

# 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
  - | Not

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

$$r_{n;t+1} = \alpha_{n;t} + \beta_{n;t}' f_{t+1} + \epsilon_{n;t+1} \quad \text{where} \quad \alpha_{n;t} = \Gamma^0 z_{n;t} \quad \text{and} \quad \beta_{n;t} = \Gamma^1 z_{n;t}$$

$z_{n;t}$  vector of firm-characteristics ( $L = 1$ )

$\alpha_{n;t}$  instrument for with characteristics ( $\Gamma^0 z_{n;t}$ ) *conditional exposures*

$\beta_{n;t}$  instrument for with characteristics ( $\Gamma^1 z_{n;t}$ ) *conditional alpha*

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

Output:  $\alpha_{n;t}$ , moments of  $f_t$ ; tangency portfolio, model-implied moments of  $r_{t+1}$

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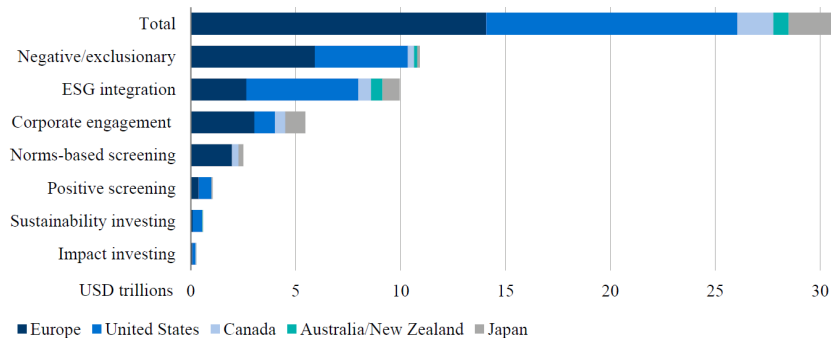
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# ESG strategies in practice



Source: GSIA (2019)

Figure: From Dimson et al. [2020]

# ESG strategies in the IPCA framework

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Tilted systematic portfolios: impose  $\Gamma = 0$  ▶ IPCA ESG Overlay

| Adjust portfolio for an ESG mandate, *after* model estimation, **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  $\Gamma \neq 0$  ▶ ESG in IPCA model

| Include ESG in  $z_{n;t}$  in model like other firm characteristics, **ESG integration**

1.  $\Gamma = 0$  and (other chars, ESG): better mean-variance frontier?

2. (other chars, ESG): *pure-alpha portfolio* performance [Kelly et al., 2019]?

3. (other chars); (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 36-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 ) 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

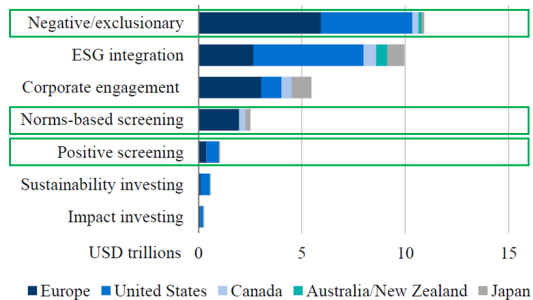
## Results: ESG as a tilt

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 |
|--------------------|-------------|--------------|----------|----------|
| <i>No ESG Tilt</i> | 1:46 (2:30) | 14:58 (7:29) | 1:96     | 0:18     |

## Results: ESG as a tilt



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- | ESG Mandate: Negative Screening #1 ) exclude firms below given ESG score

|   | SR          | Mean         | Kurtosis | Skewness |  |
|---|-------------|--------------|----------|----------|--|
| <i>No ESG Tilt</i>                                      | 1:46 (2:30) | 14:58 (7:29) | 1:96     | 0:18     |  |
| <i>Exclude rms below <math>p_{25}</math> ESG score:</i> |             |              |          |          |  |
| 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 ) do not go long 'bad' ESG firms

|  | SR          | Mean         | Kurtosis | Skewness |  |
|--|-------------|--------------|----------|----------|--|
| <i>No ESG Tilt</i>   | 1:46 (2:30) | 14:58 (7:29) | 1:96     | 0:18     |  |
| <i>Exclude rms below <math>p_{25}</math> ESG score in long-leg only:</i> |             |              |          |          |  |
| 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 ) only invest in 'good' ESG firms (i.e. zero-out firms with missing ESG scores)

|   | SR          | Mean         | Kurtosis | Skewness |  |
|---|-------------|--------------|----------|----------|--|
| <i>No ESG Tilt</i>  | 1:46 (2:30) | 14:58 (7:29) | 1:96     | 0:18     |  |
| <i>Exclude rms not-above <math>p_{50}</math> ESG score:</i> |             |              |          |          |  |
| 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:  $w_{PFP;t} = \sum_t^{-1} (t + t(s_t - N_t \bar{s}))$

|                                     | SR          | Mean         | Kurtosis | Skewness |
|-------------------------------------|-------------|--------------|----------|----------|
| <i>No ESG Tilt</i>                  | 1:46 (2:30) | 14:58 (7:29) | 1:96     | 0:18     |
| <i>Missing ESG as 0, s = 0:25 :</i> |             |              |          |          |
| 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:  $w_{PST;t} = \Sigma_t^{-1} (r_t + ds_t)$

|                                     | SR          | Mean         | Kurtosis | Skewness |
|-------------------------------------|-------------|--------------|----------|----------|
| <i>No ESG Tilt</i>                  | 1.46 (2:30) | 14.58 (7:29) | 1.96     | 0.18     |
| <i>Missing ESG as 0, d = 0.001:</i> |             |              |          |          |
| 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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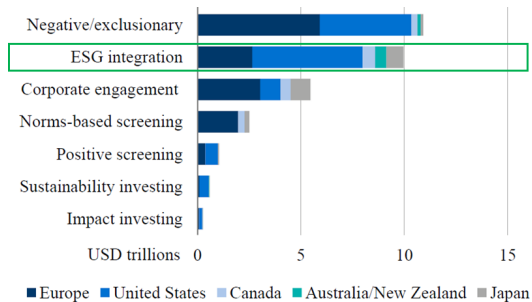
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# Results: Integrate ESG in the model

In alpha, or beta, or both



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In alpha, or beta, or both

ESG integration only in :

- |  $r_{n;t+1} = \theta_{n;t} f_{t+1} + \epsilon_{n;t+1}$ ; where  $\Gamma = 0$  and  $\epsilon_{n;t} = \Gamma^0 z_{n;t}$
- | Systematic portfolio ( $\Gamma = 0$ ), include ESG scores with other characteristics in  $z_{n;t}$ .

|   | SR   |        | Mean  |        |
|---|------|--------|-------|--------|
| Large firms, no ESG   | 1:46 | (2:30) | 14:57 | (7:28) |
| <i>Large firms, missing ESG as 0, 5-factors, <math>\Gamma = 0</math>:</i> |      |        |       |        |
| KLD   | 1:41 | (2:23) | 14:13 | (7:17) |
| Asset4  | 1:48 | (2:33) | 14:76 | (7:37) |
| Sustainalytics  | 1:47 | (2:32) | 14:71 | (7:32) |
| RepRisk   | 1:46 | (2:31) | 14:63 | (7:30) |

# Results: Integrate ESG in the model

In alpha, or beta, or both

ESG integration in      and      (pure-alpha):

- |  $r_{n;t+1} = \alpha_{n;t} + \beta_{n;t} f_{t+1} + \epsilon_{n;t+1}$ ; where  $\alpha_{n;t} = \Gamma^0 z_{n;t}$  and  $\beta_{n;t} = \Gamma^1 z_{n;t}$
- |  $z$  includes ESG *and* other characteristics.

|  | SR   |        | Mean |        |
|--|------|--------|------|--------|
| Large firms, no ESG  | 0:18 | (0:29) | 1:82 | (1:01) |
| <i>Large firms, missing ESG as 0, 5-factors, <math>\Gamma \neq 0</math>:</i> |      |        |      |        |
| 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) |

# Results: Integrate ESG in the model

In alpha, or beta, or both

ESG integration in only (beta-neutral):

- |  $r_{n;t+1} = \alpha_{n;t} + \beta_{n;t}^0 f_{t+1} + \beta_{n;t+1}^0 z_{n;t+1}$ ; where  $\beta_{n;t} = \Gamma^0 \beta_{n;t}$  and  $\beta_{n;t} = \Gamma^0 z_{n;t}$
- | includes ESG scores, z includes other characteristics.

|  | SR   |        | Mean |        |
|--|------|--------|------|--------|
| <i>Large firms, missing ESG as 0, 5-factors, <math>\Gamma \neq 0</math>:</i> |      |        |      |        |
| 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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- | No evidence that they define alpha with respect to successful asset-pricing factors



## 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** ) 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?

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- | 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  $E(r)$ 
  - ) 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
  - | Not

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:  $W_{f;t} = ( \begin{matrix} 0 \\ t \end{matrix} )^{-1} \begin{matrix} 0 \\ t \end{matrix}$

| Factor tangency portfolio:  $w_{\text{factan}} = \frac{1}{\mathbf{1}' S^{-1} \mathbf{1}_m} S^{-1} \mathbf{1}_m$  (E(f) = m; Cov(f) = S)

| )  $w_{\text{tan};t}^0 = w_{\text{factan}}^0 W_{f;t}$

## 1. Screened tangency

| **Zero-out**  $w_{i;\text{tan};t}$  where  $r_m$  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

$$W_{\text{PPF};t} = \begin{matrix} 0 \\ t \end{matrix}^{-1} \left( \begin{matrix} 0 \\ t \end{matrix} + \begin{matrix} \mathfrak{s} \\ N_t \end{matrix} S \right)$$

for  $\mathfrak{s}$  ESG scores avg,  $\begin{matrix} 0 \\ t \end{matrix} = E(r)$ ;  $\begin{matrix} 0 \\ t \end{matrix} = \text{Cov}(r)$ ,  $\begin{matrix} 0 \\ t \end{matrix}$  function of parameters

## 3. Pastor et al. [2021a] optimal portfolio

$$W_{\text{PST};t} = \begin{matrix} 0 \\ t \end{matrix}^{-1} \left( \begin{matrix} 0 \\ t \end{matrix} + d \mathfrak{s} \right), \text{ for } d \geq 0 \text{ ESG taste}$$

Model estimates:  $\begin{matrix} 0 \\ t \end{matrix} = \begin{matrix} 0 \\ t \end{matrix} E(f)$ ;  $\begin{matrix} 0 \\ t \end{matrix} = \begin{matrix} 0 \\ t \end{matrix} F \begin{matrix} 0 \\ t \end{matrix} +$

# Including ESG: In the IPCA model

Like any other characteristic

- | Is ESG in  $n_{i,t}$ ?
- | Is ESG in  $n_{i,t}$ ?
- | **How does ESG data change the estimates?**

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

Just in

- | Modified estimator:

$$r_{n,t+1} = \alpha_{n,t}^0 + z_{n,t}^0 f_{t+1}$$

for ESG not in  $z$

- | Define a "beta-neutral" portfolio (no factor exposure)

# Non-ESG Data

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

- | 50 characteristics, based on those that provide the greatest 36-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 shareschcsho\_1m chcsho\_3m chcsho\_6m chcsho\_12m
- | valuation ratios div3m\_mę div6m\_mę div12m\_mę at \_mę ni \_mę nix \_mę sale \_mę xido \_at
- | leverage ratiosdebt \_mę netdebt \_mę 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 .

# Available ESG observations over time

## Firm size and KLD ESG availability

# Firm size and ESG availability

Panel A. KLD

Panel B. Asset4

Panel C. Sustainalytics

Panel D. RepRisk

# Robustness { ESG Tilts: Alternative Thresholds

|   | SR         | Mean         | Kurtosis | Skewness |
|---|------------|--------------|----------|----------|
| Panel B: KLD  |            |              |          |          |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG             | 152 (239)  | 15.15 (7.52) | 3.86     | 0.76     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG             | 139 (220)  | 13.90 (6.48) | 6.24     | 1.10     |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG in long-leg | .25 (1.97) | 12.49 (6.17) | 2.76     | 0.19     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG in long-leg | .08 (1.23) | 7.75 (3.78)  | 1.73     | 0.00     |
| Panel C: Asset4                                     |            |              |          |          |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG             | 134 (212)  | 13.39 (6.29) | 3.05     | 0.28     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG             | 131 (206)  | 13.04 (5.99) | 3.77     | 0.67     |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG in long-leg | .22 (1.93) | 12.20 (5.84) | 2.38     | 0.47     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG in long-leg | .06 (1.52) | 9.62 (4.63)  | 1.75     | 0.23     |
| Panel D: Sustainalytics                             |            |              |          |          |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG             | 137 (217)  | 13.71 (6.65) | 2.32     | 0.23     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG             | 133 (210)  | 13.31 (6.34) | 2.70     | 0.30     |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG in long-leg | .81 (2.07) | 13.06 (6.28) | 2.36     | 0.24     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG in long-leg | .17 (1.85) | 11.72 (5.59) | 1.91     | 0.25     |
| Panel E: RepRisk                                    |            |              |          |          |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG             | 151 (238)  | 15.06 (7.33) | 2.75     | 0.60     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG             | 146 (231)  | 14.59 (6.99) | 2.93     | 0.66     |
| zero-out $w_{tan,t}$ below $p_{50}$ ESG in long-leg | .87 (2.17) | 13.72 (6.61) | 2.47     | 0.46     |
| zero-out $w_{tan,t}$ below $p_{75}$ ESG in long-leg | .26 (1.98) | 12.55 (5.99) | 2.17     | 0.44     |



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

|   | SR   |        | Mean  |        | Kurtosis | Skewness |
|---|------|--------|-------|--------|----------|----------|
| Panel B: KLD  |      |        |       |        |          |          |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0$        | 1:49 | (2:25) | 1487  | (7:25) | 1:94     | 0:03     |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0.25$     | 1:46 | (2:20) | 1458  | (7:08) | 2:03     | 0:01     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0$    | 1:51 | (2:28) | 1508  | (7:44) | 1:81     | 0:04     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:49 | (2:26) | 1492  | (7:29) | 1:91     | 0:01     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:51 | (2:28) | 1504  | (7:47) | 1:73     | 0:08     |
| Panel C: Asset4   |      |        |       |        |          |          |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0$        | 1:18 | (1:34) | 11:74 | (4:50) | 1:51     | 0:43     |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0.25$     | 1:16 | (1:31) | 11:53 | (4:39) | 1:43     | 0:43     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0$    | 1:19 | (1:35) | 11:85 | (4:54) | 1:68     | 0:47     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:16 | (1:32) | 11:60 | (4:44) | 1:56     | 0:45     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:20 | (1:36) | 11:94 | (4:56) | 1:84     | 0:49     |
| Panel D: Sustainalytics                                     |      |        |       |        |          |          |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0$        | 1:86 | (1:47) | 18:49 | (6:23) | 0:75     | 0:17     |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0.25$     | 1:86 | (1:47) | 18:48 | (6:12) | 0:78     | 0:16     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0$    | 1:87 | (1:48) | 18:56 | (6:34) | 0:71     | 0:17     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:86 | (1:47) | 18:53 | (6:21) | 0:72     | 0:13     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:85 | (1:47) | 18:45 | (6:40) | 0:68     | 0:20     |
| Panel E: RepRisk  |      |        |       |        |          |          |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0$        | 1:16 | (1:14) | 11:58 | (3:87) | 1:54     | 0:50     |
| Large, PFP optimal, missing ESG as $\mathcal{E} = 0.25$     | 1:13 | (1:11) | 11:29 | (3:75) | 1:64     | 0:54     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0$    | 1:17 | (1:15) | 11:68 | (3:90) | 1:52     | 0:49     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:15 | (1:13) | 11:46 | (3:82) | 1:61     | 0:52     |
| Large, PFP optimal, missing ESG as $\sigma = 0.5, s = 0.25$ | 1:18 | (1:16) | 11:78 | (3:94) | 1:44     | 0:47     |

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

|   | SR   |        | Mean |        | Kurtosis | Skewness |
|---|------|--------|------|--------|----------|----------|
| Panel B: KLD  |      |        |      |        |          |          |
| Large, PST optimal, missing ESG as $\theta=0:01$          | 035  | (0:56) | 3:51 | (1:85) | 1:91     | 0:29     |
| Large, PST optimal, missing ESG as $\theta=0:0001$        | 149  | (2:35) | 1489 | (7:71) | 1:83     | 0:02     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:01$   | 017  | (0:22) | 1:70 | (0:76) | 0:25     | 0:05     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:001$  | 126  | (2:00) | 1263 | (6:95) | 1:16     | 0:15     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:0001$ | 150  | (2:36) | 1497 | (7:81) | 1:74     | 0:04     |
| Panel C: Asset4   |      |        |      |        |          |          |
| Large, PST optimal, missing ESG as $\theta=0:01$          | 036  | (0:56) | 3:55 | (1:89) | 3:88     | 0:26     |
| Large, PST optimal, missing ESG as $\theta=0:0001$        | 148  | (2:34) | 1481 | (7:68) | 1:91     | 0:02     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:01$   | 052  | (0:58) | 5:15 | (1:83) | 0:31     | 0:20     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:001$  | 137  | (2:17) | 1370 | (7:01) | 1:99     | 0:25     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:0001$ | 149  | (2:35) | 1487 | (7:69) | 1:95     | 0:03     |
| Panel D: Sustainalytics                                   |      |        |      |        |          |          |
| Large, PST optimal, missing ESG as $\theta=0:01$          | 048  | (0:76) | 4:82 | (2:59) | 6:46     | 0:23     |
| Large, PST optimal, missing ESG as $\theta=0:0001$        | 148  | (2:34) | 1483 | (7:68) | 1:88     | 0:01     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:01$   | 016  | (0:13) | 1:63 | (0:41) | 0:35     | 0:02     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:001$  | 130  | (2:05) | 1297 | (6:68) | 1:67     | 0:02     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:0001$ | 148  | (2:33) | 1474 | (7:63) | 1:91     | 0:01     |
| Panel E: RepRisk  |      |        |      |        |          |          |
| Large, PST optimal, missing ESG as $\theta=0:01$          | 068  | (0:91) | 6:78 | (2:61) | 9:92     | 0:79     |
| Large, PST optimal, missing ESG as $\theta=0:0001$        | 150  | (2:36) | 1493 | (7:73) | 1:84     | 0:00     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:01$   | 0:28 | (0:12) | 2:78 | (0:33) | 0:71     | 0:22     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:001$  | 136  | (2:14) | 1355 | (6:86) | 0:90     | 0:02     |
| Large, PST optimal, missing ESG as $\theta:0.5, d=0:0001$ | 149  | (2:35) | 1490 | (7:71) | 1:81     | 0:01     |

# Robustness { ESG as a tilt

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

|   | SR   |        | Mean  |        | Kurtosis | Skewness |
|---|------|--------|-------|--------|----------|----------|
| All rms   | 4:08 | (6:28) | 4075  | (1635) | 0:89     | 0:23     |
| All rms, zero-out $w_{tan;t}$ below $p_{50}$ ESG                  | 412  | (6:33) | 41:11 | (1563) | 0:84     | 0:40     |
| All rms, zero-out $w_{tan;t}$ below $p_{50}$ ESG in long-leg      | 392  | (6:05) | 39:15 | (1538) | 0:53     | 0:25     |
| All rms, zero-out $w_{tan;t}$ not-above $p_{50}$ ESG              | 101  | (1:59) | 10:07 | (5:31) | 1479     | 1:34     |
| All rms, PFP optimal, missing ESG as $\alpha = 0$                 | 3:26 | (4:85) | 3250  | (1368) | 2:42     | 0:12     |
| All rms, PFP optimal, missing ESG as 0:5, $s = 0$                 | 3:19 | (4:75) | 31:82 | (1405) | 2:68     | 0:31     |
| All rms, PST optimal, missing ESG as $\alpha = 0:001$             | 288  | (4:50) | 2878  | (1282) | 2:46     | 0:01     |
| All rms, PST optimal, missing ESG as 0:5, $d = 0:001$             | 267  | (4:17) | 2670  | (1319) | 2:78     | 0:32     |
| Large, Total ind. adj., zero-out $w_{tan;t}$ below $p_{50}$ ESG   | 144  | (2:27) | 1438  | (6:92) | 4:56     | 0:83     |
| Large, E, zero-out $w_{tan;t}$ below $p_{50}$ ESG                 | 152  | (2:40) | 1518  | (7:66) | 2:28     | 0:45     |
| Large, S, zero-out $w_{tan;t}$ below $p_{50}$ ESG                 | 155  | (2:44) | 1545  | (7:74) | 3:30     | 0:62     |
| Large, G, zero-out $w_{tan;t}$ below $p_{50}$ ESG                 | 146  | (2:31) | 1461  | (7:23) | 2:09     | 0:24     |
| All rms, Total ind. adj., zero-out $w_{tan;t}$ below $p_{50}$ ESG | 401  | (6:17) | 4000  | (1467) | 0:80     | 0:45     |
| All rms, E, zero-out $w_{tan;t}$ below $p_{50}$ ESG               | 414  | (6:37) | 41:39 | (1631) | 0:92     | 0:28     |
| All rms, S, zero-out $w_{tan;t}$ below $p_{50}$ ESG               | 407  | (6:27) | 40:65 | (1556) | 0:84     | 0:39     |
| All rms, G, zero-out $w_{tan;t}$ below $p_{50}$ ESG               | 411  | (6:32) | 41:03 | (1625) | 0:88     | 0:26     |
| Large, 2010-  | 198  | (1:80) | 1972  | (7:04) | 0:82     | 0:30     |
| Large, 2010-, zero-out $w_{tan;t}$ below $p_{50}$ ESG             | 173  | (1:58) | 17:24 | (7:15) | 0:09     | 0:43     |
| All rms, 2010-  | 289  | (2:61) | 2881  | (1007) | 1:39     | 0:14     |
| All rms, 2010-, zero-out $w_{tan;t}$ below $p_{50}$ ESG           | 287  | (2:59) | 2858  | (1016) | 2:47     | 0:26     |

# Properties of overlaid portfolios

Panel A

Panel B

Panel C

Panel D

# Properties of overlaid portfolios

Panel A

# Properties of overlaid portfolios

Panel B

# Properties of overlaid portfolios

Panel C

# Properties of overlaid portfolios

Panel D



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

|  | R <sup>2</sup> | Factor |        | Pure-alpha |                      |
|--|----------------|--------|--------|------------|----------------------|
|  |                | SR     | Mean   | SR         | Mean                 |
| Panel A  |                |        |        |            |                      |
| Large, 5-factor restricted                                 | 30             | 1:46   | (2:30) | 1:457      | (7:28)               |
| Large, 5-factor unrestricted                               | 31             |        |        | 0:18       | (0:29) 1:82 (1:01)   |
| Panel B: KLD   |                |        |        |            |                      |
| Large, missing ESG as0:5, 5-factor restricted              | 31             | 1:36   | (2:15) | 1:362      | (6:97)               |
| Large, missing ESG as0:5, 5-factor unrestricted            | 32             |        |        | 0:19       | (0:28) 1:85 (0:98)   |
| Large, ESG nonmissing, 5-factor restricted                 | :82            | 1:16   | (1:76) | 11:59      | (6:43)               |
| Large, ESG nonmissing, 5-factor unrestricted               | :92            |        |        | 0:24       | (0:36) 2:40 (1:27)   |
| Large, ESG nonmissing, ESG included, 5-factor restricted   | :9321:16       | (1:75) | 11:55  | (6:39)     |                      |
| Large, ESG nonmissing, ESG included, 5-factor unrestricted | :0 33          |        |        | 0:16       | (0:25) 1:62 (0:85)   |
| Panel C: Asset4  |                |        |        |            |                      |
| Large, missing ESG as0:5, 5-factor restricted              | 31             | 1:47   | (2:32) | 1:468      | (7:28)               |
| Large, missing ESG as0:5, 5-factor unrestricted            | 31             |        |        | 0:07       | ( 0:08) 0:69 ( 0:27) |
| Large, ESG nonmissing, 5-factor restricted                 | :25            | 1:33   | (1:51) | 1:323      | (5:77)               |
| Large, ESG nonmissing, 5-factor unrestricted               | :25            |        |        | 0:32       | (0:37) 3:20 (1:28)   |
| Large, ESG nonmissing, ESG included, 5-factor restricted   | :2351:31       | (1:49) | 1:309  | (5:67)     |                      |
| Large, ESG nonmissing, ESG included, 5-factor unrestricted | :3 35          |        |        | 0:34       | (0:39) 3:37 (1:36)   |
| Panel D: Sustainalytics                                    |                |        |        |            |                      |
| Large, missing ESG as0:5, 5-factor restricted              | 31             | 1:47   | (2:32) | 1:469      | (7:31)               |
| Large, missing ESG as0:5, 5-factor unrestricted            | 31             |        |        | 0:10       | ( 0:08) 1:00 ( 0:28) |
| Large, ESG nonmissing, 5-factor restricted                 | :95            | 1:90   | (1:50) | 1:891      | (6:60)               |
| Large, ESG nonmissing, 5-factor unrestricted               | :06            |        |        | 0:37       | (0:30) 3:69 (1:04)   |
| Large, ESG nonmissing, ESG included, 5-factor restricted   | :0361:89       | (1:50) | 1:882  | (6:59)     |                      |
| Large, ESG nonmissing, ESG included, 5-factor unrestricted | :1 36          |        |        | 0:37       | (0:30) 3:71 (1:05)   |
| Panel E: RepRisk   |                |        |        |            |                      |
| Large, missing ESG as0:5, 5-factor restricted              | 31             | 1:58   | (2:49) | 1:576      | (8:65)               |
| Large, missing ESG as0:5, 5-factor unrestricted            | 31             |        |        | 0:38       | ( 0:38) 3:81 ( 1:33) |
| Large, ESG nonmissing, 5-factor restricted                 | :85            | 1:51   | (1:48) | 1:501      | (5:97)               |
| Large, ESG nonmissing, 5-factor unrestricted               | :95            |        |        | 0:30       | ( 0:30) 3:00 ( 1:04) |
| Large, ESG nonmissing, ESG included, 5-factor restricted   | :8351:51       | (1:48) | 1:503  | (5:97)     |                      |
| Large, ESG nonmissing, ESG included, 5-factor unrestricted | :9 35          |        |        | 0:30       | ( 0:30) 2:99 ( 1:04) |

# Robustness { ESG in the model as beta (using KLD)

|  | R <sup>2</sup> | Factor      |               |
|--|----------------|-------------|---------------|
|  |                | SR          | Mean          |
| Panel A. KLD   |                |             |               |
| Large, FF5C restricted   | 26             | 1:14 (1:80) | 11:38 (6:37)  |
| Large, missing ESG as 0:5, FF5C restricted                           | 26             | 1:14 (1:79) | 11:34 (6:35)  |
| All rms, 5-factor restricted   | 164            | 4:08 (6:28) | 40:75 (16:35) |
| All rms, missing ESG as 0:5, 5-factor restricted                     | 164            | 4:08 (6:28) | 40:76 (16:34) |
| All rms, FF5C restricted   | 137            | 3:51 (5:45) | 35:08 (15:57) |
| All rms, missing ESG as 0:5, FF5C restricted                         | 137            | 3:49 (5:41) | 34:84 (15:46) |
| Large, Total ind. adj., missing ESG as 0:5, 5-factor restricted      | 311            | 1:41 (2:22) | 14:07 (7:11)  |
| Large, E, missing ESG as 0:5, 5-factor restricted                    | 311            | 1:39 (2:19) | 13:84 (7:00)  |
| Large, S, missing ESG as 0:5, 5-factor restricted                    | 311            | 1:38 (2:18) | 13:81 (7:04)  |
| Large, G, missing ESG as 0:5, 5-factor restricted                    | 311            | 1:46 (2:31) | 14:60 (7:28)  |
| Large, Slow, 5-factor restricted                                     | 28             | 1:10 (1:74) | 11:03 (6:12)  |
| Large, Slow, missing ESG as 0:5, 5-factor restricted                 | 28             | 1:19 (1:88) | 11:92 (6:56)  |
| Large, Slow, FF5C restricted   | 26             | 0:65 (1:03) | 6:51 (3:64)   |
| Large, Slow, missing ESG as 0:5, FF5C restricted                     | 26             | 0:65 (1:03) | 6:47 (3:62)   |
| All rms, Slow, 5-factor restricted                                   | 135            | 3:54 (5:48) | 35:31 (15:08) |
| All rms, Slow, missing ESG as 0:5, 5-factor restricted               | 135            | 3:53 (5:48) | 35:28 (15:08) |
| All rms, Slow, FF5C restricted                                       | 109            | 2:99 (4:66) | 29:85 (14:49) |
| All rms, Slow, missing ESG as 0:5, FF5C restricted                   | 109            | 2:98 (4:65) | 29:79 (14:51) |
| Panel B. Large, 2010-  |                |             |               |
| 5-factor restricted  | 330            | 1:98 (1:80) | 19:72 (7:04)  |
| KLD Total, missing ESG as 0:5, 5-factor restricted                   | 331            | 1:98 (1:81) | 19:75 (7:04)  |
| Asset4 Total, missing ESG as 0:5, 5-factor restricted                | 330            | 1:98 (1:80) | 19:67 (7:03)  |
| Sustainalytics Total, missing ESG as 0:5, 5-factor restricted        | 330            | 1:97 (1:79) | 19:63 (6:91)  |
| RepRisk Total, missing ESG as 0:5, 5-factor restricted               | 330            | 1:97 (1:79) | 19:60 (6:99)  |
| Uncontroversial Total, missing ESG as 0:5, 5-factor restricted       | 330            | 1:99 (1:81) | 19:80 (7:06)  |
| Asset4 Policy Total, missing ESG as 0:5, 5-factor restricted         | 330            | 1:98 (1:80) | 19:68 (7:03)  |
| Sustainalytics Policy Total, missing ESG as 0:5, 5-factor restricted | 330            | 1:99 (1:81) | 19:82 (6:96)  |

# 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 rms, missing ESG as 0:5                     | 0.39         | (0.62) | 3.94 | (2.09) |
| All rms, missing ESG as 0                       | 0.03         | (0.04) | 0.26 | (0.13) |
| All rms, FF5C, missing ESG as 0:5               | 0.60         | (0.95) | 6.00 | (3.09) |
| All rms, 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 rms, 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) |

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

Table: Unconditional alpha from regressions

|      | Intercept   | Mkt-RF      | SMB           | HML          | RMW          | CMA          | Mom         | R <sup>2</sup> (%) |
|------|-------------|-------------|---------------|--------------|--------------|--------------|-------------|--------------------|
| 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 <sup>2</sup> (%) |
|------|-------------|-------------|---------------|--------------|--------------|--------------|-------------|--------------------|
| 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: Edmans [2011]

Table: Unconditional alpha from regressions

|      | Intercept   | Mkt-RF       | SMB          | HML          | RMW          | CMA          | Mom          | R <sup>2</sup> (%) |
|------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------------|
| 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 theory

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

$$w_{i;PST} = \frac{1}{1 + d} \left( \frac{1}{w_i} + d g_i \right)$$

ESG-taste  $d_i \geq 0$ , agent-specific ESG-measure vector  $g_i$ . Market clearing implies

$$w_{i;PST} = w_{mkt;PST} \quad dg$$

- |  $d = \frac{1}{R} \sum_i w_i d_i$ : wealth-weighted average of  $d_i$ ,  $d > 0$  if any mass have ESG tastes
- |  $g = (1-d) \frac{1}{R} \sum_i w_i g_i$ : wealth- and ESG-taste-weighted average of  $g_i$
- | If  $w_{i;PST} = w_{mkt;PST}$ , 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

$$g = E_i (g_i) + \text{Cov}_i (d_i = d; g_i)$$

- | Pastor et al. [2021a]: Plausible to assume the covariance is zero
- | If  $E_i (g_i) = 0$ , we are saying that the wealth-weighted average ESG score does not distinguish between firms



## Relation to theory

$$g = E_i (g_i) + \text{Cov}_i (d_i = d; g_i)$$

- | Pastor et al. [2021a]: Plausible to assume the covariance is zero
- | If  $E_i (g_i) = 0$ , we are saying that the wealth-weighted average ESG score does not distinguish between rms

Consider the rank correlation between measures

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

# Relation to theory

**Figure:** Densities of cross-sectional rank correlations

## Relation to theory

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

## Relation to theory

| ESG measures randomly related ) 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

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

- | ESG measures randomly related ) 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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