Credit Rating Inflation and Firms' Investments

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Credit Rating Inflation

Credit rating agencies (CRAs) are assigning overgenerous ratings.

- Jiang, Stanford, Xie (2012), Strobl and Xia (2012), Cornaggia and Cornaggia (2013)
- "Issuer-pays" business model causes conflicts of interest.

Credit rating inflation: the rating assigned to the firm stands for a higher credit quality than the firm actually has.

Criticism: During the $2007 - 2009$ financial crisis, CRAs had bad real effects (Financial Crisis Inquiry Report, 2011).

- They issued inflated ratings to mislead investors and thus allow financial institutions to engage in high-risk investments.

A Thought Experiment

- In a rational world, inflated ratings can mislead investors only if they are new informative signals.
- However, new informative signals, no matter how noisy they are, should be able to promote market efficiency and generate positive real effects ex ante.
- Hence, it seems that CRAs' ex-ante real effects should always be positive, even though they do not help to reach the first best scenario where they always provide accurate information.

Inflated Credit Ratings' Real Effects

What are a CRA's real effects?

- Are a CRA's ex-ante real effects always positive?
- Or, when does a CRA have negative ex-ante real effects?

Indeed, the conflicts of interest caused by the "issuer-pays" business model have been recognized since 1970s. Why didn't they attract much attention until the recent financial crisis?

How can a CRA have negative ex-ante real effects, if there are any?

- How do inflated ratings act as new informative signals?
- In addition to the informational effects, do a CRA's real effects have other components?

Feedback Loop

We study the credit ratings in a rational debt rollover model, which features a feedback loop:

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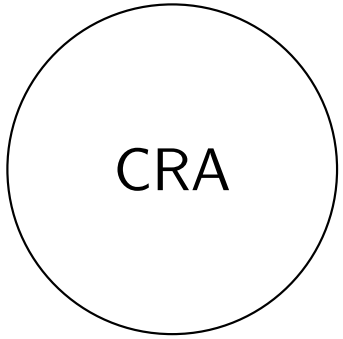

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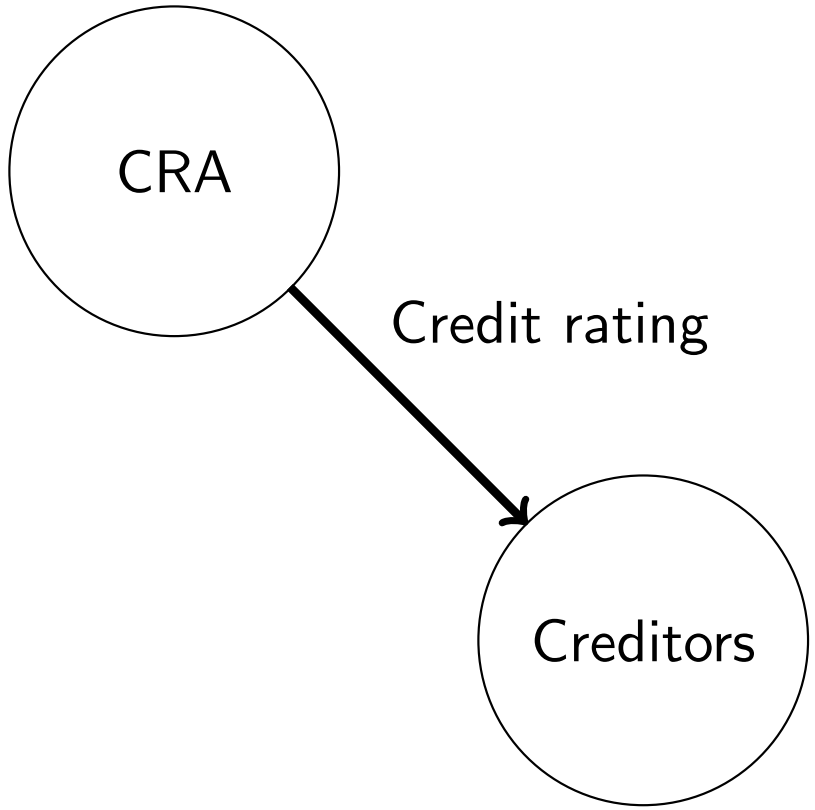

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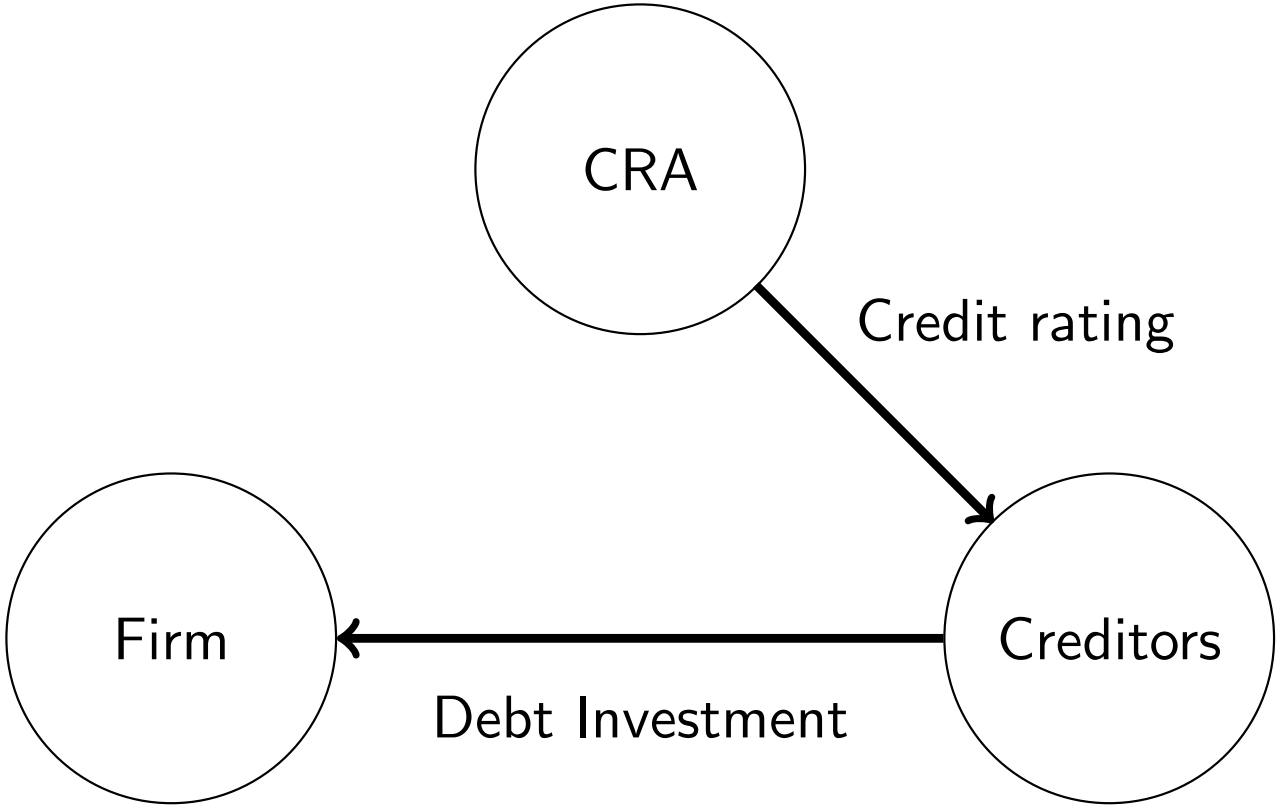

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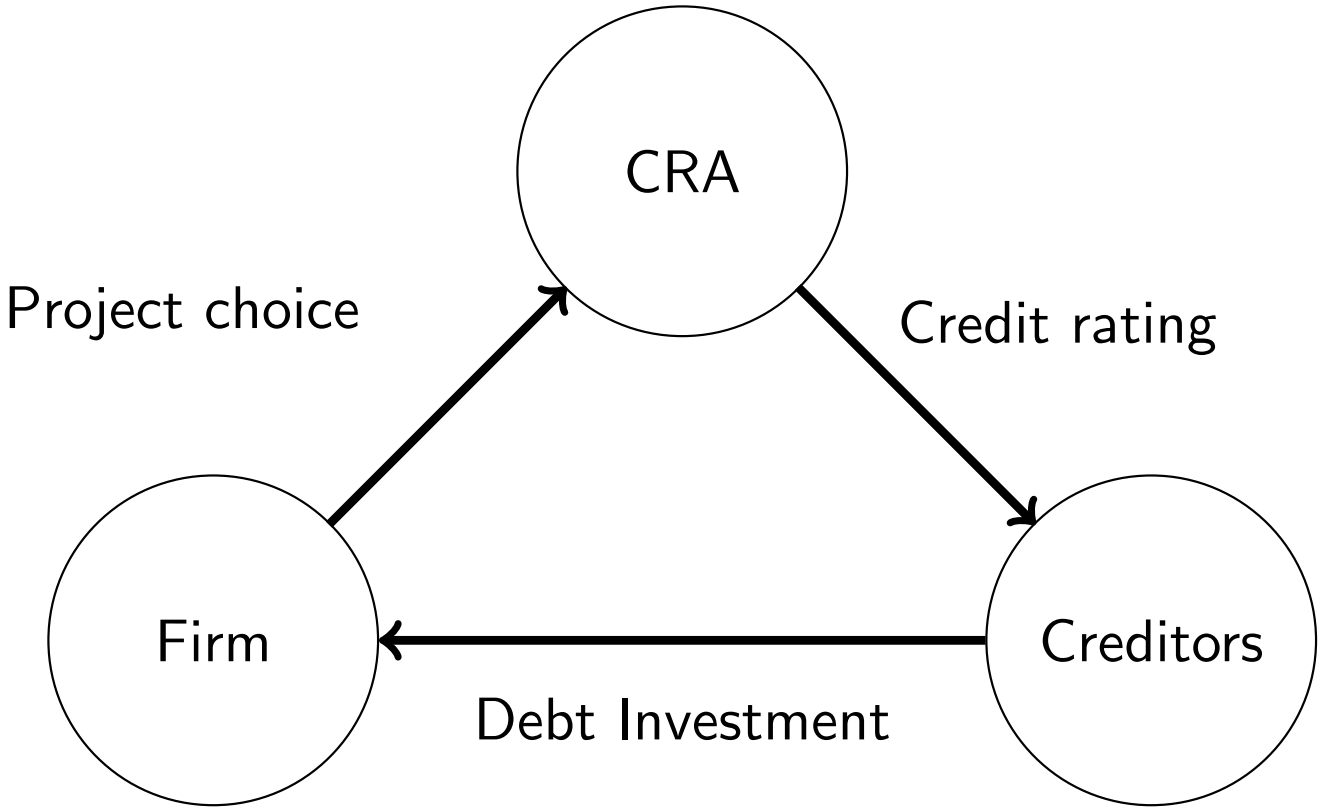


Main Results

1. The CRA's ex-ante effects can be negative.
   - When high-return high-risk projects are available to the firm.
   - During the recent financial crisis, the high-return high-risk securities, such as MBSs, played critical roles.

2. The CRA's real effects can be decomposed into
   - *informational effects:* new informative signals to investors;
   - *feedback effects:* the CRA strategically designs its rating rule, taking into account its informational effects.

3. The negative ex-ante real effects arise from the feedback effects.
   - Positive informational effects: new information and coordination
   - Negative feedback effects: assigning high ratings to firms with worse fundamentals and thus allow them to gamble for resurrection.
   - Negative real effects $\Leftrightarrow$ Feedback Effects $>$ Informational Effects

Main Results

4. Rating standards and rating inflation
   - Laxer rating standards $\neq$ higher rating inflation
   - We shouldn't use the rating standard as a measure of rating inflation in empirical studies

5. Potential policies to mitigate the adverse effects
   - Cost scheme conditional on the failure of firm's investment

Our Paper in the Literature

- Credit ratings' feedback effects (Boot, Milbourn, and Schmeits, 2006; Manso, 2013)
  - No rating inflation; CRAs do not provide new information
- Credit rating inflation (Bolton, Freixas, and Shapiro, 2012; Skreta and Veldkamp, 2009; Frenkel, 2015; Opp, Opp, and Harris, 2013)
  - Rating inflation arises from creditors' irrationality, creditors' lack of information, or exogenous regulation
  - No feedback effect
- Information manipulation in coordination games
  - Manipulation leads to full belief supports (Angeletos, Hellwig, and Pavan, 2006; Angeletos and Pavan, 2013; Edmond, 2013)
  - Manipulation leads to truncated belief supports (Goldstein and Huang, 2016; Huang, 2017)

Model

$t = 0, 1, 2$

Beginning of date 0

- the firm has \$1 existing debt
  - mature at date 1
- the firm can finance by issuing new debt or through predetermined bank credit line
  - there are $1 - \gamma$ potential creditors, each having \$1

Date 0

- CRA assigns credit ratings to the firm
- creditors decide whether to buy new debt
  - get a payoff 1 if not investing
  - if investing, get a payoff $F > 1$ if the firm does not default; get nothing if the firm defaults

Model

At date 1

- the firm decides to default or to continue to invest
  - early default is observable and verifiable, and it ends the game
    - liquidation value of early default is $B \leq \gamma$
  - if continuing to invest, the firm needs to choose between a viable project (VP) and a risky project (HR)
    - VP generates cash flow $V > F$ with probability $p < 1$
    - HR generates cash flow $H > V$ with probability $q \in (0, p)$
    - choice between VP and HR is unobservable and unverifiable
  - social welfare rank: VP $\succ$ early default $\succ$ HR
    - assumption: $pV > 1 > B > qH$

At date 2, cash flows realize, and creditors get repayments if possible

Model

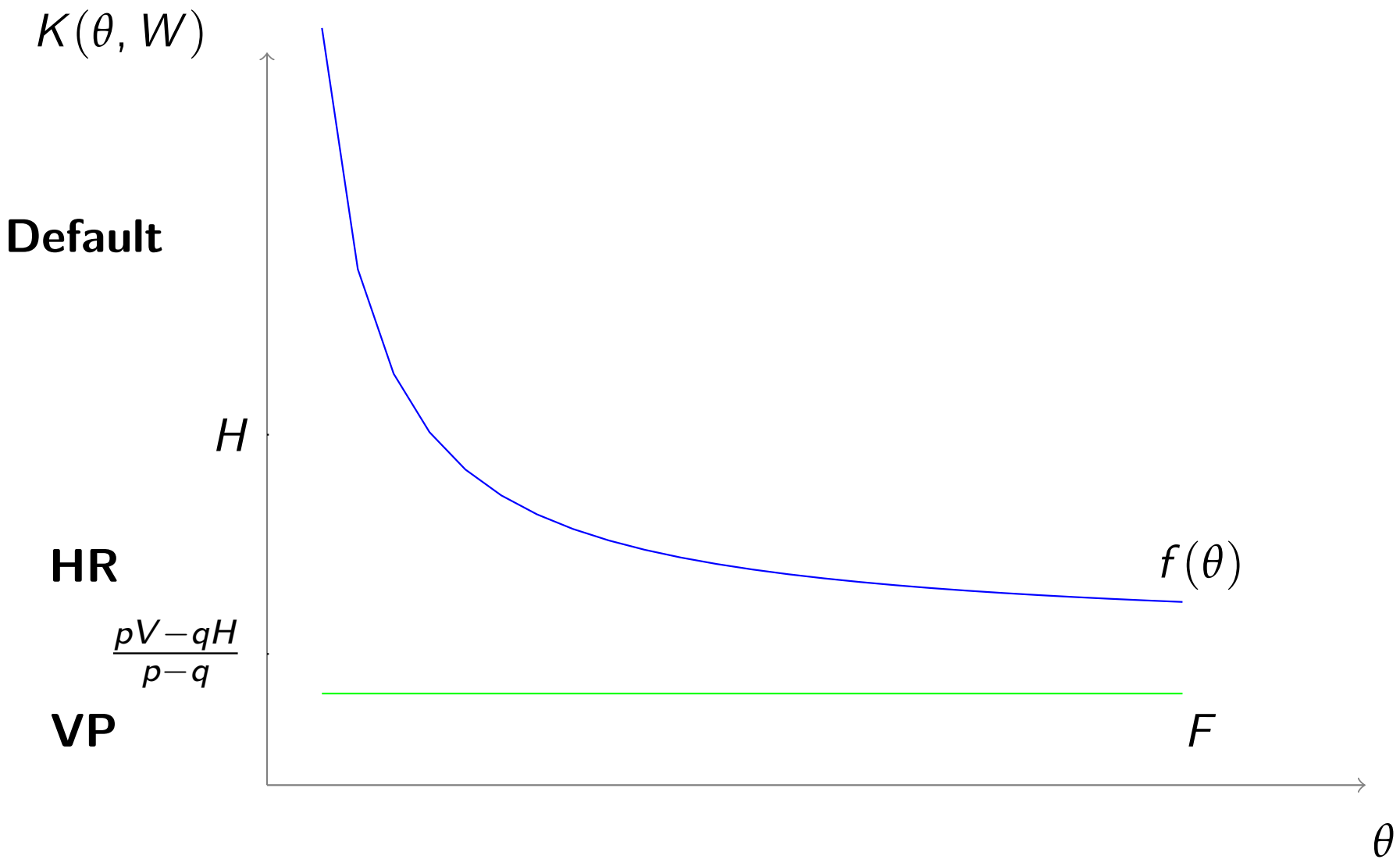
- If W measure creditors investing, and the firm decides to invest, the firm's financial cost is $K(\theta) = WF + (1 - W)f(\theta)$
  - θ is the firm's ability to manage liquidity (fundamentals)
  - θ has an improper uniform prior over the real line
  - f is strictly decreasing, $\lim_{\theta \to +\infty} f(\theta) = F$, and $\lim_{\theta \to -\infty} f(\theta) = +\infty$

- A CRA
  - knows θ
  - maximizes nominal rating $R(\theta) \in \{0, q, p\}$ for all θ
  - is constrained by the partial verifiability, so

$$R(\theta) = \begin{cases} 0, & \text{if the firm defaults early.} \\ p, & \text{if the firm does not default early.} \end{cases}$$

- Creditors' dispersed beliefs
  - before deciding whether to invest, creditor i observes $x_i = \theta + \xi_i$, where $\xi_i \sim \mathcal{N}(0, \beta^{-1})$

Benchmark: No CRA



Benchmark: No CRA

If any creditor i invests if and only if $x_i \leq \tilde{x}$, then θ-firm's financial cost is

$$K(\theta) = \underbrace{[(1-\gamma)F + \gamma f(\theta)]}_{\text{financial costs due to market liquidity}} + \underbrace{(1-\gamma)\Phi\left[\sqrt{\beta}(\tilde{x}-\theta)\right](f(\theta)-F)}_{\text{financial costs due to endogenous coordination}}.$$

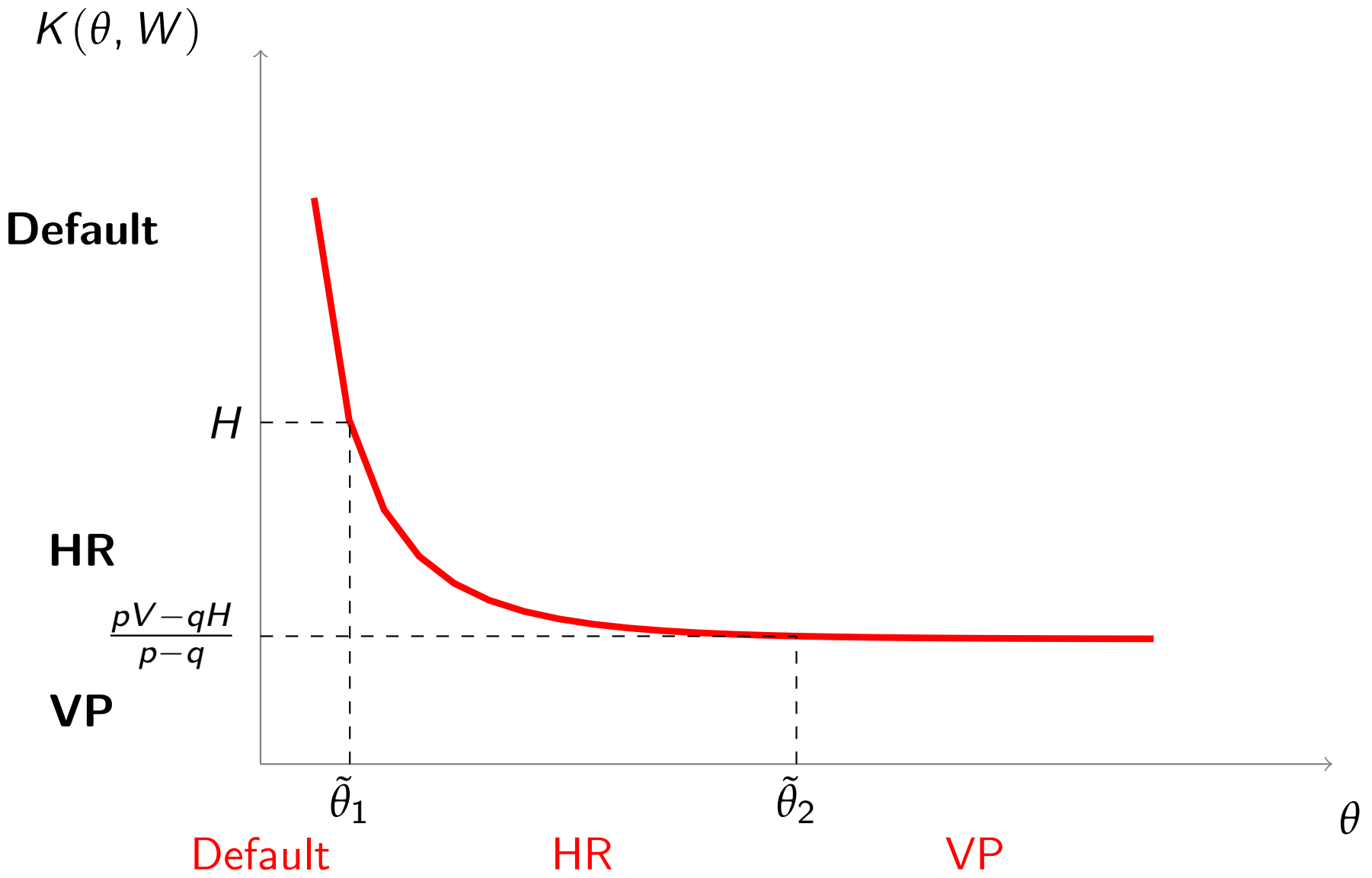
Firm's indifference conditions: $K(\tilde{\theta}_1) = H$ and $K(\tilde{\theta}_2) = \frac{pV-qH}{p-q}$

- θ-firm defaults early if $\theta < \tilde{\theta}_1$, chooses HR if $\theta \in \left[\tilde{\theta}_1, \tilde{\theta}_2\right)$, and choose VP if $\theta > \tilde{\theta}_2$

$\tilde{x}$-creditor is indifferent

$$\underbrace{\left\{\Phi\left[\sqrt{\beta}(\tilde{\theta}_2-\tilde{x})\right] - \Phi\left[\sqrt{\beta}(\tilde{\theta}_1-\tilde{x})\right]\right\}}_{\text{interim belief of HR investment}} qF + \underbrace{\left\{1-\Phi\left[\sqrt{\beta}(\tilde{\theta}_2-\tilde{x})\right]\right\}}_{\text{interim belief of VP investment}} pF = 1$$

Benchmark: No CRA

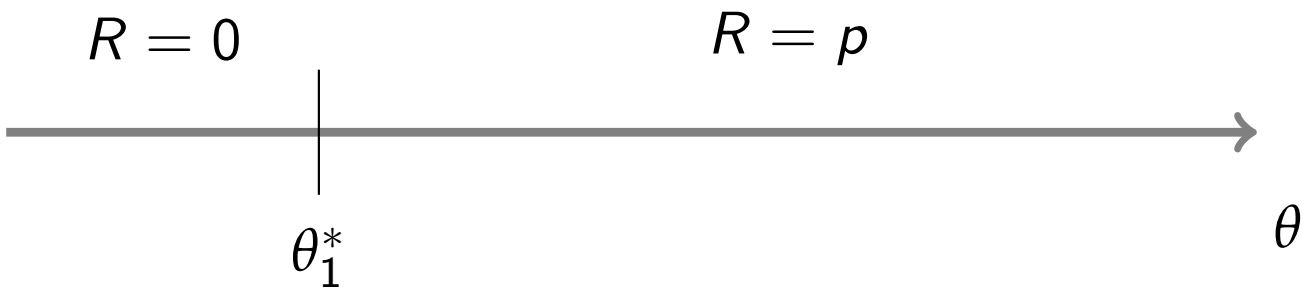


Credit Ratings' Informativeness

Partial verifiability constraint

- CRAs do not want to be caught lying (lawsuits and reputation costs)
- The event of an early default is observable and verifiable
- Investment choice between a risky project and a viable project is unverifiable

Because the firm's investment choice is monotonic in its financial cost, given creditors' strategies and the firm's strategy, the equilibrium credit rating strategy is in the form



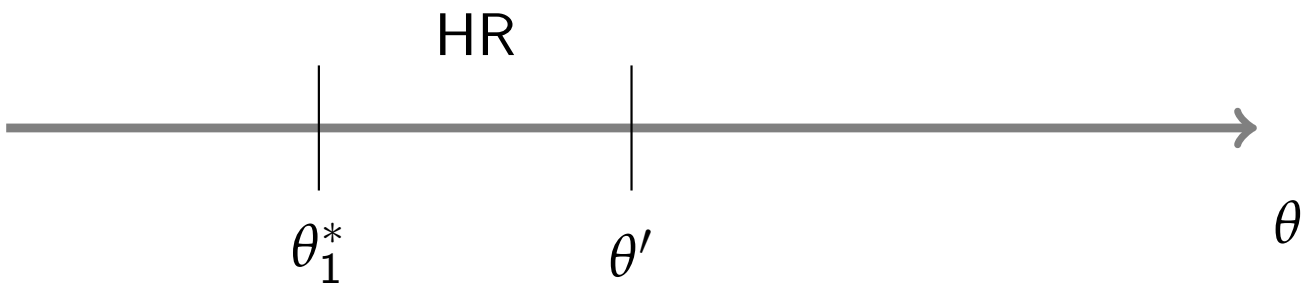
Rating Inflation

Proposition (Rating Inflation)

In an equilibrium (if any exists), there must exist $\theta' > \theta_1^*$, such that the firm in the equilibrium will choose HR if $\theta \in (\theta_1^*, \theta')$.

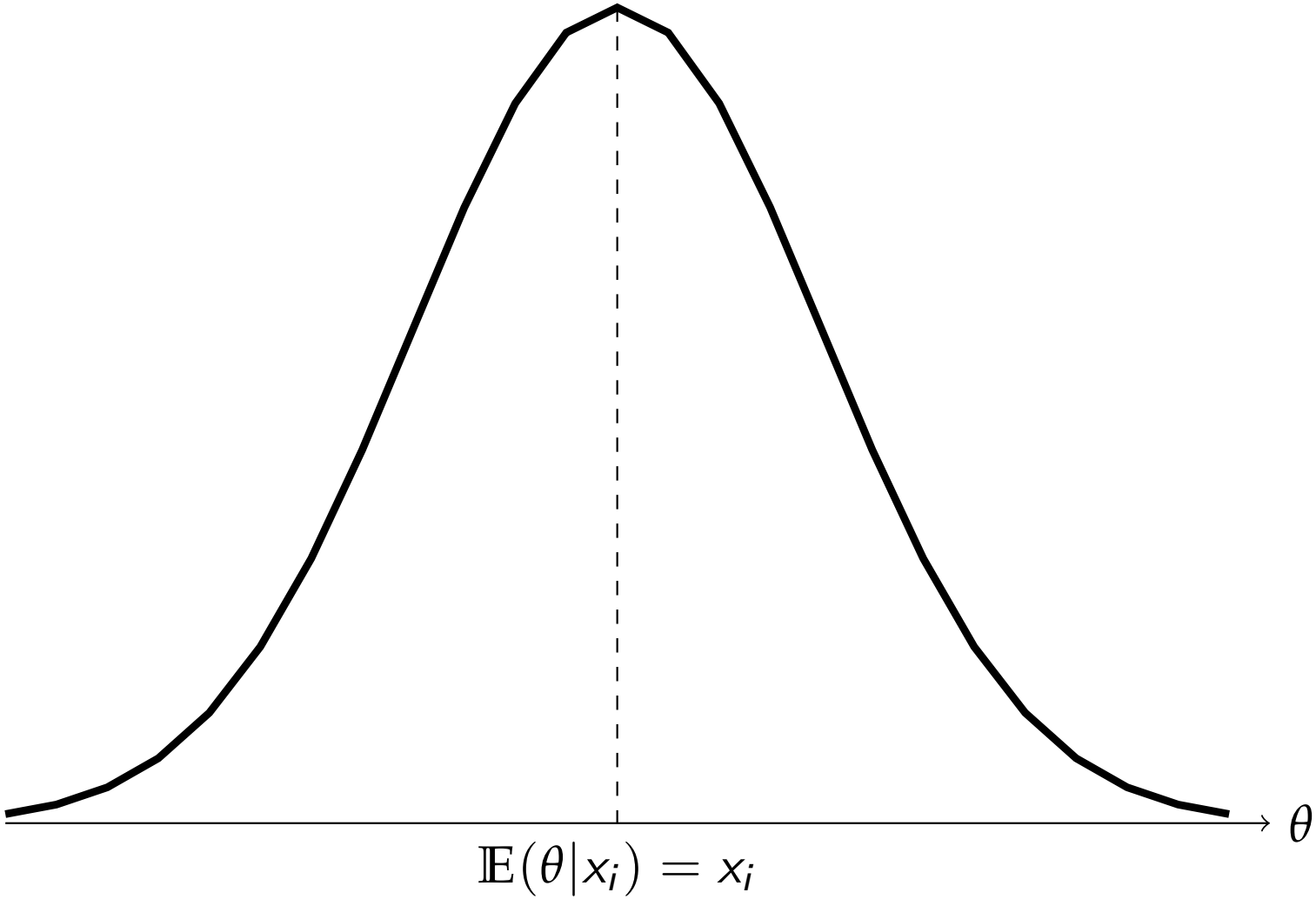
- If $R = p$ implies VP, $K(\theta_1^*) \leq (pV - qH)/(p - q) < H$
- Then, for any $\theta \in (\theta_1^* - \epsilon, \theta_1^*)$, $K(\theta) < H$, and so θ-firm does not default early if assigned $R = p$
- So the CRA always want to assign the rating $R = p$ to such firms

Rating inflation inevitably emerges in an equilibrium.



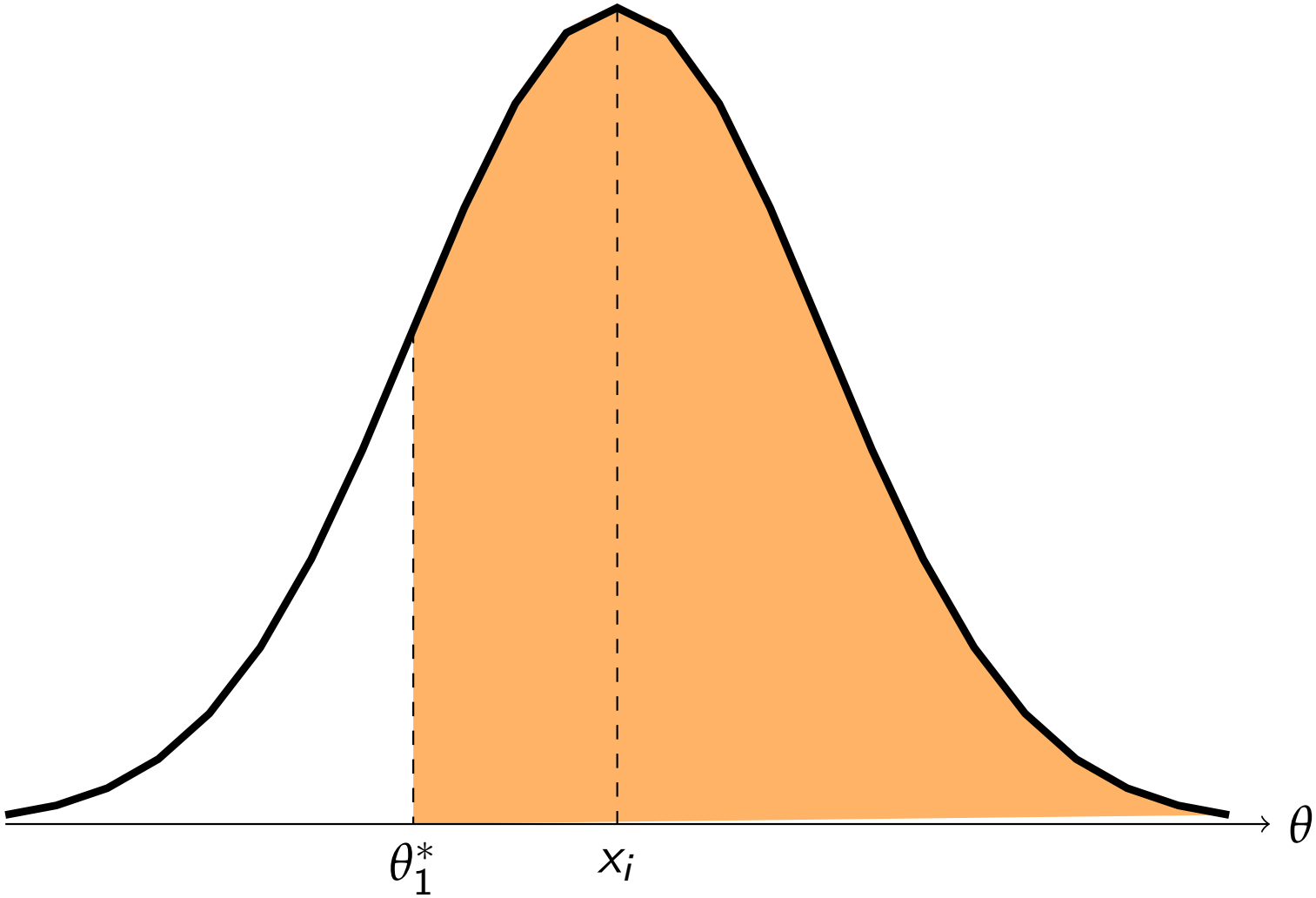
Creditors' Interpretation of $R = p$

Without the CRA's rating



Creditors' Interpretation of $R = p$

When $R = p$



Debt-run Following $R = p$

If creditor i believes that the firm will choose VP if and only if $\theta \geq \theta_2^*$, her expected payoff from rolling over is

$$\underbrace{\frac{\Phi[\sqrt{\beta}(\theta_2^* - x_i)] - \Phi[\sqrt{\beta}(\theta_1^* - x_i)]}{1 - \Phi[\sqrt{\beta}(\theta_1^* - x_i)]}}_{\text{belief of HR investment conditional on } R = p} qF + \underbrace{\frac{1 - \Phi[\sqrt{\beta}(\theta_2^* - x_i)]}{1 - \Phi[\sqrt{\beta}(\theta_1^* - x_i)]}}_{\text{belief of VP investment conditional on } R = p} pF$$

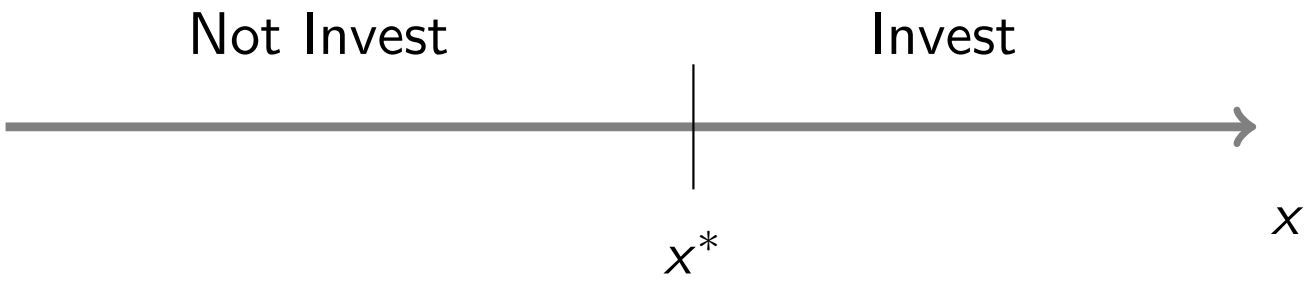
Coordination: each individual creditor cannot affect the firm's investment

- There is a marginal creditor who is indifferent
- When θ_1^* changes, some creditors' decisions will change; hence, $K(\theta)$ changes, leading to the change of the marginal creditor's signal

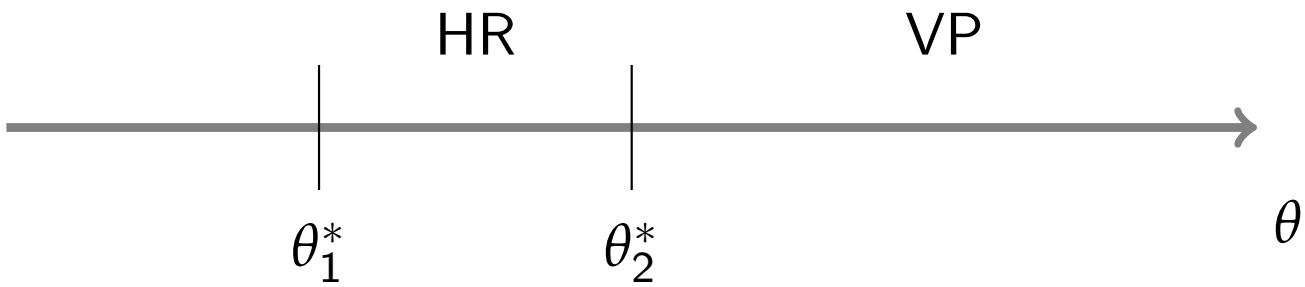
Debt-run Following $R = p$

Given creditors' interpretation of $R = p$

- Creditors



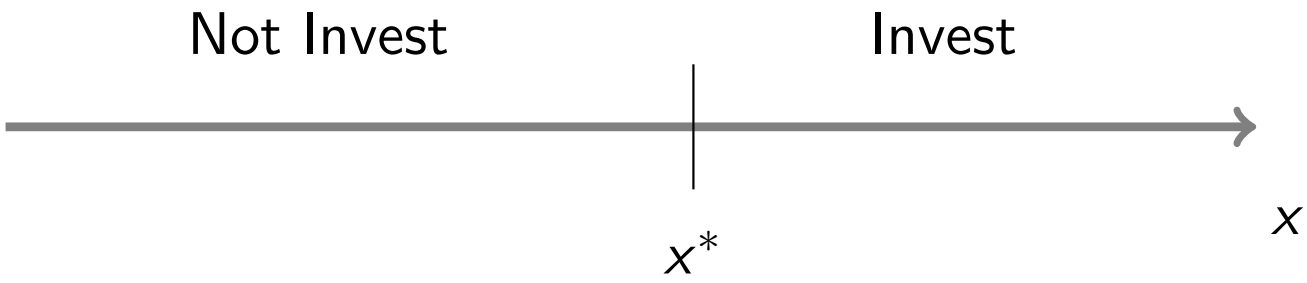
- Firm



Laxer Rating Standards

If creditors believe that θ_1^* is lower

- Creditor



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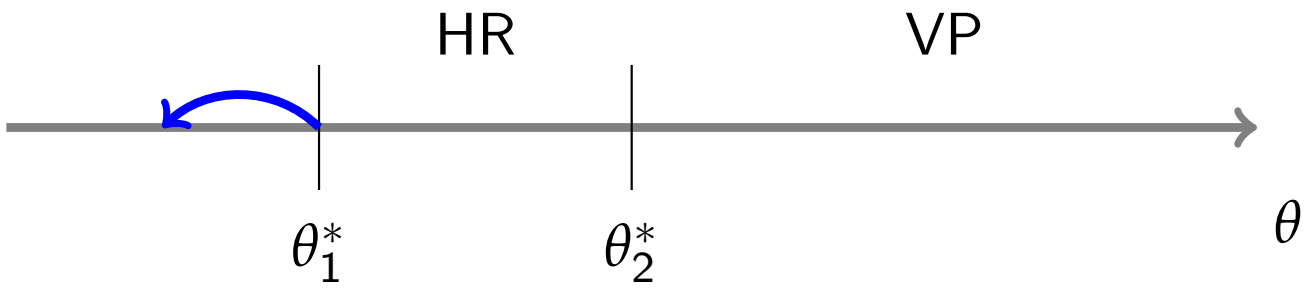

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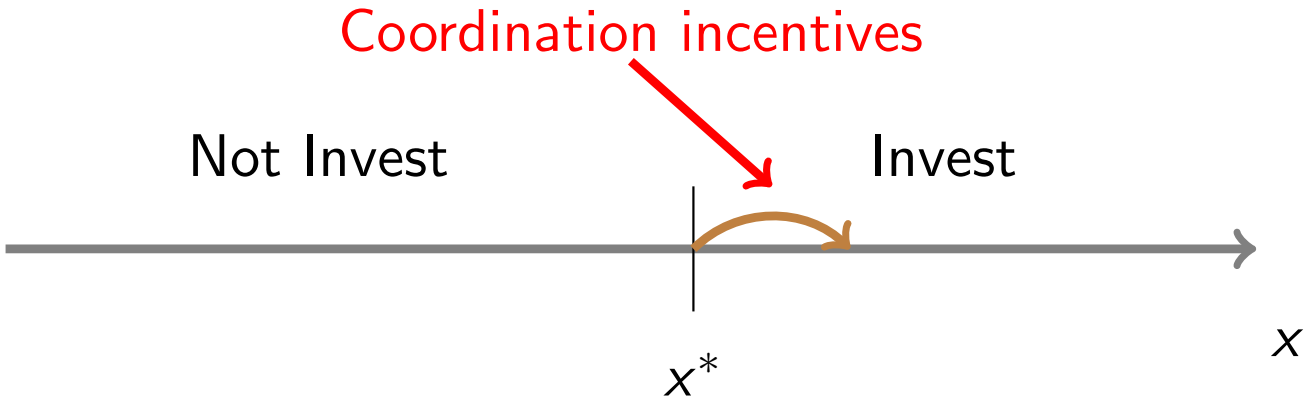
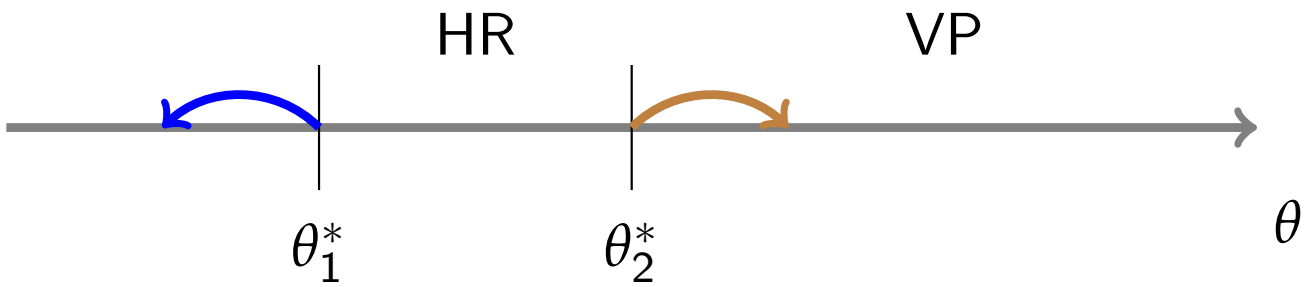
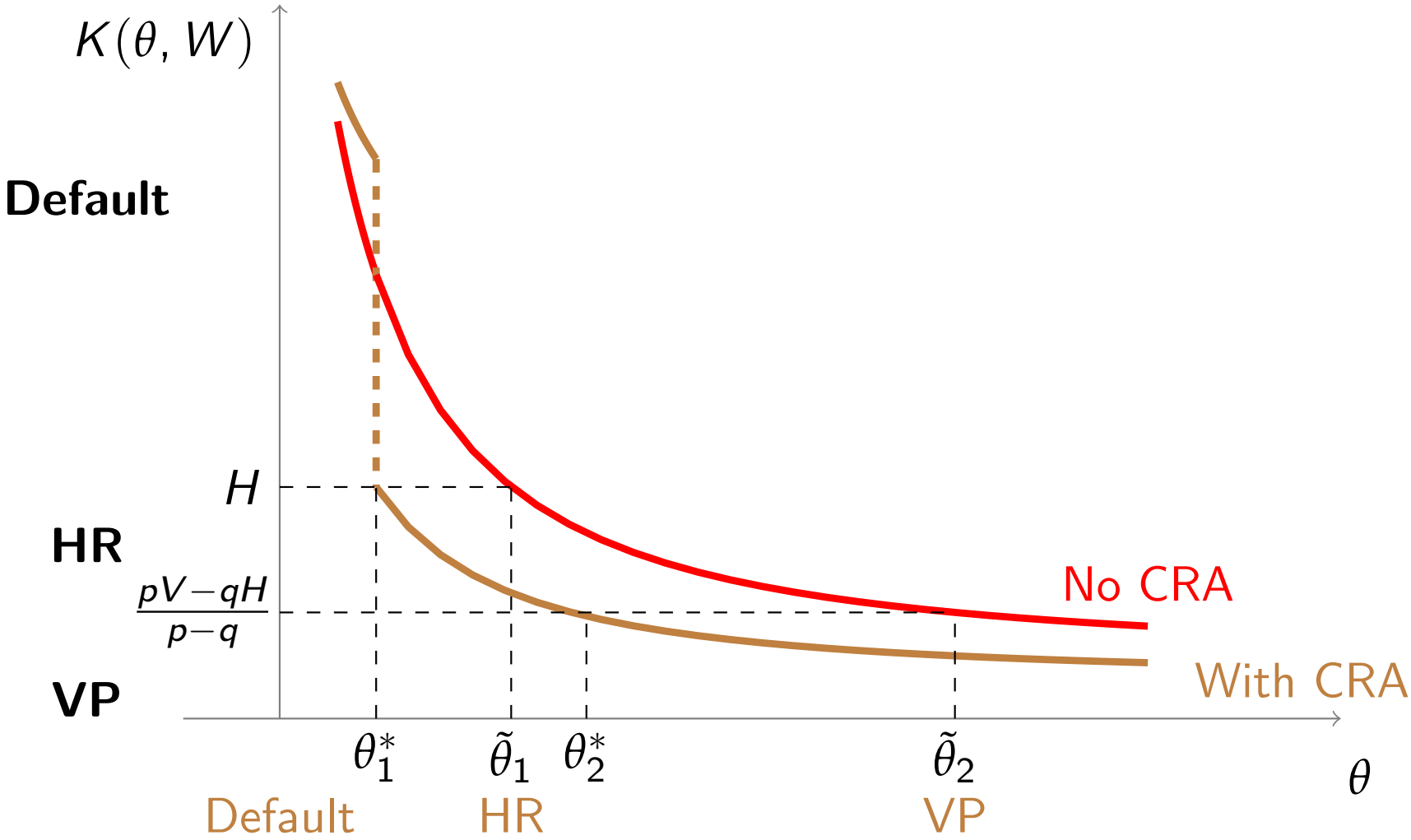


- Firm



Firm's Investment Behavior



Unique Equilibrium

The model has a unique equilibrium, in which

1. CRA's rating strategy: $R = p$ if $\theta \geq \theta_1^*$, and $R = 0$ if $\theta < \theta_1^*$;
2. When $R = 0$, no creditor invests, and the firm defaults early;
3. When $R = p$, creditor i invests if and only if $x_i \geq x^*$; the firm chooses HR if $\theta \in [\theta_1^*, \theta_2^*)$ and VP if $\theta \in [\theta_2^*, +\infty)$;
4. Here, $K(\theta_1^*) = H$, $K(\theta_2^*) = \frac{pV - qH}{p-q}$, and x^*-creditor is indifferent when $R = p$

The uniqueness arises from the rating inflation.

- Even if their belief supports are truncated from below due to $R = p$, creditors still have the dominant region of not investing.
- Global game technique applies.

The CRA's Real Effects

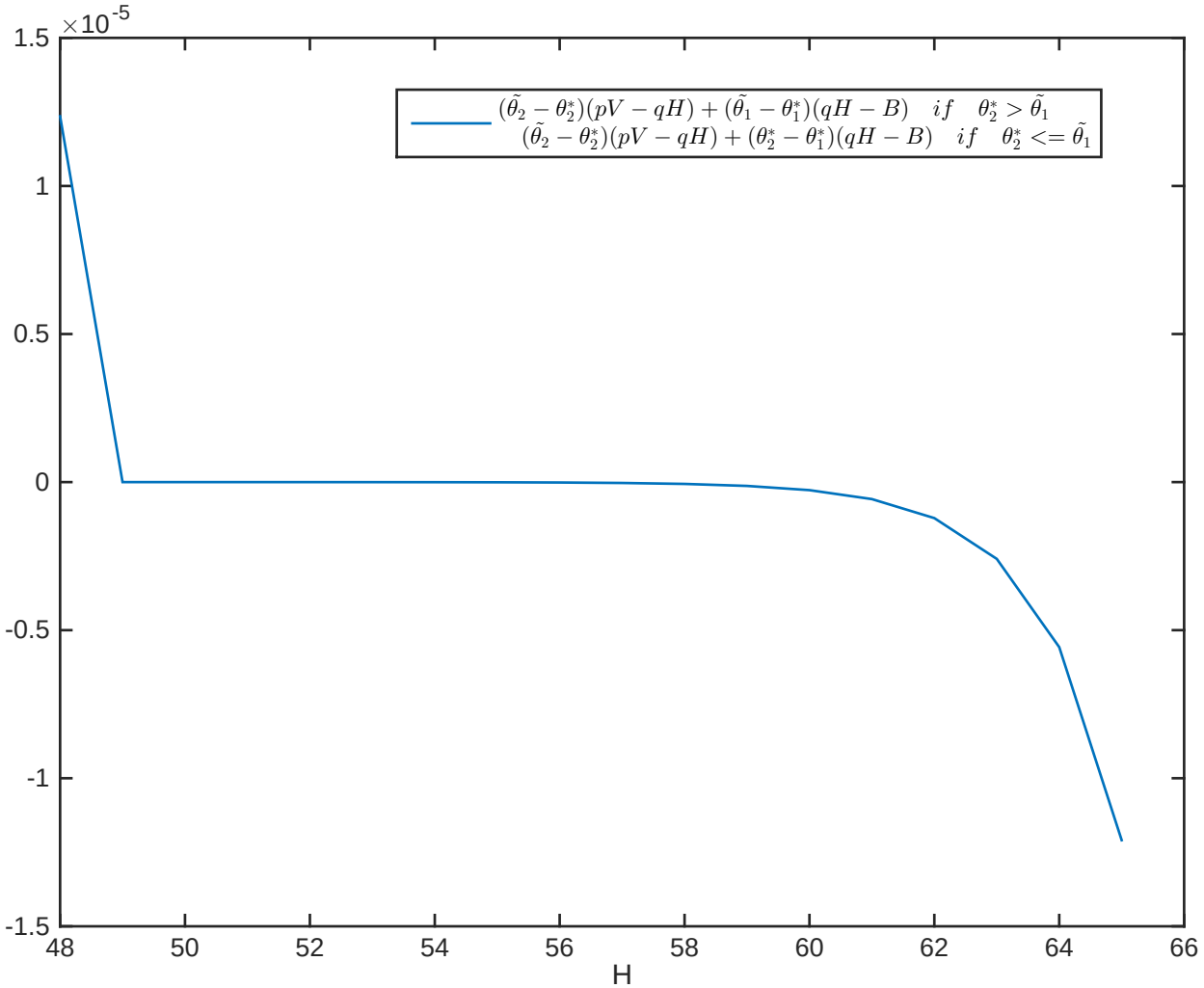
- Firm's investment without a CRA

- Firm's investment with a CRA

- CRA's real effects

The CRA's Real Effects

When H is sufficiently large, the CRA's ex-ante real effects are negative.



Informational Effects and Feedback Effects

Consider a "reflecting" CRA committing to the rating rule

$$\begin{cases} p, & \text{if } \theta \geq \hat{\theta}_1 \equiv \tilde{\theta}_1 \\ 0, & \text{if } \theta < \hat{\theta}_1. \end{cases}$$

The reflecting CRA takes the firm's investment decisions as given when assigning ratings. Hence, the reflecting CRA's real effects are exactly same as the strategic CRA's informational effects.

In the subgame following $R = p$, in any equilibrium, the firm invests in

$$\begin{cases} \text{VP}, & \text{if } \theta \geq \hat{\theta}_2 \\ \text{HR}, & \text{if } \theta \in \left[\hat{\theta}_1, \hat{\theta}_2\right). \end{cases}$$

Here, $\hat{\theta}_2 \in \left[\tilde{\theta}_1, \tilde{\theta}_2\right)$.

Informational Effects and Feedback Effects

- Informational effects: $\left(\tilde{\theta}_2 - \hat{\theta}_2\right)(pV - qH) > 0$.
  - When $\theta \in \left[\hat{\theta}_2, \tilde{\theta}_2\right)$, the firm will invest in VP with the reflecting CRA and will invest in HR without a CRA.

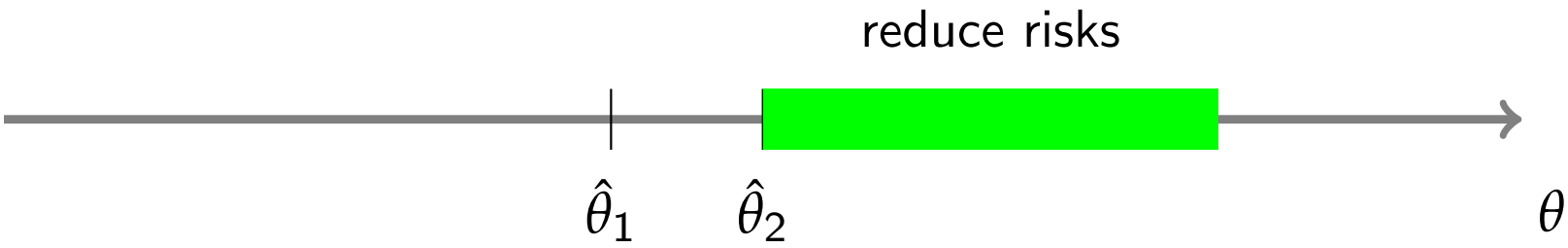
- Feedback effects: $(\hat{\theta}_1 - \theta_1^*)(qH - 1 - \gamma) + (\theta_2^* - \hat{\theta}_2)(qH - pV) < 0$.
  - $(\hat{\theta}_1 - \theta_1^*)(qH - 1 - \gamma) < 0$: the CRA knows that if it assigns the rating p to the firm with $\theta \in \left[\theta_1^*, \hat{\theta}_1\right)$, more creditors will roll over, and the firm will invest in HR to gamble for resurrection.
  - $(\theta_2^* - \hat{\theta}_2)(qH - pV) < 0$: the rating p assigned by a strategic CRA is less informative than that assigned by a reflecting CRA, so when $\theta \in (\hat{\theta}_2, \theta_2^*)$, less creditors roll over, and the firm will invest in HR with a strategic CRA.

- The ex-ante real effects $(\tilde{\theta}_1 - \theta_1^*)(qH - 1 - \gamma) + (\tilde{\theta}_2 - \theta_2^*)(pV - qH) < 0$, when the feedback effects dominate the informational effects.

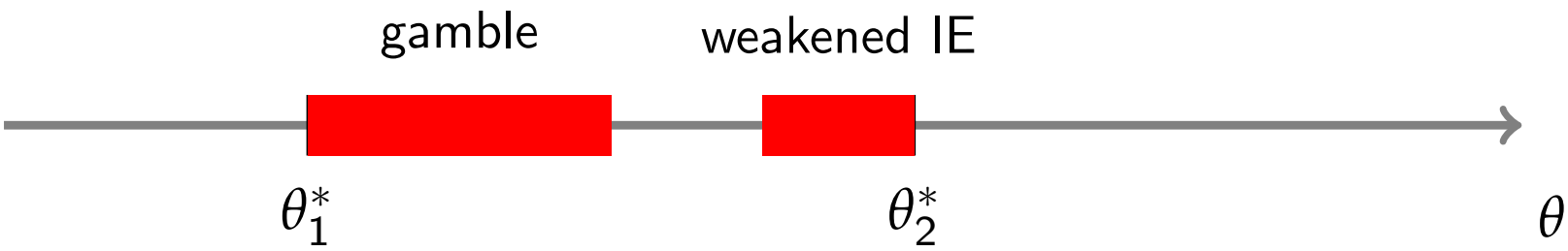
Informational Effects and Feedback Effects

- Benchmark: without CRA

- Informational Effects: a reflecting CRA



- Feedback Effects: a strategic CRA



Rating Standard and Rating Inflation

Rating standard is described by θ_1^*, and rating inflation is described by $\theta_2^* - \theta_1^*$. Both are endogenous.

1. $\partial\theta_1^*/\partial\beta > 0$, but the sign of $\partial(\theta_2^* - \theta_1^*)/\partial\beta$ is ambiguous
   - when the firm is more opaque or creditors' beliefs are more dispersed, the CRA will employ laxer rating standards, but the change of rating inflation is ambiguous
   - Fong, Hong, Kacperczyk, and Kubik (2014): An increase in security analyst coverage leads to stricter credit rating standards
2. $\partial\theta_1^*/\partial H < 0$, and $\partial(\theta_2^* - \theta_1^*)/\partial H > 0$
   - when the upside return of HR is higher, the CRA employs laxer rating standards, and the rating inflation is higher
3. $\partial\theta_1^*/\partial\gamma > 0$, but $\partial(\theta_2^* - \theta_1^*)/\partial\gamma > 0$
   - when the market liquidity is lower, the CRA employs stricter rating standards, but the rating inflation is higher

Policy: Rating-dependent Cost

Rating-dependent cost scheme conditional on investment failure

- Revenue increment from higher rating: $V^p > V^q > V^0 = 0$
- Cost conditional on investment failure: $C^p > C^q > 0$

$$\frac{V^p - V^q}{C^p - C^q} \begin{cases} \leq 1-p, & \Rightarrow \text{rating deflation} \\ \in (1-p, 1-q), & \Rightarrow \text{self-disciplined CRA} \\ \geq 1-q, & \Rightarrow \text{rating inflation} \end{cases}$$

A policy (C^p, C^q) that makes the CRA self-disciplined can mitigate the CRA's adverse effects:

- take effect through affecting CRA's incentives
- monitoring mechanism: deal with the partial verifiability constraint

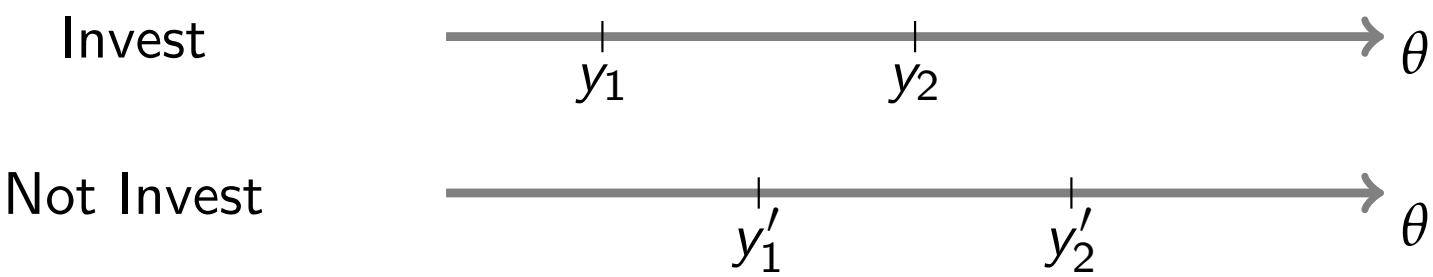
However, when $C^p - C^q$ is too large, the policy leads to rating deflation, which will have the same real effects as rating inflation

Creditors' Coordination

Suppose that the government provides a precise public signal $\theta_s \sim \mathcal{N}\left(\theta, \alpha^{-1}\right)$

- creditors share homogenous precise information $\Leftrightarrow$ one creditor
- no coordination problem in a symmetric equilibrium

The creditor's decision determines the firm's financial cost and thus the CRA's rating strategy



- Invest: $\gamma f(y_1) + (1-\gamma)F = H$ and $\gamma f(y_2) + (1-\gamma)F = \frac{pV-qH}{p-q}$
- Not invest: $f(y_1') = H$ and $f(y_2') = \frac{pV-qH}{p-q}$

Creditors' Coordination

Equilibrium rating strategy:

1. When $\theta_s \geq y_2'$, $\hat{\theta} = y_1$
2. When $\theta_s < y_2$, $\hat{\theta} = y_1'$
3. When $\theta_s \in [y_2, y_2')$, $\hat{\theta} = y_1$ if the creditor invest after $R = p$ and $\hat{\theta} = y_1'$ if the creditor does not invest after $R = p$.

Because equilibrium $\hat{\theta}$ is always bounded from above by y_1', when α is sufficiently large, the creditor will make decision based on θ_s rather than the rating.

Conclusion

- Given the "issuer-pays" model, rating inflation inevitably emerges even when we consider a monopoly CRA's information role.
  - However, inflated ratings as new informative signals always have positive real effects.
- A CRA's ex-ante real effects could be negative, especially when high-risk high-return projects are available to the firm.
  - The CRA's feedback effects can be negative.
  - When the feedback effects dominate the informational effects, the CRA's ex-ante real effects are negative.
- The distinction between rating inflation and rating standard is important for future empirical studies.
- Our framework can be used to analyze many other environments about certified experts' information transmission
  - Auditing
  - Quality inspection
  - Academic grading and recommendation