# De-Regulating Markets for Information

Pablo Kurlat and Laura Veldkamp

Stanford University, NYU Stern School of Business

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# The Dodd-Frank Act and Credit Ratings

- Right now, if the issuer of non-junk debt wants to sell, they have to pay a ratings agency to rate the asset. If not, banks and pension funds can't buy it.
- The Dodd-Frank act of 2010 tells the SEC to *"review existing regulations that require the use of an assessment of the credit-worthiness [and] remove any reference to, or requirement of reliance on credit ratings"*
- One argument for doing this is that if the information is valuable, issuers or investors will buy it anyway. Is this true?

**Do private markets for information function well?**

# Key features of the model

- Ratings market: Sellers or investors in the asset can buy a rating from a rating agency.

- No conflict of interest: The rating is an unbiased noisy signal about the asset's payoff.
(Existing work is about how to fix ratings. This is not.)

- Information facilitates real capital allocation: The asset seller is also an entrepreneur who makes a real capital investment decision before selling his firm. When investors are better informed, he will make a more efficient investment decision.

# The Model: Entrepreneur's Problem

- Choose $k \geq 0$ to invest in project that will produce

$$y = f(k) + u \quad u \sim N(0, h_u^{-1}).$$

  $k$ is private information, $f$ concave.

- Choose whether or not to buy a rating $D \epsilon \{0, 1\}$ at price $C$.

- Divide output into $\bar{x}$ shares. Sell them at auction for a market clearing price $p$ per share.

- Objective:

$$(\mathbb{E}(p|k) - k)\bar{x} - CD. \tag{1}$$

# Model: Investor's problem

- A continuum of investors with measure $Q$. Endowed with wealth $w_0$. Can borrow/lend at riskfree rate 1.
- Buy a rating $d_i = 1$ or not $d_i = 0$ at price $c$.
- Choose a menu of prices-quantities to bid at auction $b(q|\mathcal{I}_i)$. They account for winner's curse by conditioning each bid on information in market-clearing price. Equivalent to choosing $q(p, \mathcal{I}_i)$.
- Budget constraint: $W = w_0 + q(y - p) - cd$.
- Objective:

$$EU = E\left[-e^{-\rho W}\right], \tag{2}$$

- Noise trader demand: $\xi \sim N(0, h_x^{-1})$.
  Net supply is $x \equiv \bar{x} - \xi$.

# Model: Market for Ratings

- A rating is a signal about asset payoff: $\theta = y + \eta$ where $\eta \sim N(0, h_\theta^{-1})$.
- A competitive market $\rightarrow$ zero-profit.
- Fixed information discovery cost: $\chi$.
- If entrepreneur buys rating, information disclosed to all investors.

# Equilibrium is...

- Rating decision $D$ and investment decision $k(D)$ by E that maximize $\mathbb{E}\left(p|D,k\right) - k - CD$
- Investor beliefs $k^*(D)$ which are consistent
- Rating purchase decisions $d_i$ and bidding functions $b_i(q)$ by I that maximize expected utility
- Asset price $p(\theta, D, \{d_i\}, \xi)$ such that the market clears
- Rating prices $C$ and $c$ such that agency makes zero profits. For entrepreneurs, $C = \chi$. For investors, $c = \chi/\lambda$.

# Solution: Asset Prices

- Investors' first-order condition

$$q_i = \frac{1}{\rho} Var[y|\mathcal{I}_i]^{-1}(E[y|\mathcal{I}_i] - p). \tag{3}$$

  Inverse is bid function.

- Note: more information lowers $Var$, raises demand and will increase price. This is why entrepreneurs pay for ratings.

- market clearing $\rightarrow$ linear price formula

$$p = \alpha + \beta\xi + \gamma(\theta - f(k^*(D))), \tag{4}$$

# Entrepreneur's investment decision

- Objective is $\mathbb{E}(p|k) - k - CD$.
- Substitute in linear price

$$p = \alpha + \beta\xi + \gamma(\underbrace{f(k) + u + \eta}_{\theta} - f(k^*(D)))$$

to get first order condition: $f'(k) = \frac{1}{\gamma}$ where

$$\frac{1}{\gamma} = \frac{\lambda(h_u + h_\theta) + (Q - \lambda)(h_u + h_p)}{\lambda h_\theta + (Q - \lambda)\, h_p} > 1$$

- Underinvestment because $k$ is not observable.
- More information $\rightarrow$ more investment:
  $1/\gamma$ is decreasing in $\lambda$.
  Higher $\lambda$ lowers $f'(k)$, implies higher $f(k)$.

## Question 1: What information do markets provide?

- Suppose that ratings are mandatory and that mandate is suddenly lifted.
- What happens to information?
- What happens to asset prices?
- Start with investor information demand and then consider issuers and investors together.

## Solution: Investors' Information Demand

- Suppose the entrepreneur does not buy the rating.
- Equate utility of informed and uninformed investors and solve for measure of informed agents:

$$\lambda = \frac{\rho}{\sqrt{h_x h_\theta}} \sqrt{\frac{h_\theta}{(h_u + h_\theta)(1 - \exp(-2\rho c))} - 1} \tag{5}$$

  If $\lambda \epsilon (0, Q)$, then this is an equilibrium. Otherwise, $\lambda \epsilon \{0, Q\}$.
- Ratings demand is decreasing in ratings price $c$, prior precision $h_u$ and increasing in noise $h_x^{-1}$.

## Signal Precision and Investors' Information Demand

- If signal precision is too low, information market will collapse:

  **Proposition 1** *If* $h_\theta < h_u \left(\exp\left(\frac{2\rho\chi}{Q}\right) - 1\right)$*, no investor will buy a rating.*

- Market will also collapse if signal precision is too high:

  **Proposition 2** *If* $h_\theta$ *is sufficiently high, no investor will buy a rating.*

- Reason: information leakage and a rating price that increases when few investors buy the rating.

# Entrepreneur's rating decision

- Entrepreneurs take into account:
  - Cost of rating
  - Direct price effect via risk-reduction
  - Effect of decision on investor beliefs about $k$ (through $\gamma$)
  - What would $\lambda$ be if he doesn't provide a rating?

**Proposition 3**

1. If

$$f(k(Q)) - k(Q) - [f(k(0)) - k(0)] + \frac{\rho}{Q}\frac{h_\theta}{h_u(h_\theta + h_u)} < \chi$$

then the issuer will not buy a rating.

# Entrepreneur's Rating Decision and Market Size

**Proposition 4** *Define expected returns when ratings are mandatory* $r^M = E[y - p^M]$ *and not* $r^E = E[y - p^E]$. *Then*

1. *If* $Q$ *is sufficiently low,* $r^M = r^E$
2. $\lim_{Q \to \infty} r^M - r^E = 0$
3. $r^M < r^E$ *for all* $Q \in (a, b)$,

- If $Q$ small, rating is valuable to entrepreneur because asset price is sensitive to information.
- If $Q$ large, risk is tiny. Information doesn't matter.
- For medium-$Q$ assets, information market can collapse.

# Question 2: What does this mean for welfare?

- Is it bad when asset prices fall because no ratings are provided?
- Mandatory ratings maximize output.
  More information resolves incentive problem for entrepreneur.
- But what about social welfare? Depends on the weight we put on entrepreneur vs. investor. Look at each separately.
- Noise traders?
- Entrepreneur always prefers no rating mandate because he can always choose to rate the asset if he wants to.
- Quantifying the model.

# Welfare: Ratings and Investor Utility

**Proposition 5** *Investors have higher ex-ante expected utility when no information is provided ($\lambda = 0$) than when ratings are mandatory ($\lambda = 1$).*

- Holding expected return fixed, lower variance increases utility:

$$EU = E_1 \left\{ -\exp\left[ -\frac{1}{2}(\hat{\mu} - pr)^2 Var[y|\mathcal{I}_i]^{-1} \right] \right\}$$

- Expected return is proportional to variance

$$\hat{\mu} - pr = \rho(h_x^{-1} z + \bar{x})\, Var[y|\mathcal{I}_i] \qquad z \sim N(0,1)$$

- Expected return effect is squared. $\uparrow$ variance $\rightarrow \uparrow$ utility.
- Investors like risky assets. They are indifferent about holding last share and benefit from inframarginal shares.

## Welfare: Asymmetric Information

Investors prefer mandatory ratings when information is cheap.

**Proposition 6** *There exists a cutoff* $\chi^*$ *such that for* $\chi < \chi^*$*, investor welfare with mandatory ratings is higher than with investor-purchased ratings.*

- When ratings are cheap, many investors buy them. This creates a severe lemons problem for the few remaining uninformed investors. Making ratings public restores market liquidity.
- If all investors buy the rating, then they prefer mandatory ratings because entrepreneurs pay for them.

# Welfare of noise traders

- Are they real people? Or just a mathematical representation of imperfect information revelation?

- If they are real people, their expected profits ($E[\xi(y-p)]$) are

$$-\frac{\beta}{h_x}$$

where $\beta$ is the sensitivity of the price to noise-trader demand.

- $\beta$ could be nonmonotonic in $\lambda$. But the global minimum is always at $\lambda = Q$.

- Noise traders always prefer mandatory ratings.

# Calibration strategy

- Data: corporate bonds issued in 2004 -2005
- For each bond, observe
  - Contractual terms (maturity, coupon, etc.)
  - Price at time of issue
  - Rating at time of issue
  - Price 1 (or 2) years later
- Assume data comes from model with full info ($\lambda = Q$)
- Add a free public signal: $w = y + v$, $v \sim N(0, h_w)$.
  Prices contain more information than ratings.
- Match moments to recover 5 parameter values:

  $\rho$, $h_u$, $h_\theta$, $h_w$ and $h_x$

# Moment conditions

$$Var\left(y\right)=\frac{1}{h_u} \tag{6}$$

$$Var\left(p\right)=\left(\frac{1}{h_u+h_w+h_\theta}\right)^2\left[\left(\frac{\rho}{Q}\right)^2\frac{1}{h_x}+\frac{\left(h_\theta+h_w\right)^2}{h_u}+h_\theta+h_w\right] \tag{7}$$

$$\mathbb{E}\left[y-p\right]=\frac{\rho}{Q\left(h_u+h_w+h_\theta\right)} \tag{8}$$

$$R^2_{y|\theta}=\frac{1}{1+\frac{h_u}{h_\theta}} \tag{9}$$

$$R^2_{y|p}=\frac{1}{\left(\frac{\rho}{(h_\theta+h_w)Q}\right)^2\frac{h_u}{h_x}+1+\frac{h_u}{h_\theta+h_w}} \tag{10}$$

# Parameter values

| | | | |
|---|---|---|---|
| $\frac{\rho}{Q}$ | = | 12.4 | (to match average returns) |
| $h_u$ | = | 142 | |
| $h_w$ | = | 266 | Non-rating info more informative than prior |
| $h_\theta$ | = | 128 | About as informative as prior |
| $h_x$ | = | 0.330 | High variance: price variance despite good info |
| $\chi$ | = | 0.00029 | Treacy and Carey (2000) |

# Quantitative Results

- For these parameters, issuer does not rate and $\lambda = Q$. Why?

  Utility benefit:

$$\sqrt{\frac{Var\,(u|p)}{Var\,(u|\theta)}} - 1 = \sqrt{\frac{h_u + h_w + h_\theta}{h_u + h_w + h_p}} - 1 = \sqrt{\frac{536}{435.58}} - 1 = 0.109.$$

  Utility cost:

$$\exp\,(\rho c) - 1 = \exp(12.4 \cdot 0.00029) = 0.004$$

- The value of information exceeds the cost by more than a factor of 25!

- D-F act does not change information provision. A pure transfer between issuer and investors.

## The Photocopier Problem

- The model rules out investors who purchase, copy and resell information. Requires copyright law
- Copyright difficult to enforce with digital goods (e.g. Napster).
- Copying could make investor-pay impossible.
- No information asymmetry would strengthen the welfare case for repealing mandates.

# Conclusions

- What will happen as the SEC starts to implement Dodd-Frank and move away from ratings-based regulation?
- Some assets will continue to be rated. A market for investor information may arise. But for some medium-size, medium-information assets, information markets will collapse.
- Investors benefit from information market collapse.
  Ratings mandates are good for investors only when asymmetric information problems disrupt market liquidity.
- More broadly: Government mandates information disclosure about many products. In an equilibrium model, the argument that this increases consumer welfare is ambiguous.