmissing; imputed 0 or -0.5 ⏩ Robustness Imputation
- Best-in-class industry adjustment ⏩ Industry adjustment
- Fewer "slow" characteristics; recent data post 2010 ⏩ Post 2010

There are numerous ways to overlay a profitable systematic portfolio with an ESG mandate and sacrifice (close to) nothing:

- Sharpe ratios and average returns can remain high and statistically significant
- ESG overlay portfolios are net-long, have high diversification, and higher median ESG scores than tangency portfolio ⏩ Properties Portfolio Overlays

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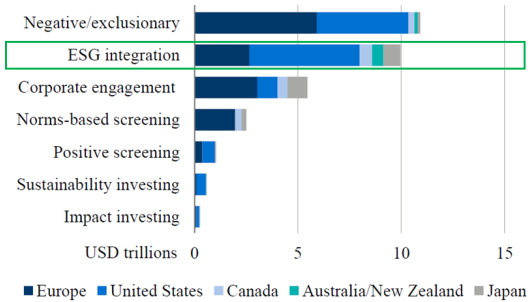
In alpha, or beta, or both



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ESG integration *only* in β:

- $r_{n,t+1} = \beta'_{n,t} f_{t+1} + \varepsilon_{n,t+1}$, where $\Gamma_\alpha = 0$ and $\beta_{n,t} = \Gamma'_\beta z_{n,t}$
- Systematic portfolio ($\Gamma_\alpha = 0$), include ESG scores with other characteristics in $z_{n,t}$.

	SR		Mean	
Large firms, no ESG	1.46	(2.30)	14.57	(7.28)
Large firms, missing ESG as 0, 5-factors, $\Gamma_\alpha = 0$*:*				
KLD	1.41	(2.23)	14.13	(7.17)
Asset4	1.48	(2.33)	14.76	(7.37)
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ESG integration in α and β (pure-alpha):

- $r_{n,t+1} = \alpha_{n,t} + \beta'_{n,t} f_{t+1} + \varepsilon_{n,t+1}$, where $\alpha_{n,t} = \Gamma'_\alpha z_{n,t}$ and $\beta_{n,t} = \Gamma'_\beta z_{n,t}$
- z includes ESG *and* other characteristics.

	SR		Mean	
Large firms, no ESG	0.18	(0.29)	1.82	(1.01)
Large firms, missing ESG as 0, 5-factors, $\Gamma_\alpha \neq 0$*:*				
KLD	−0.08	(−0.11)	−0.75	(−0.37)
Asset4	0.12	(0.13)	1.16	(0.45)
Sustainalytics	0.38	(0.30)	3.76	(1.12)
RepRisk	0.24	(0.23)	2.36	(0.77)

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ESG integration in *only* α (beta-neutral):

- $r_{n,t+1} = \alpha_{n,t} + \beta'_{n,t} f_{t+1} + \varepsilon_{n,t+1}$, where $\alpha_{n,t} = \Gamma'_\alpha \zeta_{n,t}$ and $\beta_{n,t} = \Gamma'_\beta z_{n,t}$
- ζ includes ESG scores, z includes other characteristics.

	SR		Mean	
Large firms, missing ESG as 0, 5-factors, $\Gamma_\alpha \neq 0$*:*				
KLD	0.20	(0.32)	2.03	(1.04)
Asset4	0.06	(0.09)	0.60	(0.33)
Sustainalytics	0.03	(0.05)	0.34	(0.19)
RepRisk	0.20	(0.32)	2.01	(1.03)

Robustness

ESG in the model

- Alternative configurations, imputations for missing values Robustness missing values
- Subcomponents (E, S, G)
- Best-in-class industry adjustment
- Other FF model specs Robustness beta Robustness alpha
- Fewer "slow" characteristics; recent data from 2010-

Robustness: tangency ptf Robustness: beta-neutral

Taken together, the results cast doubt on the idea that ESG scores are useful for *creating* profitable portfolio strategies:

- No role for ESG scores in determining firms' beta
- No evidence that they define alpha with respect to successful asset-pricing factors

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Relation to other empirical results

E dimension: Pastor et al. [2021b] construct "green" factor

- Find Fama-French alpha over 2012–2020
- Argue this reflects unexpected climate-concern shocks, not reliable alpha *going forward*

S dimension: Edmans [2011] constructs "employment satisfaction" factor

- Finds Carhart [1997] alpha over 1984-2009.
- Argues that financial markets under-appreciate the importance of employment satisfaction.

- We successfully replicate both papers using Fama-French (Carhart) risk factors: *unconditional alpha* Pastor et al. (2021b) result Edmans (2011) result
- However, we find no reliable *conditional alpha* in IPCA model (beta-neutral portfolios)
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Relation to theory

ESG measures **don't reliably predict returns** $\Rightarrow$ we **can use them to overlay** well-performing portfolios **without reduction** in performance

- But if every investor does this, what is the equilibrium effect?
- Won't 'bad' ESG stock prices fall, expected returns rise, and ESG begin to predict returns?

Relation to theory

ESG measures **don't reliably predict returns** $\Rightarrow$ we **can use them to overlay** well-performing portfolios **without reduction** in performance

- But if every investor does this, what is the equilibrium effect?
- Won't 'bad' ESG stock prices fall, expected returns rise, and ESG begin to predict returns?

No, not necessarily

- Our extensive results show: no one way to "do ESG"
- Different investors may use *different measures* and have *different ESG mandates*
- Extension of Pastor et al. [2021a] model: expected returns may be unaffected by ESG concerns when ESG scores are uncorrelated ⏩ Pastor et al. (2021a) extension

Relation to theory

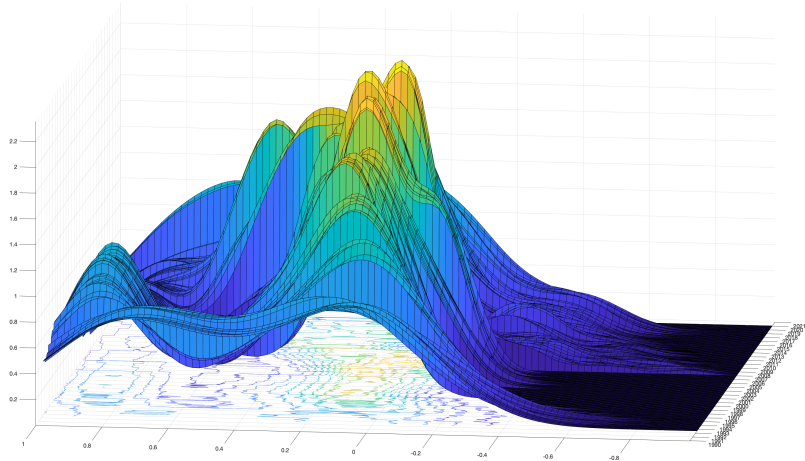
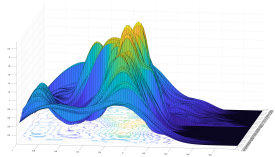


Figure: Densities of cross-sectional rank correlations

Relation to theory



- ESG measures are essentially randomly related—don't agree
- In a Pastor et al. [2021a] type model: no equilibrium effect on $E(r)$

  $\Rightarrow$ Even if investors act as promised, the plethora of ESG metrics and ESG mandates can lead to negligible equilibrium effects
- Professional portfolio-managers have incentives to advertise good ESG performance
- One might *expect* many ESG measures and measure-providers to flourish

Conclusion

- Can adjust portfolio to achieve ESG mandate with minimal effect on profits
  - Simple ESG screens or model-implied optimal portfolios

  (of course depends on strength of ESG screening)

- ESG measures do not predict returns
  - Not α
  - Not β

  within the context of *rich* conditioning information available to investors

- Consistent with equilibrium theory
  - as different ESG-minded investors use different ESG measures, and those measures disagree

Appendix Slides

Including ESG: As an overlay/tilt

Overlay: adjust portfolio for an ESG-investing mandate, not as part of mean/cov estimation

Unadjusted Tangency

- Factor portfolios: $W_{f,t} = (\beta_t' \beta_t)^{-1} \beta_t'$
- Factor tangency portfolio: $w_{factan} = \frac{1}{\iota_K' S^{-1} m} S^{-1} m$ $(E(f) = m, Cov(f) = S)$
- $\Rightarrow w_{tan,t}' = w_{factan}' W_{f,t}$

1. Screened tangency
   - Zero-out $w_{i,tan,t}$ where firm i's ESG is below p_Q (e.g. $Q = 50\%$)
   - In either leg, or only in long leg
2. Pedersen et al. [2020] optimal portfolio
   $w_{PFP,t} = \Sigma_t^{-1} (\mu_t + \pi_t (s_t - \iota_{N_t} \bar{s}))$
   for s_t ESG scores, $\bar{s}$ avg, $\mu = E(r), \Sigma = Cov(r)$, π_t function of parameters
3. Pastor et al. [2021a] optimal portfolio
   $w_{PST,t} = \Sigma_t^{-1} (\mu_t + d s_t)$, for $d \geq 0$ ESG taste

Model estimates: $\mu_t = \beta_t E(f), \Sigma_t = \beta_t \Sigma_F \beta_t' + \Sigma_\epsilon$

◂ IPCA model

Including ESG: In the IPCA model

Like any other characteristic

- Is ESG in $\beta_{n,t}$?
- Is ESG in $\alpha_{n,t}$?
- How does ESG data *change* the estimates?

$\alpha_{n,t}$ makes a profitable "pure-alpha" portfolio (no factor exposure)? [Kelly et al., 2019]

Just in α

- Modified estimator:
  $r_{n,t+1} = \zeta'_{n,t}\Gamma_\alpha + z'_{n,t}\Gamma_\beta f_{t+1}$ for ESG ζ *not* in z
- Define a "beta-neutral" portfolio (no factor exposure)

◂ IPCA model

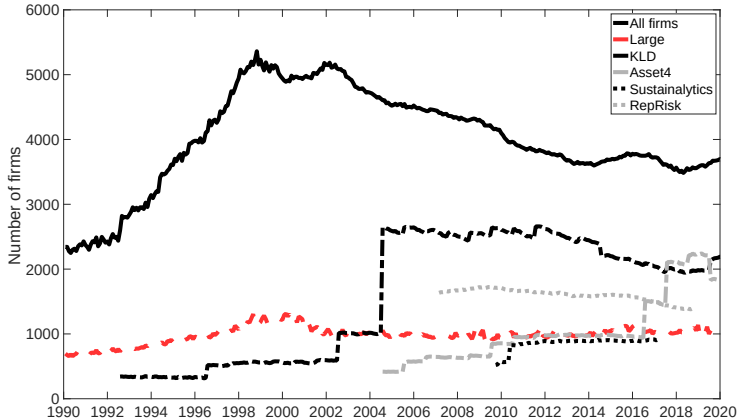
Non-ESG Data

CRSP and Compustat via the codes provided by [Jensen et al., forthcoming]

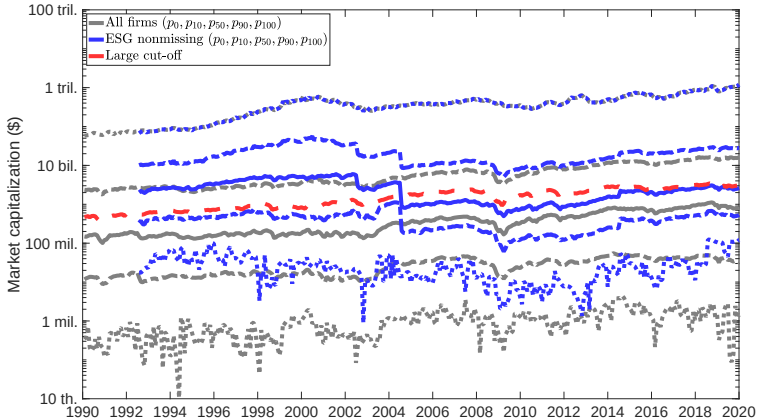
- 50 characteristics, based on those that provide the greatest firm-month coverage
- market_equity and assets
- cash-flow variables net_income, sales
- pay-out ratios eqnpo_1m, eqnpo_3m, eqnpo_6m, eqnpo_12m, ni_at
- change in shares chcsho_1m, chcsho_3m, chcsho_6m, chcsho_12m
- valuation ratios div3m_me, div6m_me, div12m_me, at_me, ni_me, nix_me, sale_me, xido_at
- leverage ratios debt_me, netdebt_me, debt_at
- turnover, trading, and volume variables tvol, zero_trades_21d, zero_trades_126d, dolvol_126d, turnover_126d, dolvol_var_126d, turnover_var_126d, zero_trades_252d, bidaskhl_21d, rvolhl_21d
- past return variables ret_1_0, ret_2_0, ret_3_0, ret_3_1, ret_6_0, ret_6_1, ret_9_0, ret_9_1, ret_12_0, ret_12_1, ret_12_7
- quality-minus-junk qmj_safety, qmj_prof
- other variables seas_1_1an, age, mispricing_perf.

Data

Available ESG observations over time



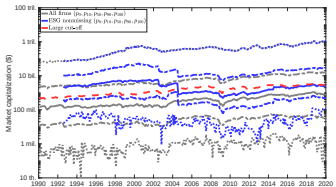
Firm size and KLD ESG availability



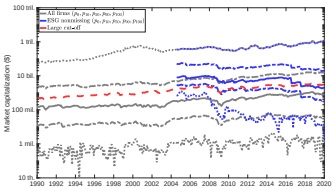
Data

Firm size and ESG availability

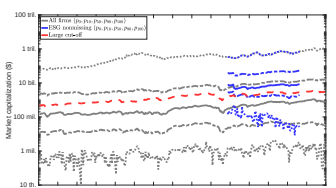
Panel A. KLD



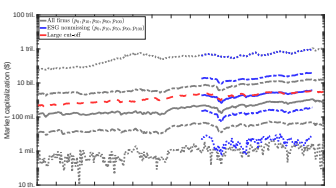
Panel B. Asset4



Panel C. Sustainalytics



Panel D. RepRisk



Data

Robustness – ESG Tilts: Alternative Thresholds

	SR		Mean		Kurtosis	Skewness
Panel B: KLD						
zero-out $w_{tan,t}$ below p_{50} ESG	1.52	(2.39)	15.15	(7.52)	3.86	0.76
zero-out $w_{tan,t}$ below p_{75} ESG	1.39	(2.20)	13.90	(6.48)	6.24	1.10
zero-out $w_{tan,t}$ below p_{50} ESG in long-leg	1.25	(1.97)	12.49	(6.17)	2.76	0.19
zero-out $w_{tan,t}$ below p_{75} ESG in long-leg	0.78	(1.23)	7.75	(3.78)	1.73	−0.00
Panel C: Asset4						
zero-out $w_{tan,t}$ below p_{50} ESG	1.34	(2.12)	13.39	(6.29)	3.05	0.28
zero-out $w_{tan,t}$ below p_{75} ESG	1.31	(2.06)	13.04	(5.99)	3.77	0.67
zero-out $w_{tan,t}$ below p_{50} ESG in long-leg	1.22	(1.93)	12.20	(5.84)	2.38	0.47
zero-out $w_{tan,t}$ below p_{75} ESG in long-leg	0.96	(1.52)	9.62	(4.63)	1.75	0.23
Panel D: Sustainalytics						
zero-out $w_{tan,t}$ below p_{50} ESG	1.37	(2.17)	13.71	(6.65)	2.32	0.23
zero-out $w_{tan,t}$ below p_{75} ESG	1.33	(2.10)	13.31	(6.34)	2.70	0.30
zero-out $w_{tan,t}$ below p_{50} ESG in long-leg	1.31	(2.07)	13.06	(6.28)	2.36	0.24
zero-out $w_{tan,t}$ below p_{75} ESG in long-leg	1.17	(1.85)	11.72	(5.59)	1.91	0.25
Panel E: RepRisk						
zero-out $w_{tan,t}$ below p_{50} ESG	1.51	(2.38)	15.06	(7.33)	2.75	0.60
zero-out $w_{tan,t}$ below p_{75} ESG	1.46	(2.31)	14.59	(6.99)	2.93	0.66
zero-out $w_{tan,t}$ below p_{50} ESG in long-leg	1.37	(2.17)	13.72	(6.61)	2.47	0.46
zero-out $w_{tan,t}$ below p_{75} ESG in long-leg	1.26	(1.98)	12.55	(5.99)	2.17	0.44

◂ Robustness Overlays

Robustness – Responsible-investing models: Pedersen et al. (2020)

	SR		Mean		Kurtosis	Skewness
Panel B: KLD						
Large, PFP optimal, missing ESG as 0, $\bar{s} = 0$	1.49	(2.25)	14.87	(7.25)	1.94	−0.03
Large, PFP optimal, missing ESG as 0, $\bar{s} = -0.25$	1.46	(2.20)	14.58	(7.08)	2.03	−0.01
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0$	1.51	(2.28)	15.08	(7.44)	1.81	0.04
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = -0.25$	1.49	(2.26)	14.92	(7.29)	1.91	−0.01
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0.25$	1.51	(2.28)	15.04	(7.47)	1.73	0.08
Panel C: Asset4						
Large, PFP optimal, missing ESG as 0, $\bar{s} = 0$	1.18	(1.34)	11.74	(4.50)	1.51	−0.43
Large, PFP optimal, missing ESG as 0, $\bar{s} = -0.25$	1.16	(1.31)	11.53	(4.39)	1.43	−0.43
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0$	1.19	(1.35)	11.85	(4.54)	1.68	−0.47
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = -0.25$	1.16	(1.32)	11.60	(4.44)	1.56	−0.45
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0.25$	1.20	(1.36)	11.94	(4.56)	1.84	−0.49
Panel D: Sustainalytics						
Large, PFP optimal, missing ESG as 0, $\bar{s} = 0$	1.86	(1.47)	18.49	(6.23)	0.75	0.17
Large, PFP optimal, missing ESG as 0, $\bar{s} = -0.25$	1.86	(1.47)	18.48	(6.12)	0.78	0.16
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0$	1.87	(1.48)	18.56	(6.34)	0.71	0.17
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = -0.25$	1.86	(1.47)	18.53	(6.21)	0.72	0.13
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0.25$	1.85	(1.47)	18.45	(6.40)	0.68	0.20
Panel E: RepRisk						
Large, PFP optimal, missing ESG as 0, $\bar{s} = 0$	1.16	(1.14)	11.58	(3.87)	1.54	−0.50
Large, PFP optimal, missing ESG as 0, $\bar{s} = -0.25$	1.13	(1.11)	11.29	(3.75)	1.64	−0.54
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0$	1.17	(1.15)	11.68	(3.90)	1.52	−0.49
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = -0.25$	1.15	(1.13)	11.46	(3.82)	1.61	−0.52
Large, PFP optimal, missing ESG as −0.5, $\bar{s} = 0.25$	1.18	(1.16)	11.78	(3.94)	1.44	−0.47

◂ Robustness Overlays

Robustness – Responsible-investing models: Pastor et al. (2021)

	SR		Mean		Kurtosis	Skewness
Panel B: KLD						
Large, PST optimal, missing ESG as 0, $d = 0.01$	0.35	(0.56)	3.51	(1.85)	1.91	−0.29
Large, PST optimal, missing ESG as 0, $d = 0.0001$	1.49	(2.35)	14.89	(7.71)	1.83	−0.02
Large, PST optimal, missing ESG as −0.5, $d = 0.01$	0.17	(0.22)	1.70	(0.76)	0.25	0.05
Large, PST optimal, missing ESG as −0.5, $d = 0.001$	1.26	(2.00)	12.63	(6.95)	1.16	0.15
Large, PST optimal, missing ESG as −0.5, $d = 0.0001$	1.50	(2.36)	14.97	(7.81)	1.74	0.04
Panel C: Asset4						
Large, PST optimal, missing ESG as 0, $d = 0.01$	0.36	(0.56)	3.55	(1.89)	3.88	−0.26
Large, PST optimal, missing ESG as 0, $d = 0.0001$	1.48	(2.34)	14.81	(7.68)	1.91	−0.02
Large, PST optimal, missing ESG as −0.5, $d = 0.01$	0.52	(0.58)	5.15	(1.83)	0.31	−0.20
Large, PST optimal, missing ESG as −0.5, $d = 0.001$	1.37	(2.17)	13.70	(7.01)	1.99	−0.25
Large, PST optimal, missing ESG as −0.5, $d = 0.0001$	1.49	(2.35)	14.87	(7.69)	1.95	−0.03
Panel D: Sustainalytics						
Large, PST optimal, missing ESG as 0, $d = 0.01$	0.48	(0.76)	4.82	(2.59)	6.46	−0.23
Large, PST optimal, missing ESG as 0, $d = 0.0001$	1.48	(2.34)	14.83	(7.68)	1.88	−0.01
Large, PST optimal, missing ESG as −0.5, $d = 0.01$	0.16	(0.13)	1.63	(0.41)	0.35	0.02
Large, PST optimal, missing ESG as −0.5, $d = 0.001$	1.30	(2.05)	12.97	(6.68)	1.67	0.02
Large, PST optimal, missing ESG as −0.5, $d = 0.0001$	1.48	(2.33)	14.74	(7.63)	1.91	−0.01
Panel E: RepRisk						
Large, PST optimal, missing ESG as 0, $d = 0.01$	0.68	(0.91)	6.78	(2.61)	9.92	−0.79
Large, PST optimal, missing ESG as 0, $d = 0.0001$	1.50	(2.36)	14.93	(7.73)	1.84	0.00
Large, PST optimal, missing ESG as −0.5, $d = 0.01$	−0.28	(−0.12)	−2.78	(−0.33)	−0.71	−0.22
Large, PST optimal, missing ESG as −0.5, $d = 0.001$	1.36	(2.14)	13.55	(6.86)	0.90	0.02
Large, PST optimal, missing ESG as −0.5, $d = 0.0001$	1.49	(2.35)	14.90	(7.71)	1.81	0.01

◂ Robustness Overlays

Robustness – ESG as a tilt

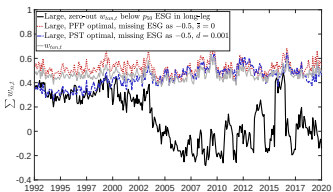
Subindices, all firms, industry-adjustment, post-2010

	SR		Mean		Kurtosis	Skewness
All firms	4.08	(6.28)	40.75	(16.35)	0.89	0.23
All firms, zero-out $w_{tan,t}$ below p_{50} ESG	4.12	(6.33)	41.11	(15.63)	0.84	0.40
All firms, zero-out $w_{tan,t}$ below p_{50} ESG in long-leg	3.92	(6.05)	39.15	(15.38)	0.53	0.25
All firms, zero-out $w_{tan,t}$ not-above p_{50} ESG	1.01	(1.59)	10.07	(5.31)	14.79	−1.34
All firms, PFP optimal, missing ESG as 0, $\bar{s} = 0$	3.26	(4.85)	32.50	(13.68)	2.42	0.12
All firms, PFP optimal, missing ESG as -0.5, $\bar{s} = 0$	3.19	(4.75)	31.82	(14.05)	2.68	0.31
All firms, PST optimal, missing ESG as 0, $d = 0.001$	2.88	(4.50)	28.78	(12.82)	2.46	−0.01
All firms, PST optimal, missing ESG as -0.5, $d = 0.001$	2.67	(4.17)	26.70	(13.19)	2.78	0.32
Large, Total ind. adj., zero-out $w_{tan,t}$ below p_{50} ESG	1.44	(2.27)	14.38	(6.92)	4.56	0.83
Large, E, zero-out $w_{tan,t}$ below p_{50} ESG	1.52	(2.40)	15.18	(7.66)	2.28	0.45
Large, S, zero-out $w_{tan,t}$ below p_{50} ESG	1.55	(2.44)	15.45	(7.74)	3.30	0.62
Large, G, zero-out $w_{tan,t}$ below p_{50} ESG	1.46	(2.31)	14.61	(7.23)	2.09	0.24
All firms, Total ind. adj., zero-out $w_{tan,t}$ below p_{50} ESG	4.01	(6.17)	40.00	(14.67)	0.80	0.45
All firms, E, zero-out $w_{tan,t}$ below p_{50} ESG	4.14	(6.37)	41.39	(16.31)	0.92	0.28
All firms, S, zero-out $w_{tan,t}$ below p_{50} ESG	4.07	(6.27)	40.65	(15.56)	0.84	0.39
All firms, G, zero-out $w_{tan,t}$ below p_{50} ESG	4.11	(6.32)	41.03	(16.25)	0.88	0.26
Large, 2010-	1.98	(1.80)	19.72	(7.04)	0.82	−0.30
Large, 2010-, zero-out $w_{tan,t}$ below p_{50} ESG	1.73	(1.58)	17.24	(7.15)	0.09	−0.43
All firms, 2010-	2.89	(2.61)	28.81	(10.07)	1.39	−0.14
All firms, 2010-, zero-out $w_{tan,t}$ below p_{50} ESG	2.87	(2.59)	28.58	(10.16)	2.47	0.26

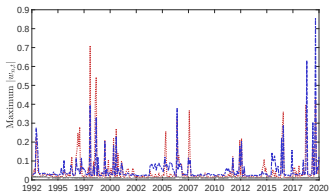
◂ Robustness Overlays

Properties of overlaid portfolios

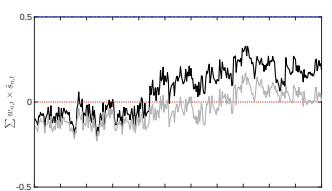
Panel A



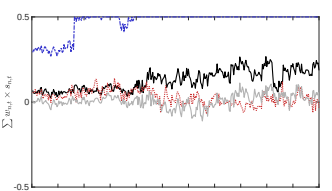
Panel B



Panel C



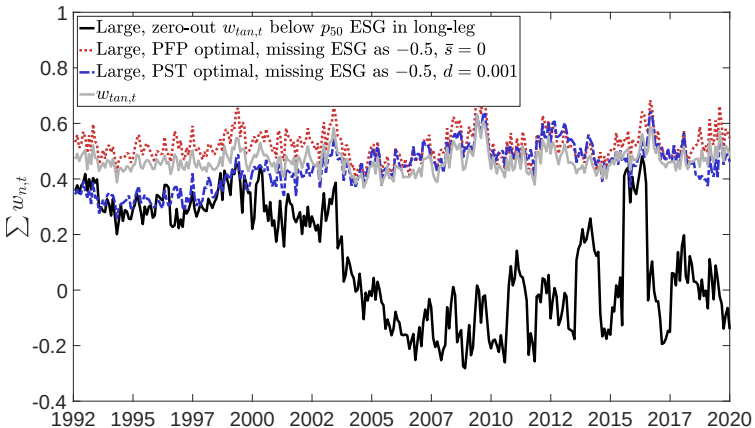
Panel D



Robustness Overlays

Properties of overlaid portfolios

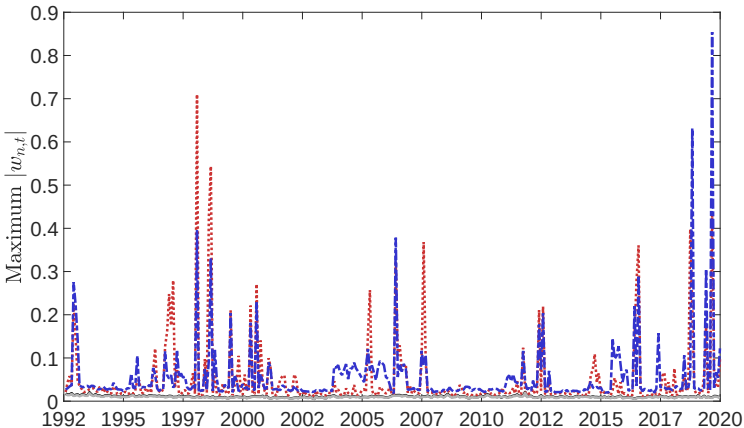
Panel A



Robustness Overlays

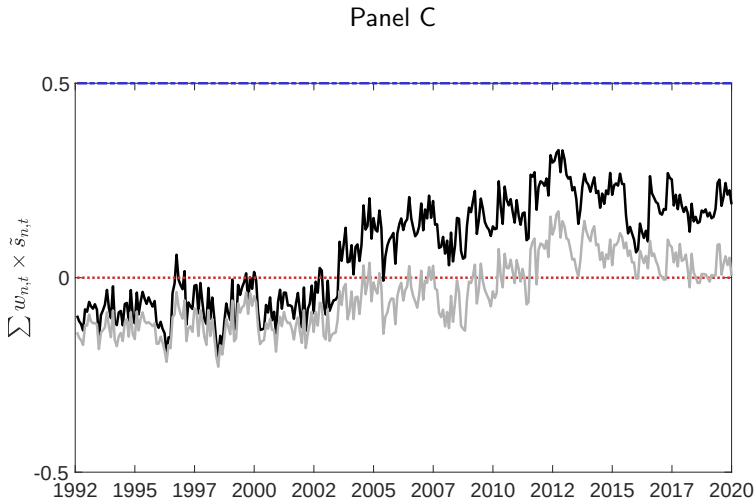
Properties of overlaid portfolios

Panel B



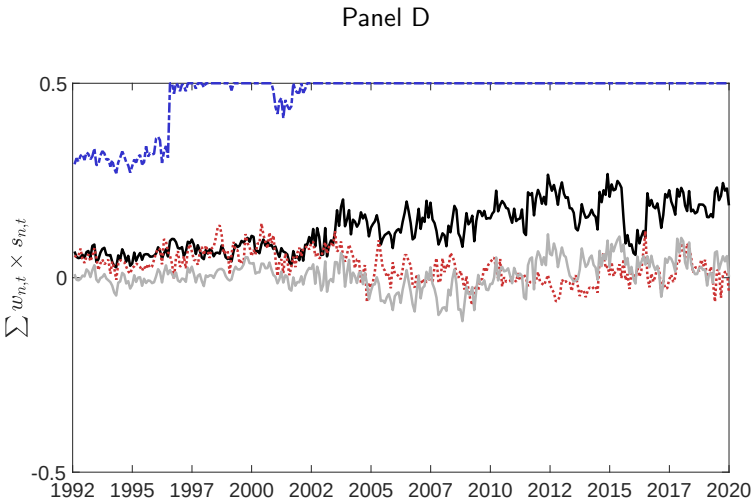
Robustness Overlays

Properties of overlaid portfolios



Robustness Overlays

Properties of overlaid portfolios



Robustness Overlays

Robustness – ESG in the model: As beta and pure-alpha

	R^2	Factor				Pure-alpha			
		SR		Mean		SR		Mean	
Panel A									
Large, 5-factor restricted	31.0	1.46	(2.30)	14.57	(7.28)				
Large, 5-factor unrestricted	31.1					0.18	(0.29)	1.82	(1.01)
Panel B: KLD									
Large, missing ESG as −0.5, 5-factor restricted	31.1	1.36	(2.15)	13.62	(6.97)				
Large, missing ESG as −0.5, 5-factor unrestricted	31.2					0.19	(0.28)	1.85	(0.98)
Large, ESG nonmissing, 5-factor restricted	32.8	1.16	(1.76)	11.59	(6.43)				
Large, ESG nonmissing, 5-factor unrestricted	32.9					0.24	(0.36)	2.40	(1.27)
Large, ESG nonmissing, ESG included, 5-factor restricted	32.9	1.16	(1.75)	11.55	(6.39)				
Large, ESG nonmissing, ESG included, 5-factor unrestricted	33.0					0.16	(0.25)	1.62	(0.85)
Panel C: Asset4									
Large, missing ESG as −0.5, 5-factor restricted	31.0	1.47	(2.32)	14.68	(7.28)				
Large, missing ESG as −0.5, 5-factor unrestricted	31.1					−0.07	(−0.08)	−0.69	(−0.27)
Large, ESG nonmissing, 5-factor restricted	35.2	1.33	(1.51)	13.23	(5.77)				
Large, ESG nonmissing, 5-factor unrestricted	35.2					0.32	(0.37)	3.20	(1.28)
Large, ESG nonmissing, ESG included, 5-factor restricted	35.2	1.31	(1.49)	13.09	(5.67)				
Large, ESG nonmissing, ESG included, 5-factor unrestricted	35.3					0.34	(0.39)	3.37	(1.36)
Panel D: Sustainalytics									
Large, missing ESG as −0.5, 5-factor restricted	31.0	1.47	(2.32)	14.69	(7.31)				
Large, missing ESG as −0.5, 5-factor unrestricted	31.1					−0.10	(−0.08)	−1.00	(−0.28)
Large, ESG nonmissing, 5-factor restricted	35.9	1.90	(1.50)	18.91	(6.60)				
Large, ESG nonmissing, 5-factor unrestricted	36.0					0.37	(0.30)	3.69	(1.04)
Large, ESG nonmissing, ESG included, 5-factor restricted	36.0	1.89	(1.50)	18.82	(6.59)				
Large, ESG nonmissing, ESG included, 5-factor unrestricted	36.1					0.37	(0.30)	3.71	(1.05)
Panel E: RepRisk									
Large, missing ESG as −0.5, 5-factor restricted	31.0	1.58	(2.49)	15.76	(8.65)				
Large, missing ESG as −0.5, 5-factor unrestricted	31.1					−0.38	(−0.38)	−3.81	(−1.33)
Large, ESG nonmissing, 5-factor restricted	35.8	1.51	(1.48)	15.01	(5.97)				
Large, ESG nonmissing, 5-factor unrestricted	35.9					−0.30	(−0.30)	−3.00	(−1.04)
Large, ESG nonmissing, ESG included, 5-factor restricted	35.8	1.51	(1.48)	15.03	(5.97)				
Large, ESG nonmissing, ESG included, 5-factor unrestricted	35.9					−0.30	(−0.30)	−2.99	(−1.04)

◂ Robustness

Robustness – ESG in the model as beta (using KLD)

	R^2	Factor			
		SR		Mean	
Panel A. KLD					
Large, FF5C restricted	28.6	1.14	(1.80)	11.38	(6.37)
Large, missing ESG as −0.5, FF5C restricted	28.6	1.14	(1.79)	11.34	(6.35)
All firms, 5-factor restricted	16.4	4.08	(6.28)	40.75	(16.35)
All firms, missing ESG as −0.5, 5-factor restricted	16.4	4.08	(6.28)	40.76	(16.34)
All firms, FF5C restricted	13.7	3.51	(5.45)	35.08	(15.57)
All firms, missing ESG as −0.5, FF5C restricted	13.7	3.49	(5.41)	34.84	(15.46)
Large, Total ind. adj., missing ESG as −0.5, 5-factor restricted	31.1	1.41	(2.22)	14.07	(7.11)
Large, E, missing ESG as −0.5, 5-factor restricted	31.1	1.39	(2.19)	13.84	(7.00)
Large, S, missing ESG as −0.5, 5-factor restricted	31.1	1.38	(2.18)	13.81	(7.04)
Large, G, missing ESG as −0.5, 5-factor restricted	31.1	1.46	(2.31)	14.60	(7.28)
Large, Slow, 5-factor restricted	28.1	1.10	(1.74)	11.03	(6.12)
Large, Slow, missing ESG as −0.5, 5-factor restricted	28.1	1.19	(1.88)	11.92	(6.56)
Large, Slow, FF5C restricted	26.0	0.65	(1.03)	6.51	(3.64)
Large, Slow, missing ESG as −0.5, FF5C restricted	26.0	0.65	(1.03)	6.47	(3.62)
All firms, Slow, 5-factor restricted	13.5	3.54	(5.48)	35.31	(15.08)
All firms, Slow, missing ESG as −0.5, 5-factor restricted	13.5	3.53	(5.48)	35.28	(15.08)
All firms, Slow, FF5C restricted	10.9	2.99	(4.66)	29.85	(14.49)
All firms, Slow, missing ESG as −0.5, FF5C restricted	10.9	2.98	(4.65)	29.79	(14.51)
Panel B. Large, 2010-					
5-factor restricted	33.0	1.98	(1.80)	19.72	(7.04)
KLD Total, missing ESG as −0.5, 5-factor restricted	33.1	1.98	(1.81)	19.75	(7.04)
Asset4 Total, missing ESG as −0.5, 5-factor restricted	33.0	1.98	(1.80)	19.67	(7.03)
Sustainalytics Total, missing ESG as −0.5, 5-factor restricted	33.0	1.97	(1.79)	19.63	(6.91)
RepRisk Total, missing ESG as −0.5, 5-factor restricted	33.0	1.97	(1.79)	19.60	(6.99)
Uncontroversial Total, missing ESG as −0.5, 5-factor restricted	33.0	1.99	(1.81)	19.80	(7.06)
Asset4 Policy Total, missing ESG as −0.5, 5-factor restricted	33.0	1.98	(1.80)	19.68	(7.03)
Sustainalytics Policy Total, missing ESG as −0.5, 5-factor restricted	33.0	1.99	(1.81)	19.82	(6.96)

◂ Robustness

Robustness – ESG in the model as only alpha (beta-neutral)

	Sharpe ratio		Mean	
Panel A. KLD				
Large, FF5C, missing ESG as −0.5	0.20	(0.31)	1.96	(1.09)
Large, FF5C, missing ESG as 0	0.20	(0.31)	1.97	(1.03)
All firms, missing ESG as −0.5	0.39	(0.62)	3.94	(2.09)
All firms, missing ESG as 0	−0.03	(−0.04)	−0.26	(−0.13)
All firms, FF5C, missing ESG as −0.5	0.60	(0.95)	6.00	(3.09)
All firms, FF5C, missing ESG as 0	0.05	(0.08)	0.51	(0.25)
Large, Total ind. adj., missing ESG as −0.5	0.10	(0.16)	0.98	(0.52)
Large, E, missing ESG as −0.5	0.05	(0.07)	0.47	(0.26)
Large, S, missing ESG as −0.5	0.10	(0.17)	1.05	(0.56)
Large, G, missing ESG as −0.5	−0.21	(−0.33)	−2.06	(−1.04)
Large, Slow, Total, missing ESG as −0.5	0.10	(0.17)	1.05	(0.57)
All firms, Slow, Total, missing ESG as −0.5	0.02	(0.03)	0.18	(0.10)
Panel B. Large, 2010-				
KLD Total, missing ESG as −0.5	0.63	(0.58)	6.32	(1.89)
Asset4 Total, missing ESG as −0.5	0.13	(0.12)	1.30	(0.37)
Sustainalytics Total, missing ESG as −0.5	0.47	(0.43)	4.71	(1.37)
RepRisk Total, missing ESG as −0.5	0.55	(0.51)	5.50	(1.89)
Uncontroversial Total, missing ESG as −0.5	0.53	(0.49)	5.29	(1.47)
Asset4 Policy Total, missing ESG as −0.5	0.16	(0.14)	1.56	(0.45)
Sustainalytics Policy Total, missing ESG as −0.5	0.69	(0.63)	6.83	(1.93)

◂ Robustness

Relation to other empirical results: Pastor et al. [2021b]

Table: Unconditional alpha from regressions

	Intercept	Mkt-RF	SMB	HML	RMW	CMA	Mom	R^2(%)
FF3	3.11 (2.49)	0.01 (0.16)	−0.41 (−10.44)	−0.00 (−0.08)				56.0
FF5C	2.88 (2.43)	0.01 (0.22)	−0.43 (−11.65)	0.15 (2.64)	−0.06 (−0.75)	−0.23 (−2.93)	0.08 (2.39)	63.4

Relation to other empirical results: Pastor et al. [2021b]

Table: Unconditional alpha from regressions

	Intercept	Mkt-RF	SMB	HML	RMW	CMA	Mom	R^2(%)
FF3	3.11 (2.49)	0.01 (0.16)	−0.41 (−10.44)	−0.00 (−0.08)				56.0
FF5C	2.88 (2.43)	0.01 (0.22)	−0.43 (−11.65)	0.15 (2.64)	−0.06 (−0.75)	−0.23 (−2.93)	0.08 (2.39)	63.4

Table: Conditional alpha from beta-neutral portfolios

	Mean		SR	
	Panel A: FF3			
Missing ESG as 0	3.29	(0.97)	0.33	(0.26)
Missing ESG as −0.5	−2.77	(−0.85)	−0.28	(−0.22)
ESG nonmissing	2.14	(0.62)	0.22	(0.17)
	Panel B: FF5C			
Missing ESG as 0	−0.92	(−0.27)	−0.09	(−0.07)
Missing ESG as −0.5	−1.56	(−0.47)	−0.15	(−0.12)
ESG nonmissing	0.15	(0.04)	0.02	(0.01)

◂ Relation to other empirical results

Relation to other empirical results: Edmans [2011]

Table: Unconditional alpha from regressions

	Intercept	Mkt-RF	SMB	HML	RMW	CMA	Mom	R^2(%)
FF3	3.32 (2.13)	0.02 (0.67)	−0.17 (−3.26)	−0.38 (−5.52)				19.7
FF5C	5.30 (3.11)	−0.04 (−1.38)	−0.19 (−3.64)	−0.24 (−3.21)	−0.10 (−1.42)	−0.31 (−2.50)	−0.04 (−0.84)	23.5

Table: Conditional alpha from beta-neutral portfolios

	Mean		SR	
FF3	1.64	(0.78)	0.16	(0.24)
FF3C	−1.75	(−0.83)	−0.18	(−0.26)
FF5C	−6.85	(−3.11)	−0.69	(−1.00)

◂ Relation to other empirical results

Relation to theory

Pastor et al. [2021a]: investor i forms the portfolio

$$w_{i,PST} = \Sigma^{-1}(\mu + d_i \tilde{g}_i)$$

ESG-taste $d_i \geq 0$, agent-specific ESG-measure vector $\tilde{g}_i$. Market clearing implies

$$\mu = \Sigma w_{mkt,PST} - \bar{d} g$$

- $\bar{d} = \int_i \omega_i d_i di$: wealth-weighted average of d_i, $\bar{d} > 0$ if any mass have ESG tastes
- $g = (1/\bar{d}) \int_i \omega_i d_i \tilde{g}_i di$: wealth- and ESG-taste-weighted average of $\tilde{g}_i$
- If $\mu = \Sigma w_{mkt,PST}$, then in the ordinary CAPM world

If $g = 0$, expected returns can be unaffected by ESG tastes, even if agents have them.

Relation to theory

Relation to theory

$$g = E_\omega(\tilde{g}_i) + Cov_\omega(d_i/\bar{d}, \tilde{g}_i)$$

- Pastor et al. [2021a]: Plausible to assume the covariance is zero
- If $E_\omega(\tilde{g}_i) = 0$, we are saying that the wealth-weighted *average* ESG score does not distinguish between firms

◂ Relation to theory

Relation to theory

$$g = E_\omega(\tilde{g}_i) + Cov_\omega(d_i/\bar{d}, \tilde{g}_i)$$

- Pastor et al. [2021a]: Plausible to assume the covariance is zero
- If $E_\omega(\tilde{g}_i) = 0$, we are saying that the wealth-weighted *average* ESG score does not distinguish between firms

Consider the rank correlation between measures

- Correlation of 1: two measures completely agree on firms' ESG ranking
- Correlation of 0: two measures' rankings not related, their agreement is random

Relation to theory

Relation to theory

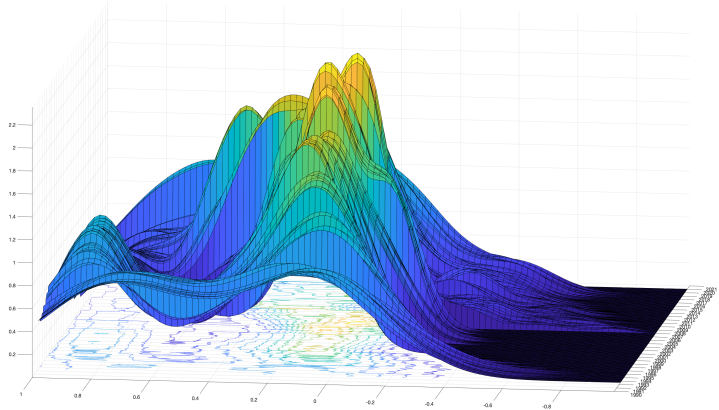
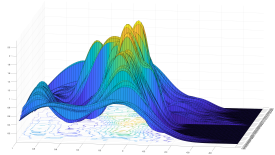


Figure: Densities of cross-sectional rank correlations

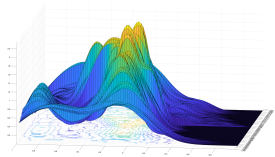
Relation to theory



- ESG measures randomly related $\Rightarrow$ no equilibrium effect on $E(r)$ [Pastor et al., 2021a]

Relation to theory

Relation to theory



- ESG measures randomly related $\Rightarrow$ no equilibrium effect on $E(r)$ [Pastor et al., 2021a]

In line with recent literature [e.g. Berg et al., 2020, Avramov et al., 2021, Christensen et al., 2021, Gibson et al., 2021]

Relation to theory

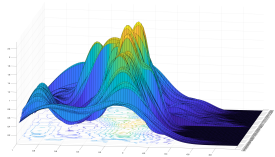
Relation to theory

Outside the model, further related issues

- Brandon et al. [2021]: institutional investors ESG scores not better even when they say they take ESG into account: cheap-talk
- Why would institutional investors behave in this way?
  - Riedl and Smeets [2017], Bauer et al. [2021]: social preferences explain ESG adoption, not financial considerations; attract clientele with lower fee-price elasticity
  - Hartzmark and Sussman [2019]: sustainability causes outflows from low-sustainability, inflows to high-sustainability funds

◂ Relation to theory

Relation to theory



- ESG measures randomly related $\Rightarrow$ no equilibrium effect on $E(r)$ [Pastor et al., 2021a]
- Professional portfolio-managers have incentives to advertise good ESG performance
- No definitive rule for how to measure ESG characteristics
- One might *expect* many ESG measures and measure-providers to flourish
- Even if investors act as promised, the plethora of ESG metrics can lead to negligible equilibrium effects

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