Who should pay for ESG ratings?

Stefano Lovo and Jacques Olivier
(HEC Paris)

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Motivation

- Rise of SRI has generated sharp growth in information about non-financial performance of firms:
  - Amount spent by investors to purchase ESG research and analytics $\times$ 3 between 2016 and 2021
  - Market size reached \$750M in 2021 (Source: Opimas)
- Striking difference between who pays for the information between credit and ESG ratings
  - Credit ratings are almost exclusively paid by issuers
  - Survey evidence by ESMA (2022): 2/3 of ESG ratings have an "investors pay" business model

Research questions

- This paper research questions:
  - Can we explain why a difference between who pays for credit ratings and who pays for ESG ratings?
  - Can we explain why some ESG ratings sold to investors and others to firms?
  - Does it have an impact on stock prices?
  - Does it have an impact on incentives of firms and real outcomes?
  - Can we say anything about welfare?

Preview of the model

- Baseline model: standard CARA / normal noisy REE model with three deviations from Grossman-Stiglitz (1980):
  - Some Socially Responsible investors derive part of their utility from the ESG performance of firms they invest into
  - A profit-maximizing Rating Agency (RA) sells a report, either to the firm or to investors, on the ESG performance of the firm
  - Ex-ante investment determines the expected ESG performance of the firm
- Example used throughout for ease of exposition:
  ESG performance = carbon emissions

Roadmap

- Literature review
- The model
- Proofs (sketch)
- Key results and intuition
- Conclusion

Related literature

- Credit rating theories: Skreta and Veldkamp 2009, Bolton et al. 2012, Manso 2013. ...
- Transparency and greenwhashing: Goldstein et al. 2021, Chen 2023, Cartellier et al. 2024. ...
- Impact Finance: Heinkel e al 2021, Green and Roth 2024, Landier and Lovo 2024, Ohemke and Opp 2024, etc. ...

The model

- Static model with three ingredients:
  - Firm
    - Entrepreneur issued a measure 1 of shares she sells to investors
    - Entrepreneur maximizes expected stock price
  - Investors
    - Mass 1 of competitive rational investors who may either be "Normal" (N-investors) or "Socially Responsible" (S-Investors)
    - Noise traders
  - Rating agency
    - Chooses business model and pricing strategy to maximize profits derived from selling report

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The firm is characterized by financial cash-flows $\tilde{V}$ and emissions $\tilde{e}$

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- Cash-flows:

$$\tilde{V} = \underbrace{\tilde{v}}_{\text{gross cash-flowws}} - \underbrace{C(\overline{e})}_{\text{Emission abatement cost}} - \underbrace{\pi_{issuer}}_{\text{rating fee}}$$

where:

- $\tilde{v}$: exogenous, $\sim N\left(\bar{v}, \sigma_v^2\right)$ with $\bar{v} > 0$, $\sigma_v^2 > 0$;
- $$C(\overline{e}) := \frac{c}{2}(e_0 - \overline{e})^2$$

  with e_0 = brownness of industry, $\overline{e}$= expected emission, and c= abatement cost factor.

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- Emission:
  - $\tilde{e}$: ex-post emission $\sim N\left(\bar{e}, \sigma_e^2\right)$ with: $\sigma_e^2 > 0$ and $\sigma_{ev} = 0$.
- The firm chooses $\overline{e}$ and whether to hire or not the RA with the objective of maximizing the expected trade price of its shares, $\overline{P}$.

Investors

- A mass 1 of competitive rational investors of two types: normal (subscript "N") or socially responsible (subscript "S").
  - $\omega \in (0,1)$ denotes the proportion of socially responsible investors.
  - Investors may invest in a risk-free asset with $r_f = 0$ and in $n \in \mathbb{R}$ shares of the firm.
  - Normal investors maximize:

$$E\left(-e^{-\gamma \tilde{W}_N}\right)$$

    where $\tilde{W}_N = n_N(\tilde{V} - P)$.
  - Socially responsible investors maximize:

$$E\left(-e^{-\gamma\left(\tilde{W}_S - n_S \tilde{e}\right)}\right)$$

    where $\tilde{W}_S = n_S(\tilde{V} - P)$.
- Noise traders exogenously demand $\tilde{z}$ shares of stock at the market price, with $\tilde{z} \sim N(0, \sigma_z^2)$, where $\sigma_z^2 > 0$ and $\sigma_{ez} = \sigma_{vz} = 0$.

Rating Agency (RA)

- The RA can observe $\tilde{e}$ and sell a truthful report before trading starts.
  - The cost of producing the report is zero.
  - The RA chooses ex-ante whether the model is "issuer pays" or "investor pays."
- If "issuer pays," there is Nash bargaining between the firm and the RA to determine the price π_{issuer} of the report.
  - Bargaining takes place before $\tilde{e}$ is observed.
  - $\lambda \in [0, 1]$ denotes the RA's bargaining power.
  - The RA discloses $\tilde{e}$ to everyone if and only if the firm purchases the rating service.
- If "investors pay," the RA chooses the price π_{investor} of the report.
  - Because $\sigma_{ev} = 0$, no normal investor buys the report.
  - $q \in [0, 1]$ denotes the endogenous proportion of socially responsible investors who buy the report.

Timing

1. The RA chooses a business model: "issuer pays" or "investors pay."

2. The entrepreneur chooses $\overline{e}$ and invests $C(\overline{e})$ in abatement costs. $C(\overline{e})$ is observed by all agents.

3. If "issuer pays," either the firm and RA agree on a price, and $\tilde{e}$ is revealed to all ($q = 1$), or the negotiation fails ($q = 0$).

   If "investors pay," the RA sets the price of the report, which a fraction $q = q(\pi_{\text{investor}})$ of socially responsible investors purchase to learn $\tilde{e}$.

4. Rational investors submit limit orders, noise traders submit market orders, and markets clear.

5. Uncertainty is resolved, and payoffs are realized.

Key Results

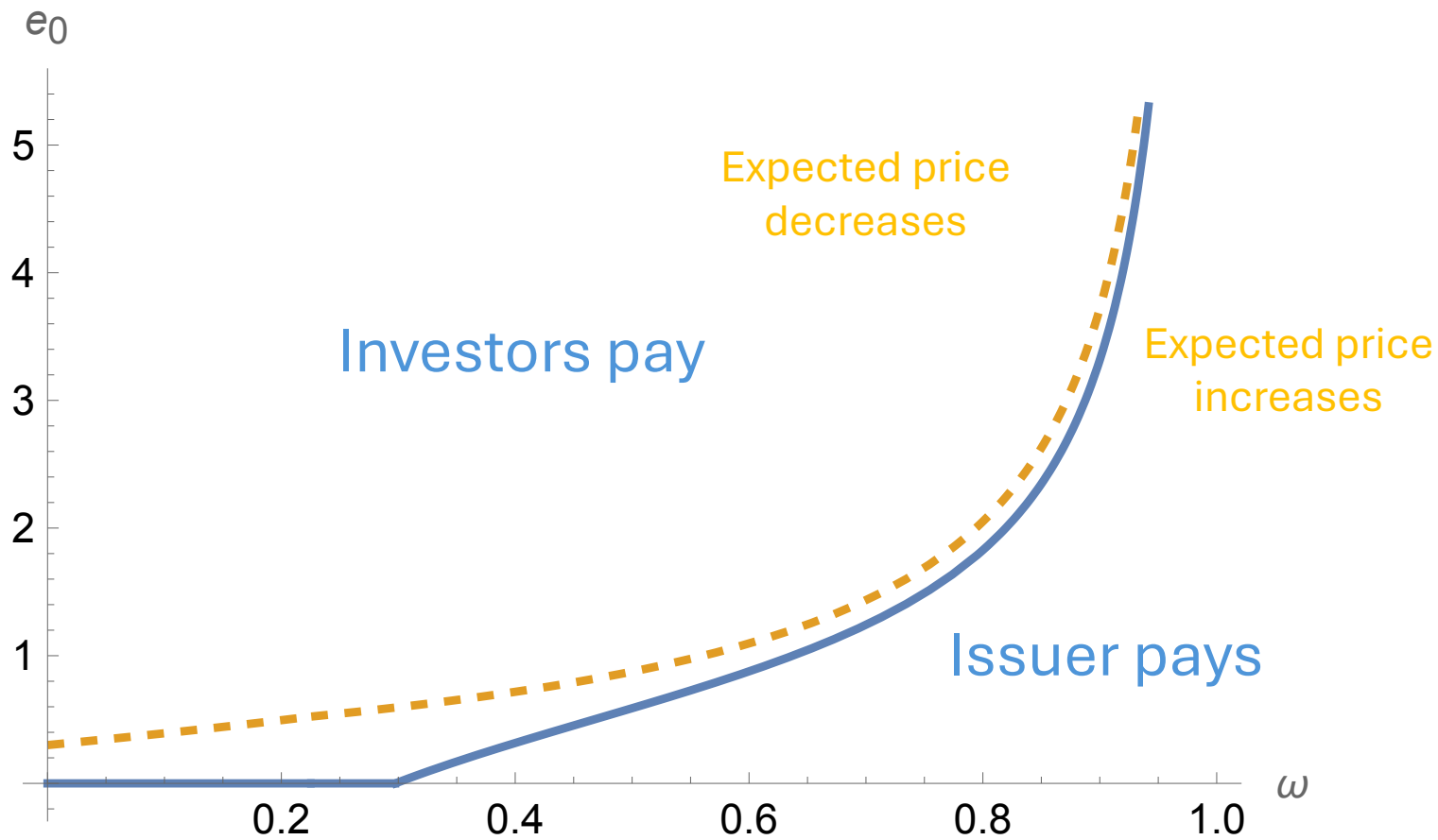
1. **RA business model:** The RA opts for "issuer pays" if and only if:
   - The fraction ω of socially responsible investors is large enough.
   - The firm's industry is not too brown (i.e., e_0 is small enough).

2. **Firm stock price:** The presence of the RA increases a firm's expected stock price only if:
   - The fraction ω of socially responsible investors is large enough.
   - The firm's industry is not too brown (i.e., e_0 is small enough).

3. **Firm's emissions:** The presence of the RA increases the firm's investment in emission abatement.

4. **Investors' utility:** The presence of the RA may not increase investors' utility (even for socially responsible investors).

RA business model and firm prices



Roadmap

1. Investors demand
2. Firm equilibrium price
3. Equilibrium in the Issuer pay
4. Equilibrium in the Investors pay
5. Firm abatement choice
6. RA business model choice

Normal Investors demand

- Normal investors: do not care about $\tilde{e}$ as it is not correlated with $\tilde{V}$

$$n_N(P) = \frac{E[\tilde{V} - P]}{\gamma Var[\tilde{V}]}$$

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$$Var(\tilde{V} + \tilde{e}) = \sigma_v^2 + \sigma_e^2 > \sigma_v^2 = Var(\tilde{V})$$

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- If $q \geq 0$ of the S-investors are informed $\tilde{e}$
  - Informed S-investors know $\tilde{e} = e$

$$n_{S,I}(P, e) = \frac{E[\tilde{V} - e - P]}{\gamma Var[\tilde{V}]}$$

  - Uniformed S-investors partially guess $\tilde{e}$ from equilibrium prices.

$$n_{S,I}(P) = \frac{E[\tilde{V} - \tilde{e} - P|P]}{\gamma Var[\tilde{V} - \tilde{e}|P]}$$

Stock Market equilibrium

- Share market clearing condition

$$\underbrace{(1-\omega)n_N(P)}_{\text{Normal investors}} + \underbrace{q\omega n_{S,I}(P,e)}_{\text{Informed S-investors}} + \underbrace{(1-q)\omega n_{S,U}(P)}_{\text{Uninformed S-investors}} =$$

$$= \underbrace{1-\tilde{z}}_{\text{supply not absorbed by liquidity traders}}$$

- $\overline{P}(\omega, q, \overline{e})$:= Expected equilibrium stock price given that q of the ω S-investors knows $\tilde{e}$, and the the others know $E[\tilde{e}] = \overline{e}$.

$$\overline{P}(\omega, q, \overline{e}) :\downarrow \omega, \downarrow \overline{e}$$

Stock price effect of disclosing $\tilde{e}$ to investors: $\overline{P}(\omega, 1, \overline{e}) - \overline{P}(\omega, 0, \overline{e})$ when ω is small

Disclosing $\tilde{e}$ makes long and short position in the stock less risky to S-investors:

$$Var[\tilde{V} - \tilde{e} | \tilde{e} = e] = \sigma_v^2 < \sigma_v^2 + \sigma_e^2 = Var[\tilde{V} - \tilde{e}]$$

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When most of the investors are N-investor (ω is small):

- the stock equilibrium price is mostly determined by the preference of N-investors $\Rightarrow$
- At this price S-investors short sell, the more so the larger is the firm's expected emission $\overline{e}$.
- If S-investors face no uncertainty on $\tilde{e}$, on average they short even more $\Rightarrow$
- Disclosing $\tilde{e}$ reduces expected price.

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When most of the investors are S-investor (ω is large):

- the stock equilibrium price is mostly determined by the preference of S-investors $\Rightarrow$
- At this price, S-investors hold the asset.
- If S-investors face no uncertainty on $\tilde{e}$, on average their long position is less risky and they demand even more $\Rightarrow$
- Disclosing $\tilde{e}$ increases expected price.

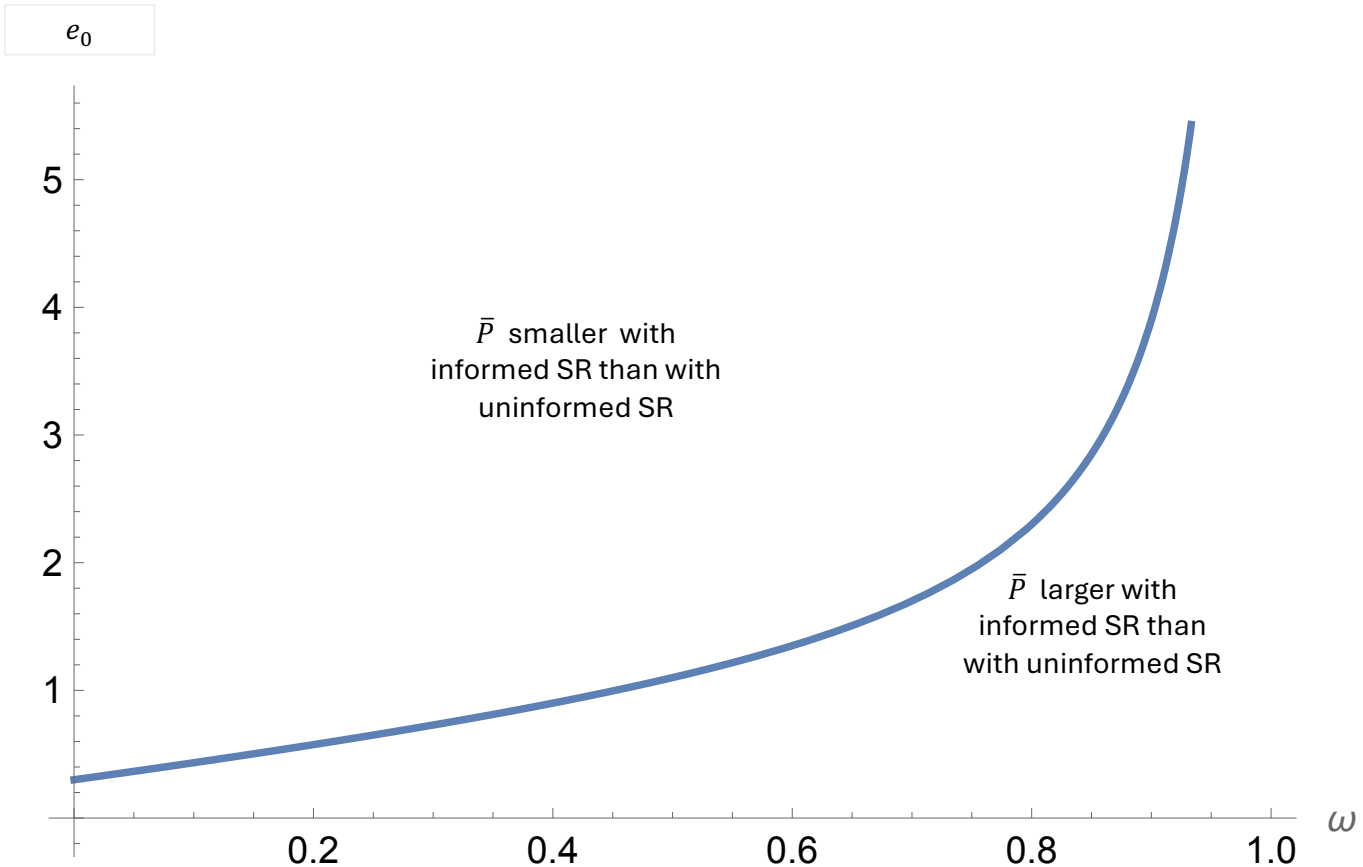
When does informing S-investors of $\tilde{e}$ increase the expected stock price?

Lemma

Informing S-investors of $\tilde{e}$ decreases the firm expected equilibrium price if and only if

$$\overline{e} > \hat{e}(\omega) := \frac{\gamma \sigma_v^2}{1-\omega}$$

When does informing S-investors of $\tilde{e}$ increase the expected stock price?



Issuer Pay

- Timing
  1. RA and firm negotiate rating fee $\pi_{isssuer}$, RA's bargaining power is $\lambda \in [0, 1]$

  2.a If agreement is reached, then
     - Firm pays $\pi_{isssuer}$ to RA
     - RA learns $\tilde{e}$
     - RA discloses $\tilde{e}$ to all investors

  2.b If no agreement is reached, then $\tilde{e}$ remains unknown and no investor is informed.

- Bargaining occurs on how to share the surplus:

$$\overbrace{\underbrace{\overline{P}(\omega, 1, \overline{e})}_{\text{expected price if all SR know } \tilde{e}} - \underbrace{\overline{P}(\omega, 0, \overline{e})}_{\text{expected price if no SR know } \tilde{e}}}^{\text{Expected change in price from informing investors}}$$

Issuer Pay: equilibrium

Lemma

- *If* $\overline{e} < \frac{\gamma\sigma_v^2}{1-\omega}$ *then surplus is positive and*
  - *The RA asks*

$$\pi_{issuer} = \lambda(P(\omega, 1, \overline{e}) - \overline{P}(\omega, 1, \overline{e}))$$

$$\frac{\pi_{issuer}}{\omega} \uparrow \omega$$

  - *The firm purchase the rating*
  - *The firm share expected equilibrium price is*

$$\overline{P}_{issuer}(\omega, \overline{e}) := \lambda\overline{P}(\omega, 0, \overline{e}) + (1-\lambda)\overline{P}(\omega, 1, \overline{e})$$

  Increasing in ω *and decreasing in* $\overline{e}$ *and* λ *.*

- *If* $\overline{e} \geq \frac{\gamma\sigma_v^2}{1-\omega}$ *then surplus is negative and the firm does not purchase the rating and its expected equilibrium price is overline* $\overline{P}(\omega, 0, \overline{e})$*.*

Investors Pay

1. The RA chooses a information letter subscription price $\pi_{investors}$
2. Each investor chooses whether to subscribe or not.
3. RA learns $\tilde{e}$ and disclose it to only investors who subscribed.
4. Stock market trade take place.

- The more investors subscribe $\Rightarrow$
  the more the information about $\tilde{e}$ will be reflected in equilibrium stock price $\Rightarrow$
  the more uniformed investors can free-ride on this information
  $\Rightarrow$ the least each investor is willing to pay for the news letter.
- RA chooses $\pi_{investors}$ to maximize its revenue

Investors Pay: Equilibrium

Lemma

There is $\omega^* \in (0,1)$ *such that*

- *RA set* $\pi_{investors}$ *so that the mass of subscriber is* $\min\{\omega, \omega^*\}$*:*

$$q = 1 \text{ for } \omega < \omega^*$$

$$q = \frac{\omega^*}{\omega} \text{ for } \omega \geq \omega^*$$

- *RA's revenue per SR investor is*
  - *Decreasing in* ω*.*
  - *not affected by* $\overline{e}$*.*

Firm choice of $\overline{e}$

Firms know their stock price is decreasing in $\tilde{e}$, the more so the more there are S-investors $\Rightarrow$ incentive to abate emission.

- Benchmark
  - If no SR investor is informed $\Rightarrow$

$$\overline{e} = \overline{e}(0, \omega) := e_0 - \frac{\omega \sigma_v^2}{c(\sigma_v^2 + (1-\omega)\sigma_e^2)}$$

  - If all SR investor are informed $\Rightarrow$

$$\overline{e} = \overline{e}(1, \omega) := e_0 - \frac{\omega}{c} < \overline{e}(0, \omega)$$

Firm's choice of $\overline{e}$ if the RA opts for the issuer pay model

Let to

$$\overline{e}_\lambda(\omega) := \lambda \overline{e}(0,\omega) + (1-\lambda) e(1,\omega)$$

- If $\overline{e}_\lambda(\omega) < \frac{\gamma\sigma_v^2}{1-\omega)}$, firm set $\overline{e} = \overline{e}_\lambda(\omega)$ and the purchase the rating.
- If $\overline{e}_\lambda(\omega) \geq \frac{\gamma\sigma_v^2}{1-\omega)}$, the firm sets emission $\overline{e}$ to $\overline{e}(0,\omega)$ and then does not purchase the rating.

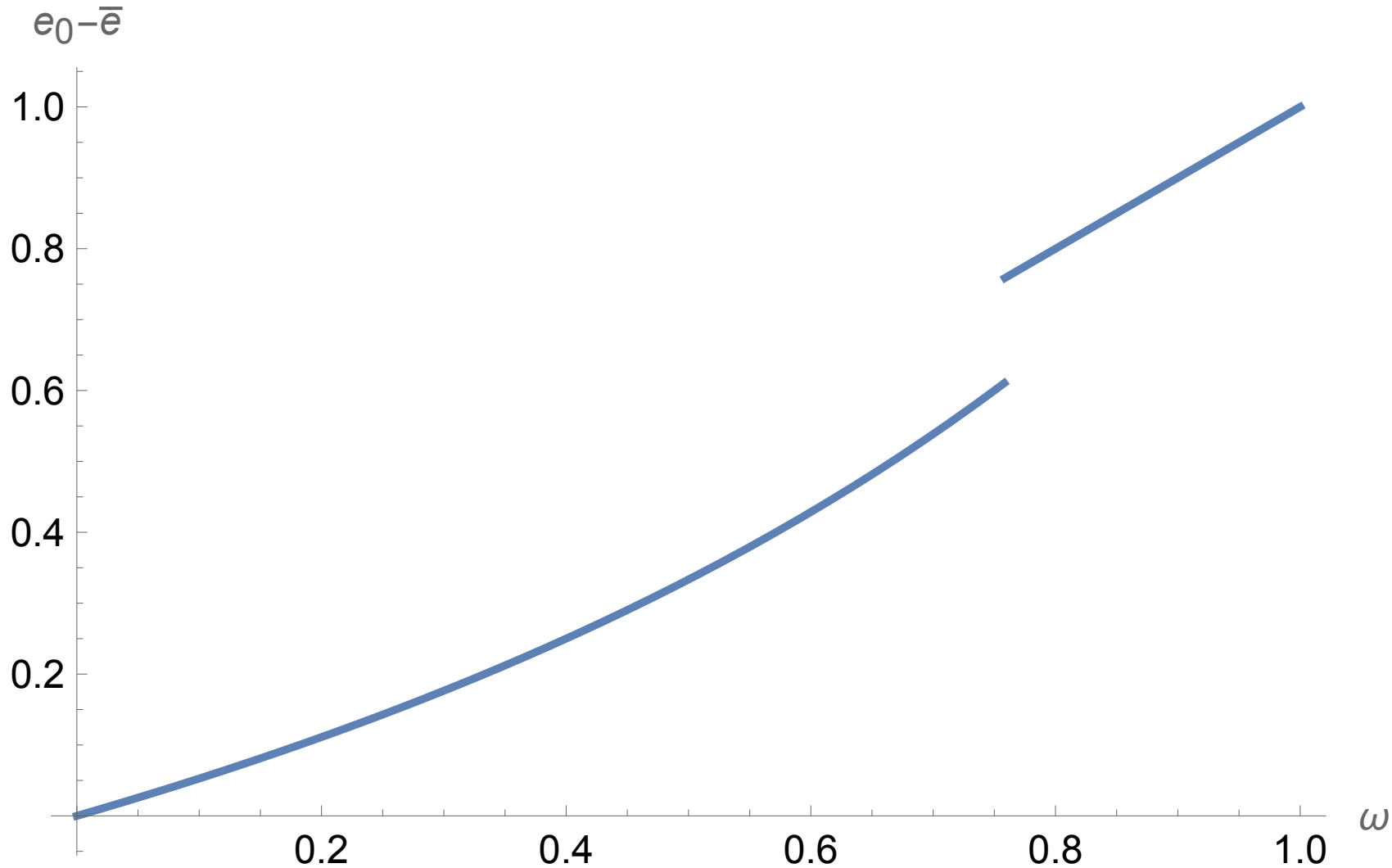
Intuition:

- Firm abate more when expecting to purchase the rating than when not.
- Note that

$$\lim_{\lambda \to 1} \overline{e}_\lambda(\omega) = \overline{e}(0,\omega)$$

Strong RA bargaining power, implies RA appropriate the surplus from disclosing information reducing firm incentive to abate emission.

Firm's emission abatement if the RA opts for the issuer pays



Firm's choice of $\overline{e}$ if the RA opts for the investors pay

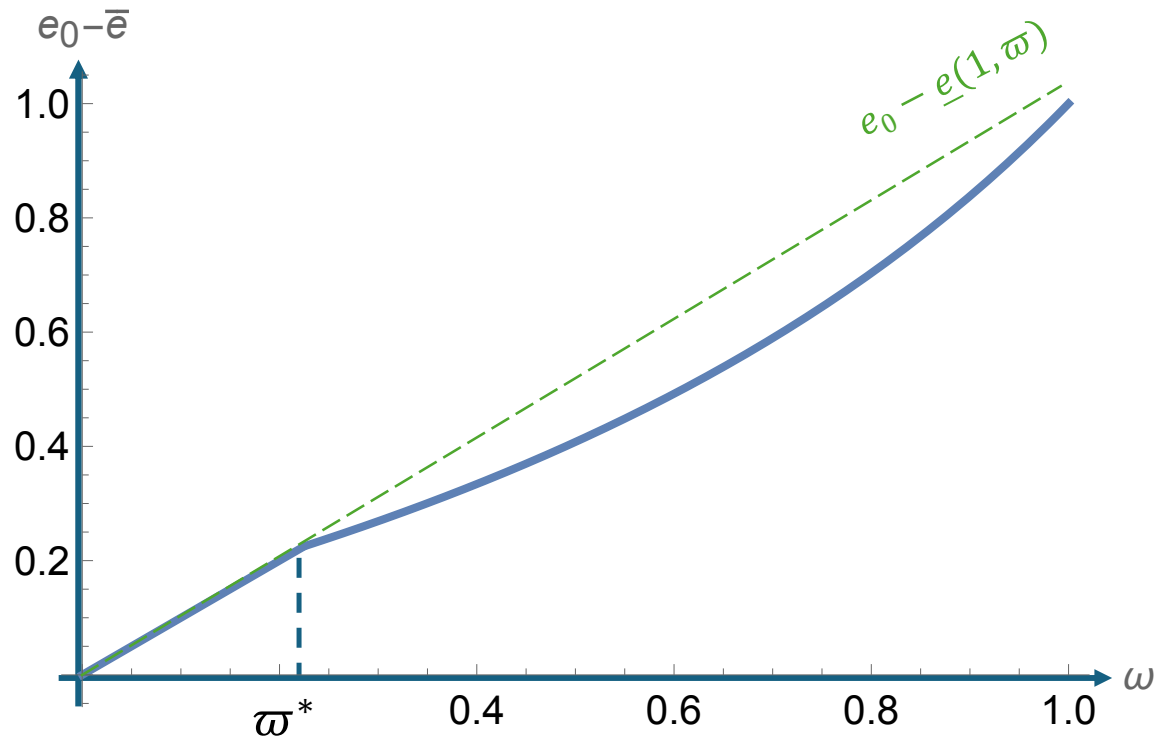
- If $\omega < \omega^*$ RA sell infromation to all S-investors and firm sets

$$\overline{e} = \overline{e}(1, \omega)$$

- If $\omega > \omega^*$ RA sell information only to ω^* investors and firm sets

$$\overline{e} = \overline{e}(\omega)^\star < \overline{e}(1, \omega)$$

Firm's emission abatement if the RA opts for the investors pay



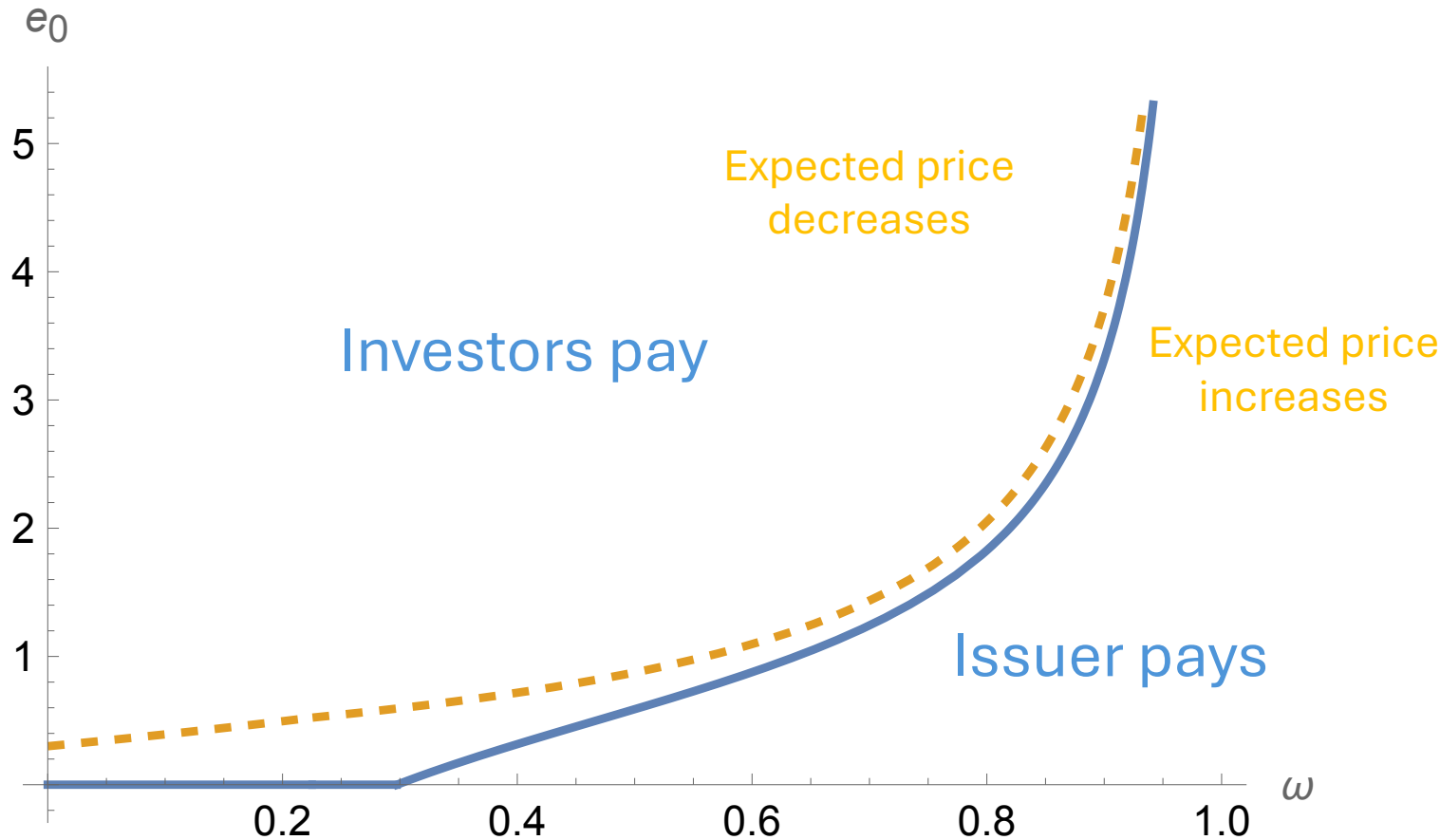
RA choice of business model

$$e(\omega) := \frac{\gamma\sigma_v^2}{1-w} + \frac{w}{2c}\frac{(2\sigma_v^2 + (1-\lambda)(1-w)\sigma_e^2)}{\sigma_v^2 + (1-\omega)\sigma_e^2}$$

Lemma

- *If* $e_0 < e(\omega)$, *then*
  1. *RA: issuer pays model*
  2. *Firm:* $\overline{e} = \overline{e}_\lambda(\omega)$ *and buy rating*
  3. *Presence of RA* $\uparrow \overline{P}$
- *If* $e_0 \geq e(\omega)$, *then*
  1. *RA: investors pay model*
  2. *The firm set* $\overline{e}$ *to* $\overline{e}(1,\omega)$ *or* $\overline{e}(\omega)^\star$ *depending on* $\omega >$ *or* $< \omega^\star$.
  3. *Presence of RA* $\downarrow \overline{P}$ *(unless* e_0 *is small enough).*

RA business model and firm prices



What is the effect of ESG ratings abatement investment?

- Ratings increase incentives to invest in emissions abatement
  - Incentives of entrepreneur to abate emissions stem from sensitivity of expected stock price to expected emissions
  - ESG ratings make expected stock price more sensitive to expected emissions
  - "Issuer pays" does better than "investors pay" if many S-investors + green industry + small bargaining power of RA

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4. The issuer-pay model should be observed more in green, illiquid sectors:
   - where firms do want to pay for ratings,
   - where private information is less profitable as trades move prices significantly.
5. An increase in transparency in the ESG dimension should lead to a rise in the prices of firms in relatively green sectors and a decrease in the prices of firms in relatively brown sectors.
6. Brown sectors are expected to be the most opposed to policies requiring ESG disclosure.

Effect of RA on social welfare

- RA gains
- Firms, depending on how brown they are might lose or gain from presence of ESG ratings.
- N-Investors: can gain or lose
- S-Investors: can gain or lose

Conclusion

- First economic model of choice of business model by a rating agency that encompasses both ESG and credit ratings
  - Prediction of model consistent with motivating empirical evidence on ESG vs. credit ratings
  - Additional predictions: when should "issuer pays" vs. "investors pay" prevail + impact on incentives to invest in ESG

- **THANK YOU!**