

An Equilibrium Model of Credit Rating Agencies

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Introduction

Background

1. Credit Rating Agency (CRA) incentives and ratings quality
2. CRAs and the propagation of crises

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Background

1. Credit Rating Agency (CRA) incentives and ratings quality
 - ▶ Common claim: Credit ratings inflated due to the issuer pay model (Pagano and Volpin, 2010)
 - ▶ CRAs' response: Reputation as disciplining device
⇒ Incentive to be correct ex post
2. CRAs and the propagation of crises

Introduction

Background

1. Credit Rating Agency (CRA) incentives and ratings quality
2. CRAs and the propagation of crises
 - ▶ “The decision of a rating agency to downgrade the rating of the Greek debt even before the authorities’ programme and amount of the support package were known must make us ponder the rating agencies’ role in propagating crises.” (Merkel and Sarkozy, May 6 2010)
 - ▶ “Results from our econometric model illustrate that rating agencies attached higher weights to their qualitative judgement than to the economic fundamentals [...], such behaviour may have helped to exacerbate the boom and bust cycle in East Asia.” (Ferri, Liu and Stiglitz, 1999)

Introduction

Background

1. Credit Rating Agency (CRA) incentives and ratings quality
2. CRAs and the propagation of crises

Our paper

- ▶ How does the desire to be correct ex post affect the information content and the impact of CRAs' ratings?
 - ▶ ... when investors' response to a rating is endogenous, contingent on CRA incentives.
- ▶ In equilibrium, where no one behaves entirely mechanically, what is the role of credit rating agencies?

Our contribution

- ▶ An *equilibrium* theory of credit ratings:
 - ▶ CRA assigns ratings based on its information and incentives
 - ▶ Investors respond to ratings taking CRA-incentives into account (rational expectations)
 - ▶ CRA internalize investors response when assigning rating
 - ▶ CRA may affect performance of the rated object by affecting investor choice

- ▶ Typical approaches in the literature:
 - ▶ CRAs provide truthful information by assumption
 - ▶ Investors follow CRAs by assumption
 - ▶ Performance of rated object insensitive to rating

Main results

1. **Coarse information** even though CRAs are motivated by reputation alone
 - ▶ Desire to be correct ex post \Rightarrow use rating to affect outcome
 - ▶ Switching strategy with polarized ratings
2. When ratings matter, they are **pro-cyclical**:
 - ▶ Propagate underlying market conditions
 - ▶ Ratings inflation in booms, deflation in busts
3. Rating effects are **asymmetric** and CRA biases become “**self-defeating**”
 - ▶ Depending on fundamentals: Either only negative ratings matter, or only positive ratings matter, or none matter
 - ▶ If *Positive bias*: Positive ratings are frequent. Only negative ratings matter.
 - ▶ If *Negative bias*: Negative ratings are frequent. Only positive ratings matter.

Literature 1: Theory

- ▶ **Feedback effects**
 - ▶ Manso (2012), Mariano (2012)
- ▶ **Reputation**
 - ▶ Mathis, McAndrews and Rochet (2009) Bolton, Freixas and Shapiro (2011), Bar-Isaac and Shapiro (2012)
- ▶ **Co-ordination device**
 - ▶ Boot, Milbourne and Schmeitz (2005)
- ▶ **Global games**
 - ▶ Morris and Shin (2004), Carlson and Hale (2006)
- ▶ **Competition and ratings shopping**
 - ▶ Skreta and Veldkamp (2009), Sangiorgi, Sokobin and Spatt (2009)

Literature 2: Empirical evidence

- ▶ **Coarse information content**
 - ▶ Few rating events move prices (Kiff, Nowak and Schumacher, 2012, Goh and Ederington, 1999)
 - ▶ Anecdotal evidence (Pagano and Volpin, 2010)
- ▶ **Pro-cyclical ratings**
 - ▶ Lenient ratings standards from 2003-2007 (Ashcraft, Goldsmith-Pinkham and Vickery, 2009, Griffin and Tang, 2011, 2012)
- ▶ **Propagation of underlying market conditions**
 - ▶ Mixed and limited evidence (Reisen and von Maltzan, 1999, Ferri, Liu and Stiglitz, 1999)
- ▶ **Asymmetric effects**
 - ▶ Downgrades matter, but not upgrades (Holthausen and Leftwich, 1986, Galil and Soffer 2012, and many more)
 - ▶ Upgrades matter, but not downgrades (Ismailescu and Kazemi, 2010)

Model

- ▶ Debt roll-over model a la Morris and Shin (2004, 2006).

Model

- ▶ Project, lenders, CRA.
- ▶ Project financed with standard debt contract
 - ▶ Payoff if no default: V
 - ▶ Payoff if default: 0
- ▶ Unit mass of lenders, who may liquidate debt early.
 - ▶ Opportunity cost of rolling over: v
 - ▶ $v < V$
 - ▶ Mass of withdrawing investors: l

Model

Refinancing problem

- ▶ Project must refinance l units short term debt
- ▶ Potential access to alternative means of short term financing:
 θ
- ▶ Survival requires $\theta > l$
 - ▶ If $\theta > 1$ then project always survives
 - ▶ If $\theta < 0$ then project always fails
 - ▶ If $0 < \theta < 1$ then survival is contingent on investors' choice (DD-range)

Model

Information

- ▶ θ unknown, drawn from uniform distribution over Δ
 - ▶ $\Delta = [\underline{\delta}, \bar{\delta}]$, where $\underline{\delta} \ll 0$, and $\bar{\delta} \gg 1$
- ▶ CRA's signal: $y \in [\theta - \alpha, \theta + \alpha]$
 - ▶ ...implying θ uniform over $[y - \alpha, y + \alpha]$
- ▶ Investors' signal: $x \in [\theta - \beta, \theta + \beta]$
 - ▶ ... which they combine with rating R

Model

Timing

- ▶ Period 1
 - ▶ θ is drawn.
 - ▶ CRA observes y and announces a rating R
 - ▶ Investors observe R and x , and choose whether or not to refinance
 - ▶ If $l > \theta$, the project defaults.

- ▶ Period 2
 - ▶ If $l \leq \theta$, lenders get V .
 - ▶ If $l > \theta$, lenders get 0.

Model

Decisions

- ▶ CRA:
 - ▶ Set $R = [\underline{r}, \bar{r}]$
 - ▶ ... to maximize $E(\Pi)$, where

$$\Pi = m(R)I + m(R)(1 - I)$$

- ▶ $I = 1$ if project succeeds, $I = 0$ if project fails.
- ▶ If $R = [\underline{r}, \bar{r}]$ and $R' = [\underline{r}', \bar{r}']$, then: $\bar{r} \leq \underline{r}' \Rightarrow m(R) \leq m(R')$.

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- ▶ Results in a rating mechanism: A partition $r(\Delta)$ of Δ into intervals and a map $r : \Delta \rightarrow r(\Delta)$
 - ▶ Rating and rating mechanism: $R = r(y)$
 - ▶ Consistent rating mechanism: $y \in r(y), \forall y \in \Delta$ ("truth-telling")
 - ▶ Threshold rating mechanism: $r_t(\Delta) = \{R_t^-, R_t^+\}$, where $R_t^- = [\underline{\delta}, t]$, and $R_t^+ = [t, \bar{\delta}]$
 - ▶ Uninformative rating mechanism: $r_0(\Delta) = \{\Delta\}$
 - ▶ Incentive compatible rating mechanism:
 $\Pi^e(r(y), y) \geq \Pi^e(r(y'), y), \forall y, y' \in \mathbb{R}$

Model

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- ▶ $I = 1$ if project succeeds, $I = 0$ if project fails.
 - ▶ If $R = [\underline{r}, \bar{r}]$ and $R' = [\underline{r}', \bar{r}']$, then: $\bar{r} \leq \underline{r}' \Rightarrow m(R) \leq m(R')$.
- ▶ Investors:
 - ▶ Refinance if $Prob(l \leq \theta|x, R)V > v$

Result 1: Coarse information

- ▶ How does desire to be correct ex post affect the informativeness of ratings?
 - ▶ Focus on “Irreducible” rating mechanisms

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- ▶ How does desire to be correct ex post affect the informativeness of ratings?
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Proposition

Any irreducible, consistent, and incentive compatible rating mechanism is either the uninformative rating mechanism r_0 , or it is a threshold rating mechanism $\{r_t\}_{t \in \Delta}$.

- ▶ Interpretation: Even though it is feasible for CRAs to disclose their information as precisely as possible, in equilibrium they don't.
 - ▶ At most, CRAs describe whether project quality is above or below a certain threshold.
- ▶ Intuition: Attempt to tip the boat in order to be correct ex post

Result 2: The equilibrium impact of CRAs

Define

$$P[r](y) = \mathbb{P}(I = 1 | r(y), y)$$

- ▶ The probability that a project succeeds given rating $R = r(y)$ and rating agency signal y .
- ▶ Summarizes how a rating “on average” influences the real economy when all one knows is y .

Result 2: The equilibrium impact of CRAs

Proposition

1. If $\lambda < 1 - \frac{\alpha}{2\beta}$ (**liquidity boom**): The set of "ICIC" rating mechanisms is $\{r_0, r_{t^*}\}$ for some $t^* \in \Delta$.
 - ▶ $P[r_{t^*}] > P[r_0]$ for $y \in (t^*, \lambda + \alpha)$
 - ▶ $P[r_{t^*}] = P[r_0]$ for $y < t^*$ and for $y > \lambda + \alpha$
 - ▶ r_{t^*} exhibits positive rating inflation
2. If $1 - \frac{\alpha}{2\beta} < \lambda < \frac{\alpha}{2\beta}$ then: ICIC = $\{r_0\}$.
3. If $\lambda > \frac{\alpha}{2\beta}$ (**liquidity crunch**): ICIC = $\{r_0, r_{t^*}\}$, $t^* \in \Delta$.
 - ▶ $P[r_{t^*}] - P[r_0] < 0$ for $y \in (\lambda - \alpha, t^*)$
 - ▶ $P[r_{t^*}] - P[r_0] = 0$ for $y < \lambda - \alpha$ and for $y > t^*$
 - ▶ r_{t^*} exhibits negative rating inflation

3 implications:

- ▶ Propagation of market conditions
- ▶ Cyclical rating standards
- ▶ Asymmetric impact

Result 3: The effect of biased incentives

- ▶ Denote
 - ▶ ρ_0 = payoff from correctly predicting failure with switching strategy
 - ▶ ρ_1 = payoff from correctly predicting success with switching strategy

$$\Pi(R_t^+, I) = \rho_1 I$$

$$\Pi(R_t^-, I) = \rho_0(1 - I)$$

- ▶ We can distinguish between 2 regimes based on these payoffs
- ▶ Intuition
 - ▶ Systematic biases are discounted

Result 3: The effect of biased incentives

Proposition

Self-defeating CRA biases

1. If $\frac{\rho_0}{\rho_1} < \frac{\frac{\beta}{\alpha}\lambda}{1 - \frac{\beta}{\alpha}\lambda}$ (“**positive bias**”):
 - ▶ $P[r_{t^*}] < P[r_0]$ for $y \in (\lambda - \alpha, t^*)$
 - ▶ $P[r_{t^*}] = P[r_0]$ for $y < \lambda - \alpha$ and for $y > t^*$
2. If $\frac{\rho_0}{\rho_1} > \frac{1 - \frac{\beta}{\alpha}(1 - \lambda)}{\frac{\beta}{\alpha}(1 - \lambda)}$ (“**negative bias**”):
 - ▶ $P[r_{t^*}] < P[r_0]$ for $y \in (t^*, \lambda + \alpha)$
 - ▶ $P[r_{t^*}] = P[r_0]$ for $y < t^*$ and for $y > \lambda + \alpha$
3. t^* increases with $\frac{\rho_0}{\rho_1}$. If ρ_0/ρ_1 is sufficiently low, the threshold rating mechanism exhibits positive rating inflation. If ρ_0/ρ_1 is sufficiently high, the threshold rating mechanism exhibits negative rating inflation .

▶ Intuition

- ▶ Systematic biases are discounted

Asymmetric effect of ratings

- ▶ A main finding in the vast empirical literature on credit ratings: Asymmetry
 1. For most assets: Downgrades matter, but not/less so upgrades (Holthausen and Leftwich (1986), Galil and Soffer (2012),++)
 2. Sovereign debt of emerging economies: Upgrades matter, not/less so downgrades (Ismailescu and Kazemi (2010))

- ▶ A puzzle to existing theories of CRAs.

- ▶ Explanation from our model:
 - ▶ 1. due to positively biased CRAs or low liquidity needs for investors
 - ▶ 2. due to negatively biased CRAs or high liquidity needs for investors

Policy Implications

Payoff structure

- ▶ CRAs can prevent inefficient default, but only if their payoff structure penalizes too positive ratings
 - ▶ Rationale for conservative CRAs
- ▶ Key mechanism behind argument: Investor and CRA choice in equilibrium.
- ▶ Caveat: This result depends on strong assumptions:
 - ▶ Zero effect from positive ratings in positive regime
 - ▶ Zero effect from any rating in neutral regime
 - ▶ CRAs only affect incidence of inefficient default

Banning-policy

- ▶ Could make sense to ban ratings in times of crises
- ▶ Must be general and based on public information, so as not to serve as a negative signal in itself

Conclusion

- ▶ Desire to be correct ex post may prevent truthful information revelation
- ▶ CRAs might amplify underlying market conditions
- ▶ Ratings inflation due to (i) favorable market conditions, or (ii) positive bias
- ▶ Asymmetric effects, direction driven by (i) market conditions, or (ii) biased payoff structure
- ▶ Key feature behind results: Equilibrium determination of ratings and investor response to them.

Conclusion

- ▶ Policy implication 1: Banning ratings in bad times could be warranted
 - ▶ But must be transparent and based on publicly available information. Otherwise likely to be counterproductive.
- ▶ Policy implication 2: Conservative (pessimistic) payoff structure for CRAs warranted.