

Intermediary Capital and Financing Sustainable Investment

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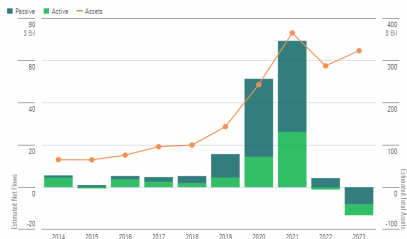
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Motivation

Sustainable Fund Flows & Assets



Source: Morningstar Direct. Data as of Dec. 31, 2023. Includes funds that have liquidated. Excludes funds of funds.

The sustainable fund market: 2014-23
Source: Morningstar Direct

- ▶ Growing concerns about ESG/impact investing
- ▶ Large empirical literature on the impact of institutional investors' ESG preferences
- ▶ Theoretical literature is also expanding
 - ▶ Existing models typically analyze **investors' decisions** to fund (de-fund) green (brown) firms
 - ▶ Less attention devoted to **firms' decisions** to obtain (how much) funding from investors

What we do in this paper

- ▶ Develop a corporate finance model with agency frictions:
 1. Investors are heterogeneous in their **social preferences**, ability to **monitor** borrowers, and **capital endowment**.
 2. Entrepreneurs have a non-contractible choice over **sustainability policy**, and choose the **optimal funding mix**
- ▶ Embed it into a competitive market economy and endogenize
 1. **cost of capital**,
 2. **firm investment scale**,
 3. **fraction of sustainable firms**.
- ▶ Evaluate the real and financial effects of sustainable investing and draw policy implications

Related Literature

Asset pricing with divestment, portfolio tilting, and “greenium”: Heinkel, Kraus, and Zechner (2001), Hong and Kacperczk (2009), Pastor, Stambaugh, and Taylor (2021), Edmans, Levit and Schneemeier (2022), Hong, Wang, and Yang (2023), Favilukis, Garlappi, and Uppal (2023), Dangi, Halling, Yu, and Zechner (2024)

- ▶ **Our contribution:** non-risk based “greenium” from a corporate finance perspective

Corporate finance and activism: Chowdhry and Waters (2018), Barbalau and Zeni (2022), Broccardo, Hart, and Zingales (2022), Jagannathan, Kim, McDonald, and Xia (2022), Landier and Lovo (2022), Oehmke and Opp (2024), Gryglewicz, Mayer and Morellec (2023)

- ▶ **Our contribution:** implications of “capital-constrained active investors” on equilibrium green investment and policies

Setup: Firms

Unit mass of **entrepreneurs (E)**, each with initial fund A . On date 0, each chooses investment scale I and

- ▶ effort level that determines profitability (constant returns to scale), à la Holmstrom-Tirole (1997)
- ▶ project type, i.e., sustainability policy, that determines the firm's social outcomes $S \in \{G, B\}$, $G > 0 > -B$, on date 1

Type: $s =$	Green (g)	Brown (b)	Deep Brown (b)
$Pr(S = G s) = q_s$	q	$q - \Delta q$	$q - \Delta q$
Private benefit	0	λ_S	$\Lambda_S(1 + r_F)$

Agency problem over corporate sustainable investment:

- ▶ Green project ($s = g$) delivers better social impact: $\mathbb{E}_g(S) > 0 > \mathbb{E}_b(S)$
- ▶ **E** prefers the deep brown project: $\Lambda_S(1 + r_F) > \lambda_S > 0$

Setup: Investors

Financial Investors (F) do not value CSR and have unlimited capital

- ▶ Both **E** and **F** discount at exogenous rate $r_F \geq 0$

Socially responsible (SR) funds

- ▶ balance financial gains and non-pecuniary benefit $\gamma_{SR}SI$, w/ $\gamma_{SR} > 0$
- ▶ Endogenous discount rate r_{SR} (determined in market eqm.)

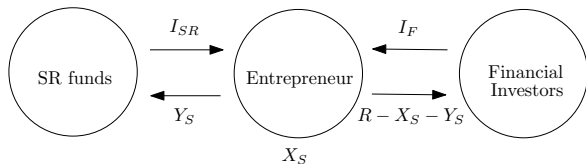
Dual role of SR funds:

1. **Active investors:** SR funds can monitor away the deep brown project at a private cost cI ; the monitoring decision is non-contractible
2. **Capital providers:** SR funds have a fixed amount of capital K_{SR}

Financial Contracting

E signs financial contracts $X_S, Y_S \geq 0$ with **F** and **SR funds** in exchange for I_F and I_{SR} , respectively

- ▶ Contract are contingent on realized, verifiable social outcome S , e.g., level of emissions, ESG metrics
- ▶ Date-0 budget constraint $I = I_F + I_{SR} + A$



Benchmark: Financial Investors Only

F do not care to incentivize **E** for green \Rightarrow **All firms are deep brown:**

- ▶ Compensation to **E**: $X = \frac{\lambda_R}{\Delta p}$, independent of social outcomes
- ▶ Repayment to **F**: $R - \frac{\lambda_R}{\Delta p}$

Pledgeable income determines max. investment scale I_b :

$$\underbrace{\frac{p}{1+r_F} \left(R - \frac{\lambda_R}{\Delta p} \right)}_{\text{pledgeable income}} \cdot I_b \geq \underbrace{I_b - A}_{\text{external fund}}$$

E's gross payoff: $\left(\frac{p}{1+r_F} \frac{\lambda_R}{\Delta p} + \Lambda_S \right) I_b$; and his (brown) firm's WACC: $r_{wacc}^b = r_F$

How Do SR Funds Make Impact? (1)

1. SR funds provide cheap capital with $r_{SR} < r_F$ to increase financing capacity

The investment scale I_g is constrained by

$$\left(\frac{p(R - \mathbb{E}_g(X_S))}{1 + r_F} + \frac{(r_F - r_{SR}) p \mathbb{E}_g(Y_S)}{1 + r_F} \frac{1}{1 + r_{SR}} \right) \cdot I_g \geq I_g - A$$

► $\frac{(r_F - r_{SR}) p \mathbb{E}_g(Y_S)}{1 + r_F} \frac{1}{1 + r_{SR}}$: the funding advantage of raising social capital

Pecking order: maximize $\mathbb{E}_g(Y_S)$ for cheap funding I_{SR} to scale up investment, financing the rest from **F**

How Do SR Funds Make Impact? (2)

2. SR funds reduce the agency problem by monitoring

- ▶ E's incentive must be ES-linked: $X_G > X_B$
- ▶ Monitoring decreases the private benefit of brown project, so less CF's retained in state $S = G$: $X_G \downarrow$

This helps pledge more CF's to SR funds

- ▶ $Y_G = R - X_G \uparrow$
- ▶ Generally, $Y_B \uparrow$ together with Y_G due to the monitoring constraint:

$$\underbrace{p\Delta q(Y_G - Y_B)}_{\$ \text{ gain as sustainability improves}} \geq \underbrace{c}_{\text{monitoring cost}} - \underbrace{\gamma_{SR}(\mathbb{E}_g(S) - \mathbb{E}_b(S))}_{\text{non-}\$ \text{ gain as sustainability improves}}$$

E can expand the investment scale:

$$E_g[Y_S] \uparrow \implies I_g \uparrow \text{ so that } I_g > I_b!$$

Market Equilibrium

A **market equilibrium** (r_{SR}, m_g) satisfies

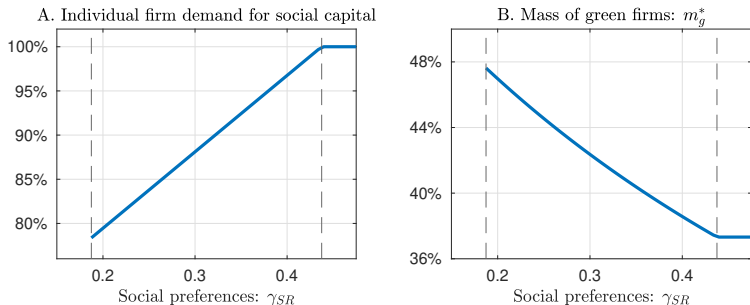
1. **E** indifferent between being a brown firm (contract with **F** only) and a green firm (contract with both **F** and **SR funds**)
2. Market of social capital clears

$$m_g I_{SR}(r_{SR}) = K_{SR}$$

We focus on interior equilibrium: $m_g \in (0, 1)$

- ▶ Unique equilibrium exists; closed-form characterization

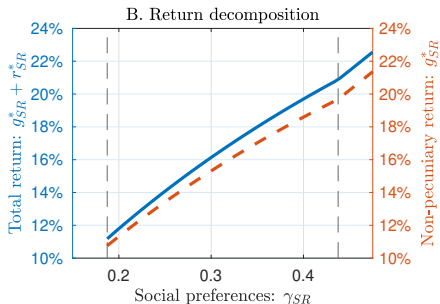
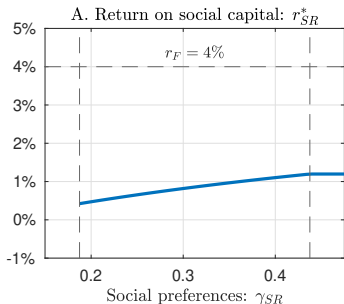
Social Preferences Intensify Market Competition



Market competition drives the comovement of social preference γ_{SR} and price of social capital r_{SR}^*

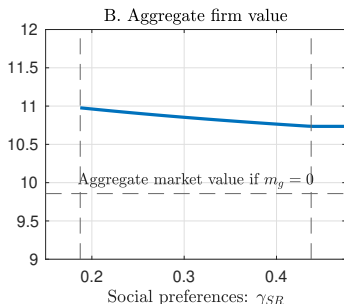
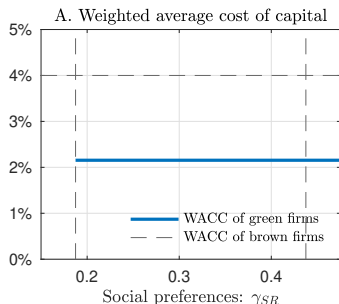
- ▶ $\uparrow \gamma_{SR}$ relaxes the monitoring constraint, $Y_B \uparrow$
- ▶ Intensive margin: demand for social capital I_{SR} increases $\Rightarrow r_{SR}^* \uparrow$
- ▶ Extensive margin: fewer green firms can be SR funded $m_g^* \downarrow$

Making Impact Is Financially Costly



- ▶ **E** prefers deep brown with highest private benefit \Rightarrow To choose green, must benefit from **SR funds**
- ▶ **Cost of capital wedge** $r_F - r_{SR}^* > 0$
- ▶ Investors with low γ_{SR} may not participate in funding green firms

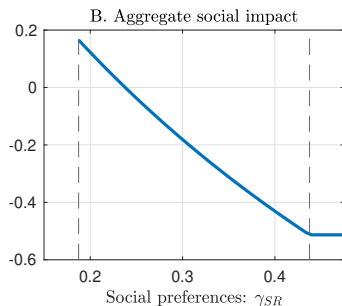
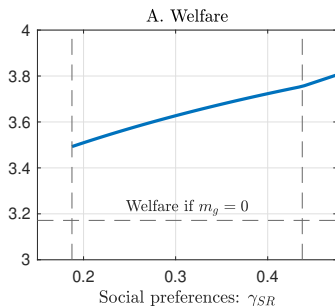
WACC and Firm Valuation



- ▶ Green firms have lower WACC \Rightarrow investment scale $I_g > I_b$
- ▶ WACC is independent of γ_{SR} (intuition: I_{SR} and r_{SR} comove with γ_{SR} with offsetting effects on WACC)
- ▶ Presence of SR funds leads to higher aggregate firm value

$$m_g^* \frac{\rho R}{1 + r_{wacc}^g} I_g + (1 - m_g^*) \frac{\rho R}{1 + r_F} I_b,$$

Welfare and Aggregate Social Impact



- ▶ The effect of γ_{SR} on welfare is largely mechanic, driven by SR funds' non-pecuniary benefit
- ▶ Agg. impact $m_g^* \mathbb{E}_g(S) I_g + (1 - m_g^*) \mathbb{E}_b(S) I_b$: **net zero calls for less fierce market competition**

Policy Implications

1. **Carbon tax:** firm pays τ_C per dollar of cash flows if $S = B$
2. **Green subsidy:** **E** receives z dollars per unit of scale if $s = g$, project type verifiable on date 1

Both policies incentivize **E** to be green

- ▶ Intensify competition for social capital $\Rightarrow r_{SR}^* \uparrow$
- ▶ Erode pledgeable income \Rightarrow investment scale $I_g \downarrow$

But, **different effects on green investment** m_g^*

- ▶ Carbon tax limits the financing capacity. $I_{SR} \downarrow$ and social capital can be used to finance more green firms, $m_g^* \uparrow$
- ▶ Green subsidy relaxes **E**'s incentive constraint, freeing up the borrowing capacity. $I_{SR} \uparrow$ and fewer green firms can be funded, $m_g^* \downarrow$

Concluding Remarks

- ▶ We provide a **tractable corporate finance model** of sustainable investment
- ▶ **Investor activism** reinforces SR funds' role as **low-cost capital suppliers**
- ▶ Prioritizing social responsibility by investors **intensifies competition** for social capital,
 - ▶ eroding its funding advantage and **crowding out** green investments.
- ▶ **Policy implications**
 - ▶ Carbon tax trades off scale and greenness
 - ▶ Green subsidy mostly crowds out green investment
 - ▶ Increasing the supply of social capital eases market competition and promotes green transition, e.g., green supporting factor in the context of bank capital requirements

Security Design

Asset: $\frac{pRI_g}{1+r_{wacc}^g}$	SL Debt: $\frac{p(R-E_g(X_S+Y_S))}{1+r_F} I_g$	→ F
	Outside Equity: $\frac{pE_g(Y_S)}{1+r_{SR}} I_g$	→ SR funds
	Inside Equity: $\frac{pE_g(X_S)}{1+r_F} I_g$	→ E

- ▶ Issue **sustainability-linked debt** to F
 - ▶ Lower repayment in $S = G$: $R - X_G - Y_G < R - X_B - Y_B$
- ▶ **E** is granted **inside equity** tied to ESG performance
 - ▶ More stocks granted or lower stock option's strike price in $S = G$
- ▶ SR funds hold **outside equity**. Equity grants control rights (voting, voice etc.): allow SR funds to take active roles