Rating Under Asymmetric Information

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Motivation

- Financial crisis: controversies regarding rating process
- U.S. Dep. of Justice vs S&P, 2013: rating inflation

  (settlements: S&P $1.5 bil. in 2015, Moody's $864 mil. in 2017)
- Questions:
  - Can information asymmetry between firm (insider) and rating agency (public) explain rating inflation?
  - How does a rating agency (public) learn a borrower's quality dynamically?
  - What are the implications for the firm and investors?

This Paper

- Game between firm (insider) and rating agency (public) in continuous time
  - with dynamic feedback
  - under asymmetric information (soft information)
- Explains learning of rating agency (public)
  - firm surviving financial distress signals “hidden treasures”
  - directional learning (leading to “ex-post rating inflation”)
    (Warren Buffett (2004):
    “You only learn who has been swimming naked when the tide goes out.”)
- Provides novel empirically testable implications:
  - effect of equity’s cash injection in bad times on spread
  - security design game (fixed vs. PSD) as signalling device

Model

- Players: firm (insider) and rating agency (public)
- Firm's true cash flow: X as GBM
- Rating agency monitors imperfectly observed cash flow

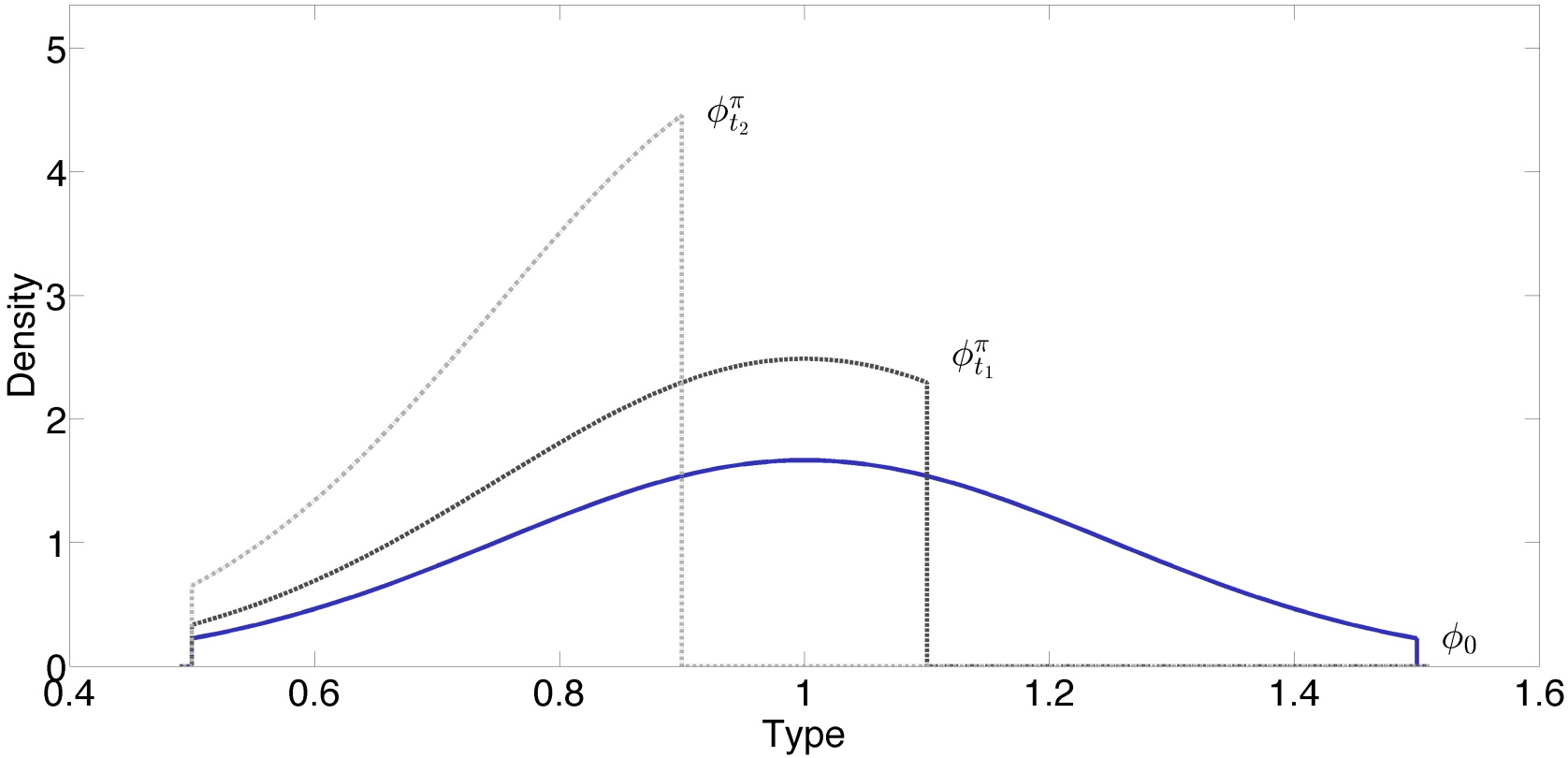
$$D = \tilde{\theta} X$$

- Unobservable firm characteristics $\tilde{\theta}$ (soft information)
- Rating is distance to predicted default threshold $\hat{D}^{\star}$

$$R_t = \frac{D_t}{\hat{D}_t^{\star}}, t \geq 0$$

- Strategies:
  - firm (insider): default time $\tau(\tilde{\theta})$
  - rating agency (public): predicted default threshold $D^{\star}$

Belief of the Rating Agency and Updating



- Prior with density ϕ_0
- Rating agency updates beliefs π on types.

Firm's payoff

- Firm's payoff for $\theta \in \Theta$: Present value of future cash flows

$$U_F^{(\theta)}(\tau, \hat{D}^\star) = \mathbb{E}\left[\int_0^{\tau(\theta)} e^{-r\,t}\left(D_t/\theta - C(D_t/\hat{D}_t^\star)\right)\,\mathrm{d}t \,\middle|\, \tilde{\theta} = \theta\right]$$

  - Remember: $X = D/\theta$
  - Firm's interest rate C: depending on rating $R = D/\hat{D}^\star$

Rating agency's payoff

- Rating agency's payoff: Discounted reputation

$$U_{RA}^{\pi}(\tau, \hat{D}^{\star}) = -\mathbb{E}\left[\int_0^{\tau} e^{-\rho\, t} k_t^{\pi}\, \mathrm{d}t\right]$$

  - $D^{\star}(\theta)$: firm's type-dependent default threshold
  - Cost rate

$$k_t^{\pi} = \int_{\Theta} (\hat{D}_t^{\star} - D^{\star}(\theta))^2\, \phi_t^{\pi}(\theta)\, \mathrm{d}\theta\,, \text{ for } t \geq 0$$

Learning of Rating Agency

- Firm signals quality by not defaulting iff $t < \tau(\theta)$
- Lower θ (underestimated cash flow) implies
  - higher shareholder value
  - delayed default
- Rating agency
  - adjusts belief π from prior π_0 by ruling out θs from right/top
  - learns from observing low cash flows without default

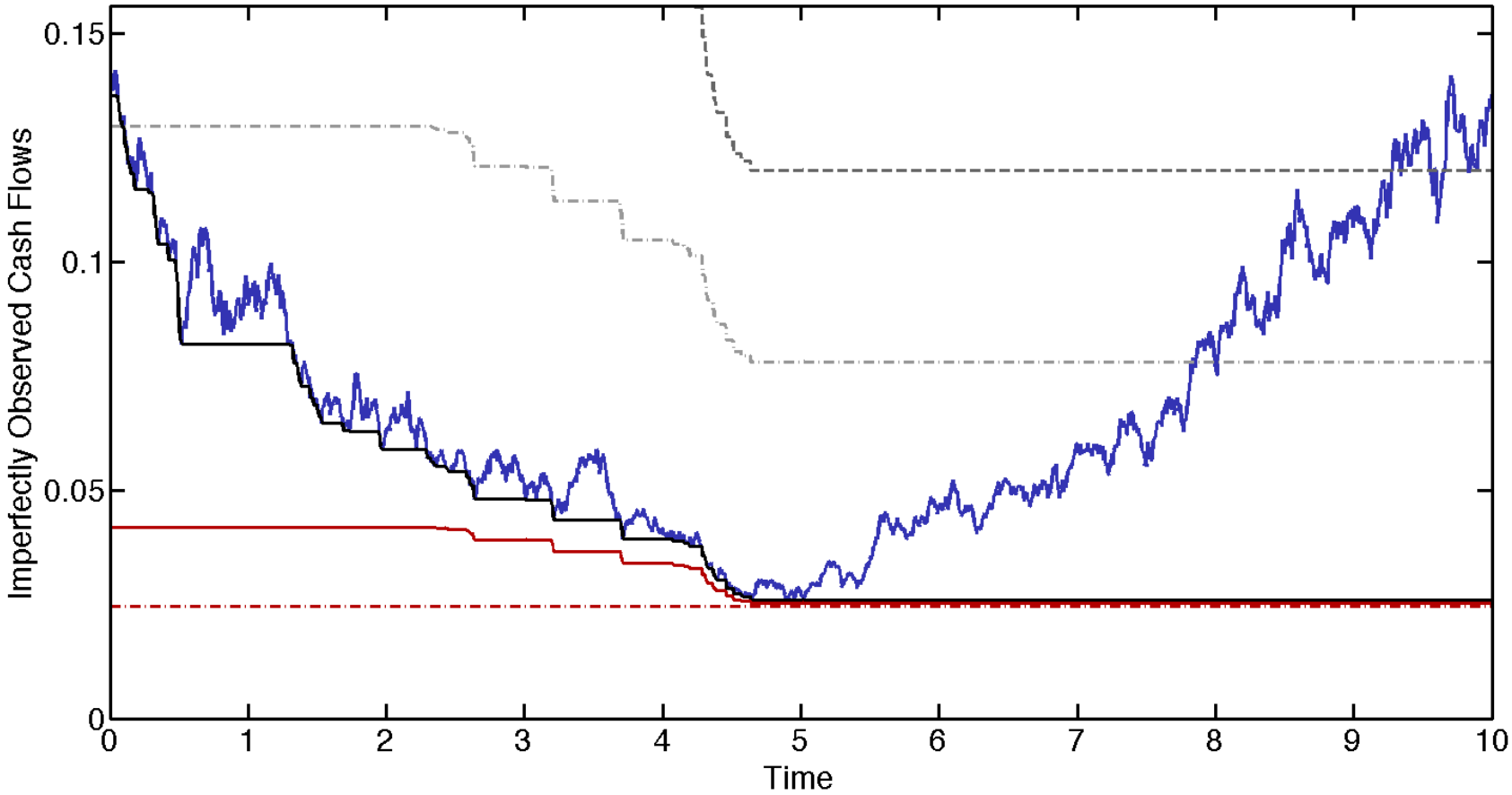
$\Rightarrow$ Directional learning

$\Rightarrow$ Signal transmitted by running minimum of observed cash flow

$$E_t = \inf_{0 \leq s \leq t} D_s \, , t \geq 0$$

Buffett: "You only learn who has been swimming naked when the tide goes out."

Best Response of Rating Agency

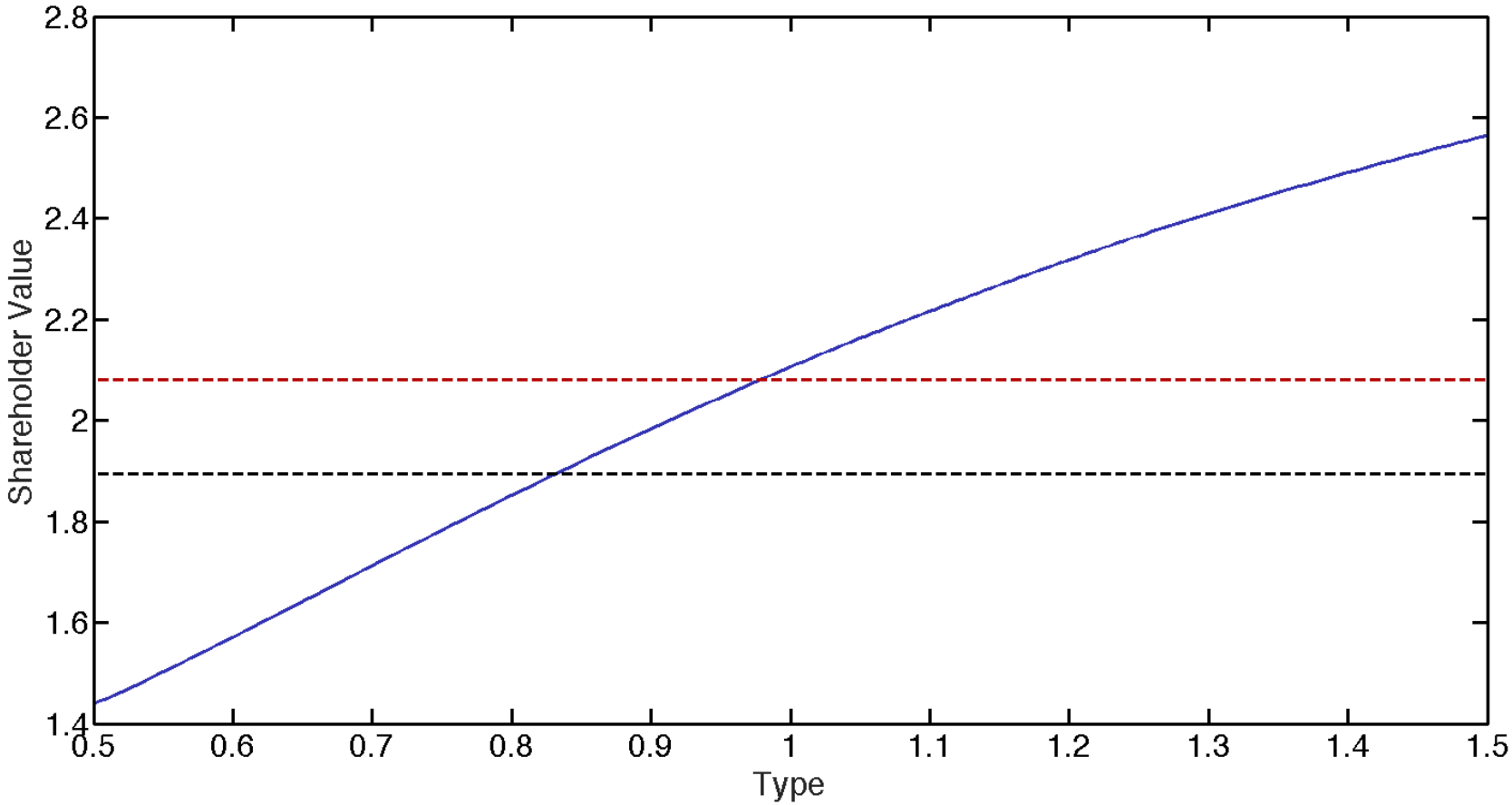


- Underestimated true cash flow

Theory Results

- Best response of rating agency: learning
- Best response of firm: cut-off rule
- Equilibrium I: existence
- Equilibrium II: uniqueness and ODE

Information Asymmetry benefits Shareholders



- C-rated firm under perfect information

$\rightarrow$ information asymmetry increases expected shareholder value

Empirically Testable Implications

- signalling quality by equity's cash injection
  - predict post-right issues/private placement outperformance in terms of the credit spread (event study)
  - complements past research on equity issues and stock price underperformance (Hertzel et al., 2002)
- security design game: fixed coupon debt vs. performance sensitive debt (PSD)
  - predicts underestimated (low θ)) firms choosing risk-compensating PSD while overestimated firms (high θ) choosing fixed-interest debt
  - extending previous theoretical results under complete information (Manso, Strulivic, Tchistyi, 2010)

Conclusion

- Directional learning induces "ex-post rating inflation":
  - firm's shareholders benefit on average from information asymmetry at expense of debt
  - firm's shareholders are able to delay default
- Model provides empirically testable predictions
  - post-right issues/private placement outperformance in terms of the credit spread
  - choice of debt contract (PSD vs. fixed coupon) is screening device under information asymmetry

Extensions

- Generalize symmetric cost rate k^{π} allowing for bias
- Leaning towards debt holders: rating agency overestimates default barrier/risk
  - most conservative case: firm follows perfect information default strategy but with higher interest payments
  - firm's self-interest: reduce information asymmetry

Shareholder Value