		Final Remarks

Advanced Macroeconomics I ECON 525a - Fall 2009 Yale University

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Week 7 - Reputation and Risk Taking

Introduction			Final Remarks

"A sound banker, alas, is not one who foresees danger and avoids it, but one who, when he is ruined, is ruined in a conventional way along with his fellows, so that no one can really blame him"

J. M. Keynes, 1931

Introduction			Final Remarks

- Reputation concerns may deter opportunistic behavior.
 - Short-term opportunistic benefits vs. long-term reputational costs.

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• Reputation has limits.

• In lending markets, borrowers whose actions are non-observable may take excessive risk...and reputation imposes self-discipline...with certain limits.

Introduction			Final Remarks

• Aggregate effects of reputation incentives?

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 - Identical borrowers with different reputation levels
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 - How do borrowers with different reputation levels behave under same aggregate conditions?
 - Effects of changes in aggregate conditions on aggregate behavior?

Introduction			Final Remarks

- Aggregate effects of reputation incentives?
 - In the aggregate,
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 - Conditions determine the temptation to take excessive risk.
 - How do borrowers with different reputation levels behave under same aggregate conditions?
 - Effects of changes in aggregate conditions on aggregate behavior?

- Why is this relevant?
 - Reputation is at the core of lending relations, based on confidence.
 - Reputation affects cost and availability of credit.

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Answer

- Reputation is effective, but fragile
 - Borrowers with intermediate and high reputation change risk-taking behavior under similar aggregate conditions.
 - Small aggregate shocks may lead to clustering in risk-taking and confidence crises.

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Answer

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- Current crisis
 - Market discipline failure. Excessive risk-taking.
 - Confidence crisis on the reliability of ratings.

Introduction			Final Remarks

Road Map

- Model of reputation and risk-taking in lending markets.
 - Diamond (89) and Mailath and Samuelson (01)
 - Introduction of aggregate shocks.
 - Selection of a unique equilibrium.

• Fragility of reputation and clustering in risk-taking.

• Sudden collapses in otherwise well-functioning lending markets.

Model		Final Remarks

Main Problem

- Firms borrow at a given interest rate to run a project.
- They decide to take safe or risky unobservable actions.

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• How far reputation can go in reducing excessive risk-taking?

Model		Final Remarks

Example - Efficiency

• If actions of firms are observable.

Loan=1, $\overline{R} = 1$,	$R_s = \frac{1}{0.9}$	$R_r = \frac{1}{0.7}$		
Action	Prob	Payoff	Payoff to lenders	Payoff to firms
Safe	0.9 0.1	$ \begin{array}{c} 1.5+2\\0 \end{array} \right\} 3.15 $	$0.9R_{s} = 1$	3.15-1
Risky	0.7 0.3	$\begin{array}{c}2.2+2\\0\end{array}\right\}2.95$	$0.7R_r = 1$	2.95-1
	Differe	ential gains Safe	;	0.2 > 0

• Safe is efficient.

Model		Final Remarks

Example - Moral Hazard

• If actions of firms are non-observable.

Loan=1, $\overline{R} = 1$,	$R \in \left\lfloor \frac{1}{0.9} \right\rfloor$	$\left[,\frac{1}{0.7}\right]$		
Action	Prob	Payoff	Payoff to lenders	Payoff to firms
Safe	0.9 0.1	$ \begin{array}{c} 1.5+2\\0 \end{array} \right\} 3.15 $	0.9 <i>R</i>	3.15 - 0.9R
Risky	0.7 0.3	$\begin{array}{c}2.2+2\\0\end{array}\right\}2.95$	0.7 <i>R</i>	2.95 - 0.7R
r				
	Differe	ential gains Safe	e	0.2 - 0.2R

• Risky is preferred when R > 1 (Always)

Model		Final Remarks

Example - Reputation

- Two unobservable types, Strategic (choose) and Risky.
- Reputation ϕ is the probability the firm is strategic.
- Signals correlated to actions.

Action	Prob	Payoff	Payoff to lenders	Payoff to firms
Safe	$0.9 < \frac{0.8}{0.2}$ 0.1	$\begin{array}{c} 1.5 + 2.5 \\ 1.5 + 1.5 \\ 0 \end{array} \right\} 3.4$	0.9 <i>R</i>	3.4 - 0.9R
Risky	$0.7 < \frac{0.4}{0.6}$	$\begin{array}{c} 2.2 + 2.5 \\ 2.2 + 1.5 \\ 0 \end{array} \right\} 2.9$	0.7 <i>R</i>	2.9 - 0.7R
	Differen	tial gains Safe		0.5 - 0.2R

• Safe is preferred when R < 2.5 (Always)

Model		Final Remarks

A simplified two period model

Timing

- Loan of 1 at $R(\phi) > 1$ (decreasing in ϕ).
- Fundamentals $\theta \sim \mathcal{N}\left(\mu, \frac{1}{\alpha}\right)$ are realized.
- Strategic firms decide safe (s) or risky (r) actions.
- Firm continues or die: $(p_s > p_r)$
 - Dies Gets 0. Defaults.
 - Continues: Gets Π_s if s or $\Pi_r = \Pi_s \theta$ if r.

Repayment. No asset accumulation.

- Lenders update reputation based on continuation from ϕ to $\phi'.$
- Fixed payment $V(\phi')$ (increasing in ϕ').

Model		Final Remarks

Δ - Differential gains from safe actions

$$V_{s}(\phi,\theta) = p_{s}(\Pi_{s} - R(\phi) + V(\phi'))$$
$$V_{r}(\phi,\theta) = p_{r}(\Pi_{s} - \theta - R(\phi) + V(\phi'))$$



Reputation Formation

Model		Final Remarks

Δ decreases with beliefs of risk taking \widehat{x}

Define $\widehat{x}(\phi)$ the probability assigned by lenders to firms ϕ taking risk

$$\Delta(\phi,\theta|\hat{x}) = (p_s - p_r)\Pi_s + p_r\theta + (p_s - p_r)V(\phi) - (p_s - p_r)R(\phi)$$
$$+ (p_s - p_r)[V(\phi') - V(\phi)]$$

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Δ decreases with beliefs of risk taking \widehat{x}

$$\Delta(\phi,\theta|\hat{x}) = (p_s - p_r)\Pi_s + p_r\theta + (p_s - p_r)V(\phi) - (p_s - p_r)R(\phi)$$
$$+ (p_s - p_r)[V(\phi'|\hat{x}) - V(\phi)]$$



Model		Final Remarks

Δ increases with fundamentals θ

$$\Delta(\phi,\theta|\hat{x}) = (p_s - p_r)\Pi_s + p_r\theta + (p_s - p_r)V(\phi) - (p_s - p_r)R(\phi)$$
$$+ (p_s - p_r)[V(\phi'|\hat{x}) - V(\phi)]$$



Model		Final Remarks

Δ decreases with beliefs of risk taking \widehat{x}

 $\Delta(\phi,\theta|\hat{x}) = (p_s - p_r)\Pi_s + p_r\theta + (p_s - p_r)V(\phi) - (p_s - p_r)R(\phi)$ $+ (p_s - p_r)[V(\phi'|\hat{x}) - V(\phi)]$



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Cutoff Strategies

$$m{a}(\phi, heta) = egin{cases} s & if & heta > k(\phi) \ r & if & heta < k(\phi) \end{cases}$$

$$\widehat{x}(\phi, heta, k(\phi)) = egin{cases} 0 & \textit{if} \quad heta > k(\phi) \ 1 & \textit{if} \quad heta < k(\phi) \end{cases}$$

Model		Final Remarks

Multiple solutions when θ is observed



Model		Final Remarks

Uniqueness when θ is not perfectly observed

- New assumption about the information structure.
 - Before production, all firms *i* observes a signal $z_i = \theta + \epsilon_i$ where $\epsilon_i \sim \mathcal{N}\left(0, \frac{1}{\beta}\right)$ identically and independently distributed across *i*.
 - After production, lenders j observes a signal $z_j = \theta + \epsilon_j$ where $\epsilon_j \sim \mathcal{N}\left(0, \frac{1}{\beta}\right)$ identically and independently distributed across j.
 - Alternative assumption: Lenders observe aggregate default rate by firms with reputation ϕ .
- Equilibrium strategies are redefined over signals.

$$a^*(\phi, z) = \begin{cases} s & \text{if } z > z^*(\phi) \\ r & \text{if } z < z^*(\phi) \end{cases}$$

Model		Final Remarks

Uniqueness when θ is not perfectly observed

$$\widehat{\theta}_{i} = E(\theta|x_{i}) = \frac{\alpha\mu + \beta x_{i}}{\alpha + \beta}$$
$$x_{j}|\widehat{\theta}_{i} \sim \mathcal{N}\left(\widehat{\theta}_{i}, \frac{1}{\alpha + \beta} + \frac{1}{\beta}\right)$$
$$\widehat{x}(z_{i}) = \Pr\left(\widehat{\theta}_{j} < \widehat{\theta}_{i}|\widehat{\theta}_{i}\right) = \Phi\left[\sqrt{\gamma}(\widehat{\theta}_{i} - \mu)\right]$$

where

$$\gamma = \frac{\alpha^2(\alpha + \beta)}{\beta(\alpha + 2\beta)}$$

Model		Final Remarks

Uniqueness as $\beta \to \infty$



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Model		Final Remarks

Uniqueness as $\beta \to \infty$

$$E_{\theta}\left(\Delta(\phi,\theta|\widehat{x})|z^*\right)=0$$

As $\beta \to \infty$, $E(\theta|x_i^*) \to z^*$ and $\widehat{x} \to 0.5$ for all z_i

$$z^{*} = -\frac{p_{s} - p_{r}}{p_{r}} \left(\Pi_{s} - R(\phi) + V(\phi'|\hat{x} = 0.5)\right) + p_{r}E(\theta|z^{*}) = 0$$
$$z^{*} = -\frac{p_{s} - p_{r}}{p_{r}} \left(\Pi_{s} - R(\phi) + V(\phi'|\hat{x} = 0.5)\right)$$

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Uniqueness as $\beta \to \infty$



	Fragility		Final Remarks

Properties of Reputation

Proposition

• Ex-ante probabilities of risk taking decrease with reputation

$$rac{d\Phi(z^*(\phi))}{d\phi} < 0$$
 for all $\phi \in [0,1]$

Interest rates decrease with reputation

$$rac{d {\cal R}(\phi)}{d \phi} < 0 \,$$
 for all $\phi \in [0,1]$

• Continuation values increase with reputation

$$rac{dV(\phi)}{d\phi} > 0$$
 for all $\phi \in [0,1]$

Reputation concerns convexify the schedule of cutoffs z^{*}(φ).

$$rac{\partial^2 \mathsf{z}^*(\phi)}{\partial \phi^2} > 0$$
 for all $\phi \in [0,1]$

	Fragility		Final Remarks

Risk Taking WITHOUT reputation formation



	Fragility		Final Remarks

Reputation formation incentives



 $\Delta(\phi,\theta) = (p_s - p_r) (\Pi_s + \mathbf{V}(\phi) - R(\phi) + [\mathbf{V}(\phi') - \mathbf{V}(\phi)]) + p_r \theta$

	Fragility		Final Remarks

Risk Taking WITH reputation formation



	Fragility		Final Remarks

Fragility of Reputation

Proposition

- Selection: For β → ∞, small changes in θ around z*(φ) induce sudden changes in risk-taking behavior among firms with the same φ.
- Learning: For $\beta \rightarrow \infty$, as fundamentals decrease, an increasingly

wider range of reputation levels ϕ decide to take risk.

	Fragility		Final Remarks

Clustering in Risk Taking



	Fragility		Final Remarks

Clustering in Risk Taking



	Simulations	Final Remarks

Simulations - Example

- Value function iteration. Finite and large grid ϕ
- Assume $\Pi_s > 0$, $\Pi_r = \Pi_s + K \psi \theta$, where $\psi > 0$ and $\theta \sim \mathcal{N}(0, 1)$
- Parameters: $\beta = 0.95$, $\overline{R} = 1$, $\Pi_s = 1.5$, K = 0.4, $\psi = 0.2$,

 $p_s = 0.9, \ p_r = 0.7, \ \alpha_s = 0.8 \text{ and } \alpha_r = 0.4.$

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Simulations - Limits to Reputation



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Simulations - Default Probabilities



	Simulations	Final Remarks

Simulations - Net Returns to Lenders



		Evidence	Final Remarks

Clustering in Corporate Default Rates

• Corporate default cluster in recessions. Duffie et al. (2007).



		Evidence	Final Remarks

Clustering in Risk Taking Behavior

• Idiosyncratic Risk cluster in recessions. Campbell et al. (2001).



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Conclusions

- Natural use of global games to select a unique equilibrium in reputational games.
- Fragility of reputation.
 - Large change in aggregate risk-taking in response to small and non-obvious changes in aggregate fundamentals.
- Financial crises.
 - Sudden raise in moral hazard vs. sudden weakening of reputation.
- Policy implications. Extensions.
 - Basel II banking regulations.
 - Credit bureaus.
 - Reputation or Regulation?

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Reputation or Regulation?

- Ben Bernanke, NY Times, Dec. 18, 2007
 - "..market discipline has in some cases broken down and the incentives to follow prudent lending procedures have, at times, eroded".
- Paul Krugman, NY Times, Dec. 21, 2007
 - "Mr. Greenspan dismissed as a "collectivist" myth the idea that businessmen, left to their own devices, "would attempt to sell unsafe food and drugs, fraudulent securities, and shoddy buildings." On the contrary, he declared, "it is in the self-interest of every businessman to have a reputation for honest dealings and a quality product... Protection of the consumer by regulation is thus illusory, the only reliable protection the consumer has is competition for reputation".
- Charles Goodhart, FT, Jan. 31, 2008
 - "Capital adequacy requirement on mortgage lending should be linked to

the rise in both mortgage lending and housing prices.."

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Even more recent quotes

- NY Times, Oct. 3, 2008 (Stephen Labaton)
 - About a 2004 rule change by the SEC that removed regulation of investment bank debt ratios, only for the largest firms "We've said these are the big guys...We foolishly believed firms had a strong culture of self-preservation and responsibility and would have the self-discipline not to be excessively borrowing".
 - "A similar laissez-faire philosophy has driven a push for deregulation throughout the government, from the CPSC and the EPA to worker safety and transportation agencies".
- NY Times, Oct. 2, 2008 (Joe Nocera)
 - "This is what a credit crises looks like...It's a loss of confidence in seemingly healthy institutions".