Sustainable Investing: The Cost of Capital Channel Panel

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3rd Sir Oliver Hart Conference, 2025

Main message of Pedersen (25)

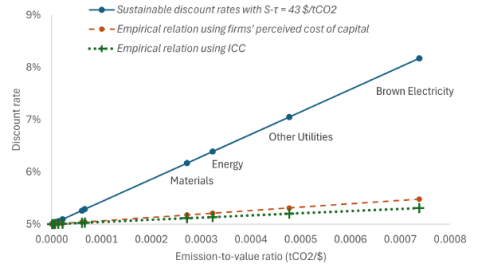
- Can investors with ethical or social objectives affect corporate behavior through the discount rate channel?
- Specifically, can such investors affect firms' discount rates so that they replicate Pigouvian taxes?
- The *sustainable discount rate* is defined as:

$$r_{it}^{x} = r + (S_{t+1} - \tau_{it+1})\frac{X_{it+1}}{v_{it}} \tag{1}$$

r=baseline cost of capital; S_{t+1} is the social cost of carbon; τ_{it} is the carbon tax imposed on firm i; X_{it+1} is the externality measured in tons of carbon emissions and tCO_2 v_{it} is the firm value.

Sustainable Discount Rates

- Estimated sustainable discount rates for different industries:



- Conclusion: necessary mix of regulation (carbon tax etc.) and green finance to save the planet is horse-and-rabbit stew, where the horse is the former.

General comments

- Very nice overview of discount rate effects of green finance with a helpful discussion of empirical and experimental evidence on discount rate effects.
- What is not emphasized: endogeneity of technology choices and emissions:
  - How elastic is the supply of cleaner technologies? How do social investors affect the equilibrium mix of different technologies? Which cost-of-capital effects would we observe when supply effects are accounted for?
- My bottom line: to evaluate effect of green finance, we should analyze **quantities**, not **prices**.

Example: Energy Sector and Effects of Green Finance

- Firms choosing between different technologies with different degrees of social harm.
- Example energy sector: global investment in renewable energy sources will reach approximately $ 2.2 trillion in 2025 — twice the level of investment in fossil fuels.
- Shift toward renewable energy is expected to have substantial geopolitical and macroeconomic consequences.
- Key question: how does green finance affect the supply of different energy sources?

Endogenous Choice of Technologies (Dangl, Halling, Yu, Zechner (JFE, 25))

- Two types of technologies: a fraction of firms, S_G produces with technology G (*green*) and fraction $S_B = 1 - S_G$ with technology B (*brown*).
- Two types of investors: *financial investors* (fraction 1-α) and *social investors* (fraction α).
- Financial and social investors' time 1 consumption:

$$\tilde{C}^F = \tilde{W}^F; \qquad \tilde{C}^S = \tilde{W}^S - bhX_B^S,$$

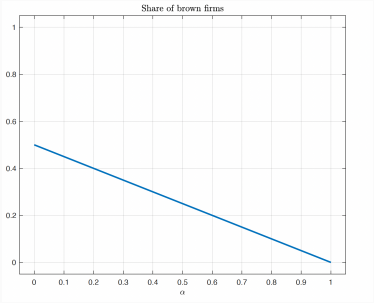
  where $\tilde{W}^F$ ($\tilde{W}^S$) denotes investors' $t = 1$ financial wealth determined by portfolio holdings chosen at $t = 0$, h denotes the social harm produced by the brown sector expressed in units of wealth, b is the fraction of social harm internalized by social investors, proportional to their fractional ownership of brown firms, X_B^S .
- Cash flows of both types of firms are normally distributed and investors exhibit negative exponential utility.

Numerical example

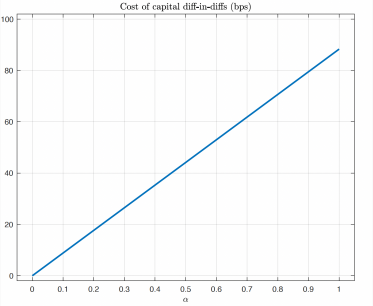
- Expected cash flow: $\mu_B = \mu_G$=40; standard deviation: $\sigma_G = \sigma_B = 10$; correlation: $\rho = 0.98$ (slightly above Berk and Binsbergen's (25) calibration of 0.93); risk aversion: $\gamma = 0.1$; social harm of brown technology: $h = 5\%$ of expected cash flows (calibrated to "Other Utilities" in Pedersen (25) for a cost of carbon of \$ 100); fraction of of social harm internalized by social investors: $b = 10\%$.
- Optimal Pigouvian tax on brown firms' revenues $= 5\%$.
- Resulting social first-best: all firms adopt the green technology, i.e. $S_B = 0\%$.
- In absence of green finance and no Pigouvian tax: 50% of firms would choose the brown technology.
- Now consider the effects of "green finance", i.e. varying proportions of social investors, α.

Supply of green technology and cost-of-capital

- Cost-of-capital diff-in-diff: difference between cost-of-capital between brown and green firms with and without social investors, respectively, given the equilibrium supply of technologies.



Share of Brown Firms, S_B,
and
Fraction of Social Investors, α.



Cost of Capital Effects (**in BPs**) due to
Social Investors ("greenium")
and Fraction of Social Investors

Interpreting greenium results (1)

- Effects of an increase in green finance on observed cost-of-capital differences may be very small even when it has non-trivial real impact.
- In above example: implementing the social first-best via green finance, i.e. 100% green firms, corresponds to a sustainable discount rate approx. 90 Bps above the standard CAPM discount rate. In contrast, the add-on to the discount rate in Pedersen (25) for *Other Utilities* would be approximately 0.0005*100, i.e. 5%.
- But much lower discount rates suffice to obtain first-best.
- The increase in discount rates crucially depend on how elastic the supply of the green technology is.

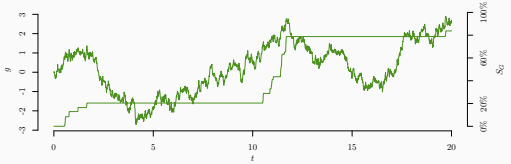
Effects of stochastic preferences

- Green preferences change over time. How does this affect the theoretical impact of green finance on i) realized returns of green vs. brown portfolios; ii) on cost-of-capital diff-in-diffs; iii) on real effects of social preferences?
- Pastor, Stambaugh, Taylor (21) analyze a single shock to preferences. Pastor, Stambaugh, Taylor (22) find empirically that stochastic changes in green preferences are important drivers of stock returns.
- In Dangl, Halling, Yu, Zechner, 2025, *Stochastic social preferences*, SSRN, we analyze effect of stochastic preferences in general equilibrium.
- The following figure from this paper shows a randomly drawn path of social preferences, g, and the resulting technology supply dynamics and risk premia.

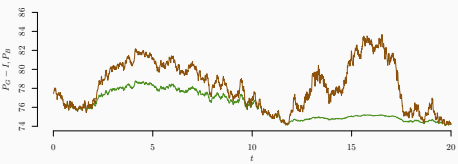
Stochastic social preferences: Dangl, Halling, Yu, Zechner (25)

Figure 1: A given path of social preferences.
Panel (A) shows the sample path together with the supply of green firms; Panel (B) shows the share prices of green and brown firms for this path; Panel (C) plots risk premia of green and brown firms over the sample path; Panel (D) shows the correlation of cash flows and share price changes of green and brown firms.

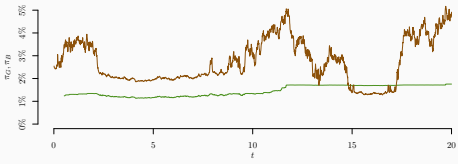
(A) Supply of green firms.



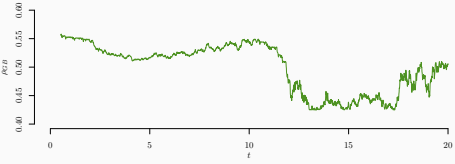
(B) Price of green and brown firms.



(C) Risk premia of green and brown firms.



(D) Corr. of cash flows and share price changes.



Effects of green finance

- Greenium crucially depends on dynamics of preference evolution.
- E.g. following an increased supply of green firms, decreasing green preferences imply dropping expected risk premia of brown firms, even below those of green firms.
- But this does not mean that green preferences have no real effects. Precisely **because** they had large real effects, risk premia may subsequently be higher for green firms.
- To assess real effects of green finance, we should **focus on quantities, and less on prices or cost-of-capital**.

Other topics for discussion

- Green preferences and heterogeneous beliefs.
- Endogenous social preferences.
- Welfare implications of heterogeneous (opposing) social preferences (Wu and Zechner 2025)).
- Commitment for green firms.

Additional slides

Estimating greenium in the presence of heterogeneous beliefs

- Green preferences may manifest themselves in higher (lower) cash-flow expectations for green (brown) firms, rather than cold prickle and warm glow (see Giglio et al (2025), or Aron-Dine et al (2024)).
- Therefore, ICC estimates of green firms may be over- and those of brown firms underestimated.

Endogenous social preferences

- Empirical evidence and theoretical models suggest that social preferences vary **endogenously** over time:
  - Values and culture (on which preferences are based) evolve endogenously and dynamically (e.g. Bowles, 1998; Bisin and Verdier, 2001; Tabellini, 2008).
  - Values exhibit *luxory good properties* (see, e.g. Enke et al, 2024).
  - Policies feed back on preferences (e.g. Mattauch et al, 2022): can crowd-in or crowd-out social preferences.
  - Beliefs about social norms predict pro-climate activity, but individuals underestimate prevalence of social norms (see Andre et al., 2024).
- This endogeneity may substantially alter how social preferences affect real outcomes.

Additional issues to discuss

1. Welfare implications of heterogeneous green preferences: does a competitive equilibrium with value-maximizing firms lead to a social optimum (see Wu and Zechner, 2025, Political preferences and financial market equilibrium, SSRN).
   - In the presence of correlated cash flows and opposing social preferences (e.g. some get cold prickle from brown firms, others warm glow), a competitive equilibrium with value-maximizing firms does not necessarily maximize social welfare.
   - Intuition: by choosing the degree of greenness, firm i creates externalities since it affects investors' optimal holdings in other firms. It may thereby lead to more aggregate cold prickle dividends generated by other firms, which is not priced in when firm i decides on its greenness.
2. Commitment problem for green finance: wouldn't that be eliminated or at least strongly mitigated in a multi-period world?

Estimating cost of capital with endogenous technology supply

- Supply effects imply that the impact of green finance on observed (non-risk-adjusted) cost-of-capital will always tend to be small.
- Intuition: more cold prickle leads brown stock prices to drop –> increase in cost of capital. But as supply of brown firms decreases, they exhibit less systematic risk –> cost of capital decreases.
- Since supply effects change the pricing kernel, it is crucial to use forward looking risk measures for correct risk-adjustments when estimating true greenium, it is crucial to use forward looking risk-adjustments.