Banker Compensation and Bank Risk Taking: The Organizational Economics View

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November 15, 2013
Indices of Riskiness: Management and Regulatory Implications
Atlanta, GA

[1] The views expressed in this discussion do not necessarily reflect the views of the Federal Reserve Bank of Richmond or the Federal Reserve System.

Regulation of Banker Compensation

Bannker compensation is being regulated under belief that compensation practices contributed to the financial crisis.

- Financial Stability Board (2009)
- U.S. regulators' supervisory guidance (2010)
- Dodd-Frank Law
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Idea: regulating compensation indirectly limits risk taking.

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Use organizational/contract theory to see if:

1. Does regulating banker pay make any sense?
2. If so, what compensation arrangements create risk?

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- CEO or top managers who alone influence bank risk
- Employees who together influence bank risk
  - e.g., loan officers

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Paper about latter group. They are important

- J.P. Morgan compensation expenses in 2012
- $31 billion to employees, $18.7 million to CEO
- 248,633 employees (FTE)

Take an Organizational Economics View

Model a bank as:

- Lots of people, each acting in own interest
- Private information
- Use of monitoring and controls
- Separation of duties

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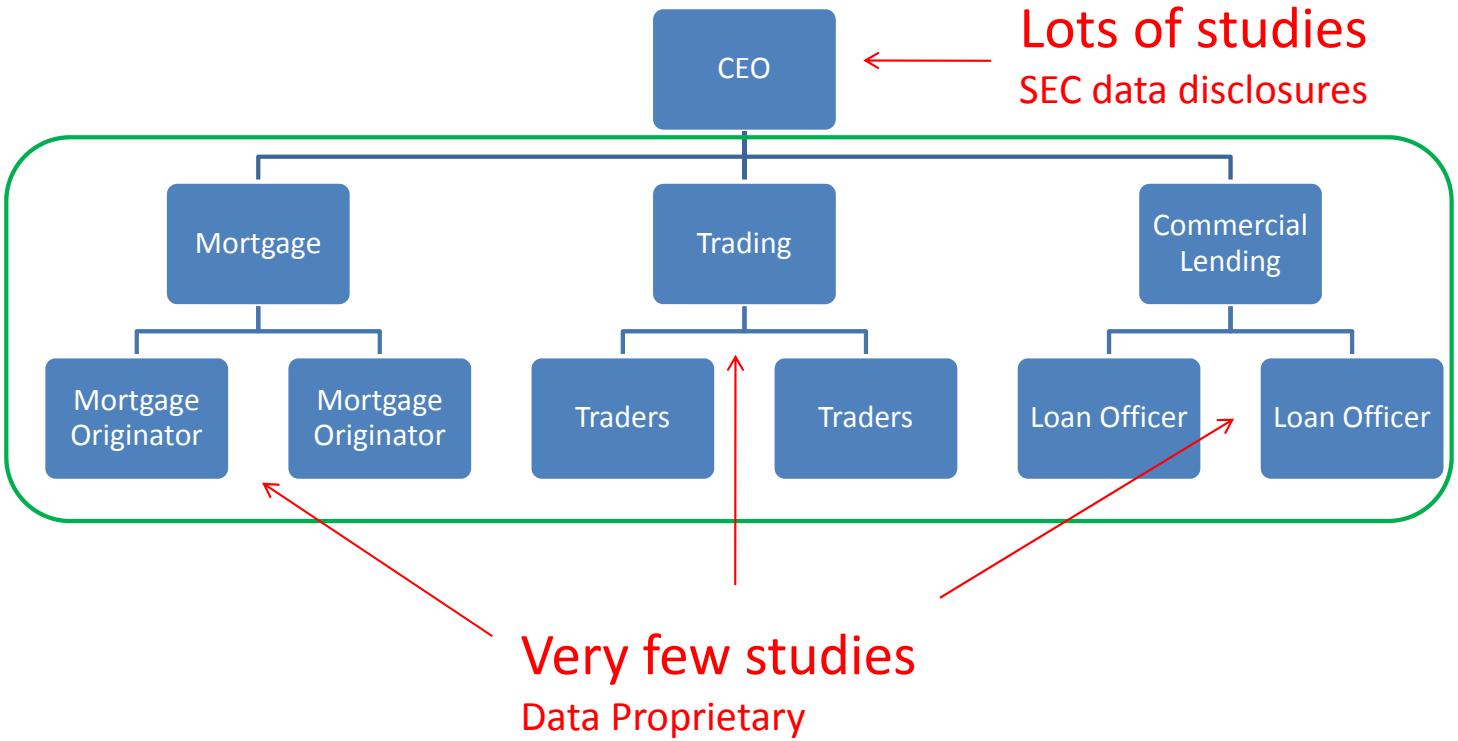
Implications

- Results can differ from single-agent model
  - Compensation good for CEO need not be good for lower employees
- Correlation of employee returns key issue
- Evaluating control/monitoring important

Organizational Hierarchy



Theoretical Literature

Banking - mostly about CEO

- Bank CEO - John, Saunders and Senbet (2000), Bolton, Mehran and Shapiro (2010), Phelan (2009)
  - Build on Jensen and Murphy (1990)
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Organizational Economics/Contract Theory

- Huge literature
- We'll use relative performance (Holmstrom (1982))
- Also, add monitoring

Empirical Literature in Banking

Looks for connection between form of CEO pay and bank risk

Studies of the 1980s and 1990s

- Houston and James (1995) - No effect
- Bensten and Evans (2006) - Some effect

Studies of the 2000s

- Cheng, Hong and Scheinkman (2010), Fahlenbrach and Stulz (2011), Balachandran, Kogut and Harnal (2010)
- Some evidence of effect, not conclusive

Empirical Literature - Bank Employees

Very few studies - data proprietary

- Agarwal and Ben-David (2011) - Natural experiment at a bank
- Berg, Puri, and Rocholl (2012) - Another natural experiment
- Cole, Kanz, and Klapper (2011) - laboratory experiments
- Hertzberg, Liberti, and Paravisini (2011) - loan officer rotation and reporting incentives

Strategy

Set up principal-multi-agent problem

- Bank with limited liability and insured deposits
- Bank risk determined by loan officers
- Equity is principal
- Loan officers are risk-averse agents

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Regulator not formally modeled

Will solve problem as if bank implements safe and risky loans. Then characterize these contracts and compare them.

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Agents (Loan Officers)

Continuum, measure one, ex ante identical

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$U(c) - V(a)$ - Agent's utility function.
$U(0) \geq 0$, $U' > 0$, $U'' < 0$, $V' > 0$, $V'' > 0$
$\bar{U}$ - Reservation Utility

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$c(r, \theta)$ - compensation schedule for agents

Notation (cont.)

Principal (owners of bank equity)

Investment funded
D - govt insured deposits (given), interest rate zero
$1 - D$ - Equity

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Lim liab and insured deposits - taxpayers bear downside risk
A major distortion in banking models

Bank's Program

$$\max_{a,c(r,\theta)\geq 0,\bar{c}(\theta)\geq 0,\bar{r}(\theta)} \sum_{\theta} h(\theta) \max\{\bar{r}(\theta) - \bar{c}(\theta) - D, 0\}$$

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subject to

$$\forall \theta, \ \bar{r}(\theta) = \sum_{r} f(r|\theta, a) r \ \text{(RC)}$$

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&\quad\geq \sum_{\theta} h(\theta)\sum_{r} f(r|\theta,\hat{a})U(c(r,\theta))-V(\hat{a}),\forall\hat{a} \ \text{(IC)}
\end{aligned}$$

How to Solve

Complication: Objective function and (BC) are non-differentiable

But, for each a, know states where firm is bankrupt.

Fix consumption in bankrupt states at zero.

Problem of implementing a is then differentiable and can get FOC.

Can find optimal a by solving the subproblems of implementing each a (like Grossman and Hart (1983)).

FOC: Interior solution

$$\frac{1}{U'(c(r,\theta))} = \lambda + \sum_{\hat{a}} \mu(\hat{a}) \left(1 - \frac{f(r|\theta,\hat{a})}{f(r|\theta,a)}\right)$$

Likelihood Ratio is key for compensation

$$LR(r,\theta,\hat{a};a) \equiv \frac{f(r|\theta,\hat{a})}{f(r|\theta,a)}$$

$$LR \uparrow \Rightarrow c \downarrow$$

Optimal compensation will depend on specification of $f(r|\theta,a)$.

The Importance of Correlation

Correlation in $f(r|\theta, a)$ critical for determining bank risk.

Evaluate compensation contracts when:

- Correlation Exogenous
- Correlation Endogenous

No Correlation

If no correlation,

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Proposition

When loan officer returns are uncorrelated, there is no connection between the form of loan officer compensation and bank risk.

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No need to regulate pay.

Perfect Correlation

Compensation

LR undefined for most r. (Deviation detected with prob. 1.)

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A relative performance implementation

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(Logic behind assuming θ public.)

Bank's Profits

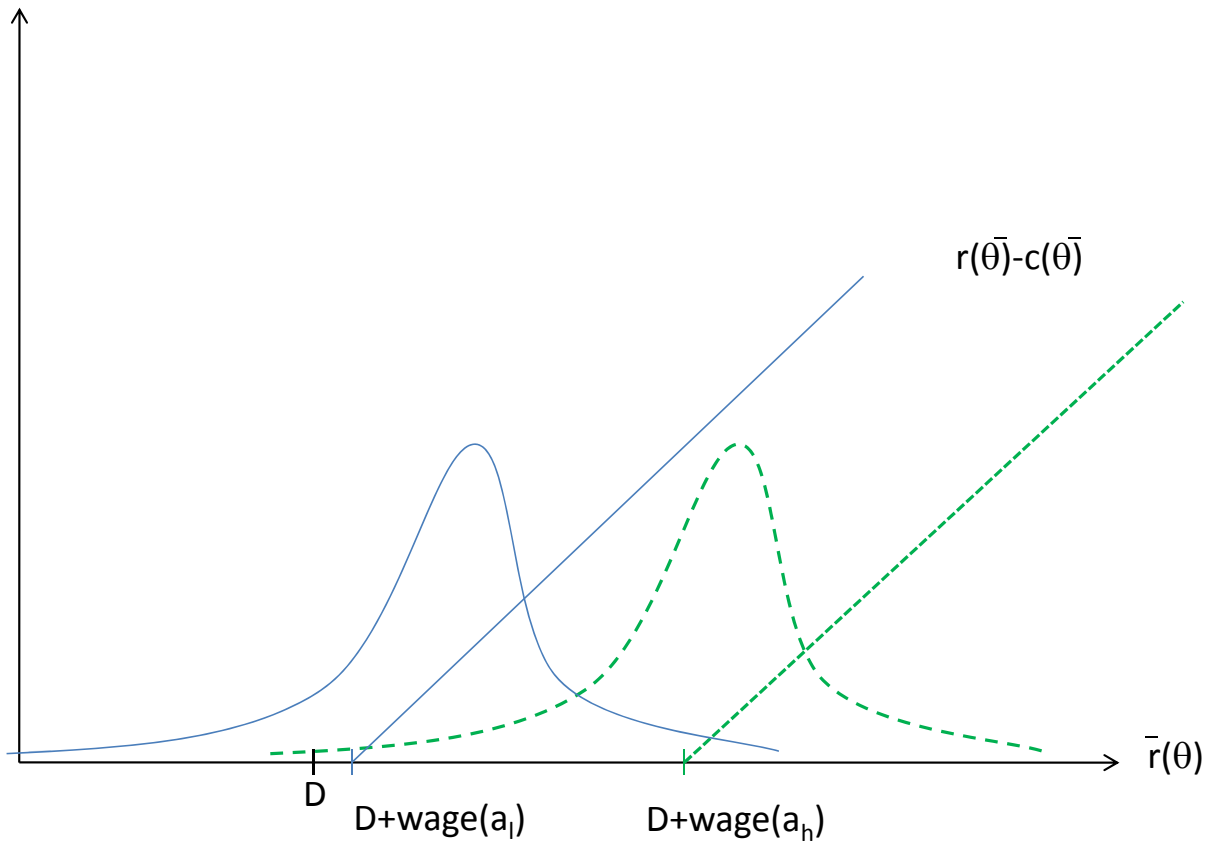
Proposition

When loan officer returns are perfectly correlated, if $E(\bar{c}|a)$ is increasing and convex in a, then the bank chooses an a that is less than the social optimum.

Idea: Lower $a \rightarrow$ lower wage $\rightarrow$ higher profits when solvent.

A low wage can be risky!!!

Example of Low Wage Increasing Risk (to govt.)



Not classic risk-shifting story where bank chooses high-variance, low-mean return. Here, by lowering *a* (the mean) the bank pays less and keeps more when successful, but fails more often.

Intermediate Correlation

Simplify technology: Two actions, two returns
$r = 0$ (loan defaults) or $r = 1$ (loan repaid),$\bar{\theta} = \sum_{\theta} h(\theta)$

$$f(r = 1|\theta, a) = a(\alpha\bar{\theta} + (1 - \alpha)\theta)$$

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If $\alpha = 0$ risk to loan officer and to bank

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Likelihood Ratios

$$LR(r=1,\theta)=\frac{\hat{a}}{a},\ LR(r=0,\theta)=\frac{1-\hat{a}(\alpha\bar{\theta}+(1-\alpha)\theta)}{1-a(\alpha\bar{\theta}+(1-\alpha)\theta)}$$

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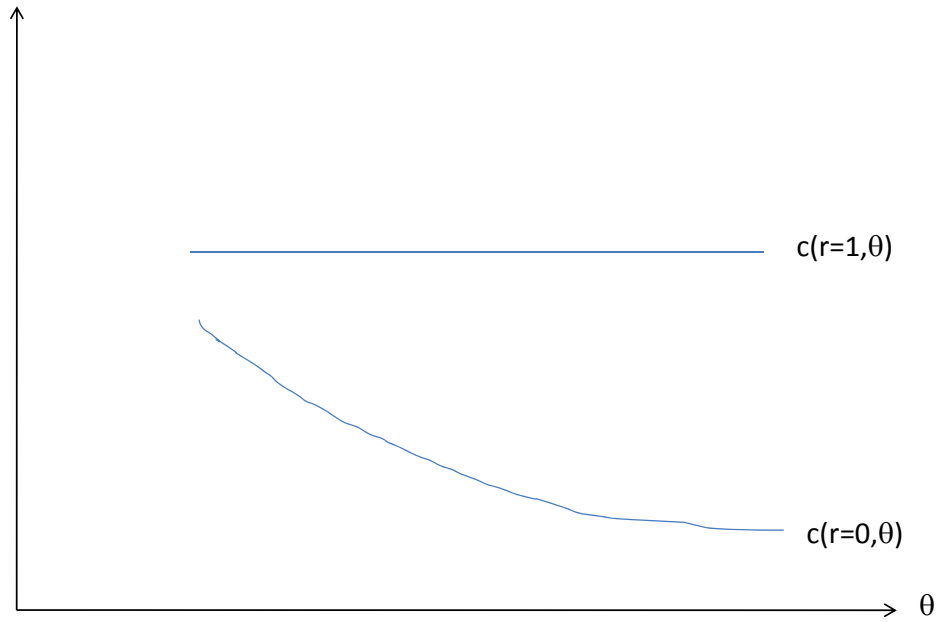
$$\frac{\partial LR(r=1,\theta)}{\partial\theta}=0\Rightarrow\frac{\partial c(r=1,\theta)}{\partial\theta}=0$$

$$\frac{\partial LR(r=0,\theta)}{\partial\theta}>0\Rightarrow\frac{\partial c(r=0,\theta)}{\partial\theta}<0$$

NOTE: Assumes interior solution.

Consumption Sharing Rules

Assume interiority for simplicity



Spread goes up with bank performance

Note: Qualitative properties do not depend on α.

Other Implications

Worker's Share of Total Revenue

$$r(\theta) = a(\alpha\bar{\theta} + (1-\alpha)\theta)$$

For interior range

$$WS(\theta) = \frac{r(\theta)c(r=1,\theta) + (1-r(\theta))c(r=0,\theta)}{r(\theta)}$$

Can show that

$$\frac{\partial WS(\theta)}{\partial r(\theta)} < 0$$

Worker's share declines (in the interior range)

Endogenous Correlation Example

$r = 0$ (loan defaults) or $r = 1$ (loan repaid)

$$f(r = 1|\theta, a) = a\bar{\theta} + (1 - a)\theta$$

$\bar{\theta} = \sum_\theta h(\theta)$, $0 < \theta < 1$, $0 < a < 1$

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If $a = 0$ risk is to loan officer and bank

$\bar{r}(\theta) = \theta$

Endogenous Correlation Example (cont.)

Two actions a_l (risky) and a_h (safe) with $a_l < a_h$

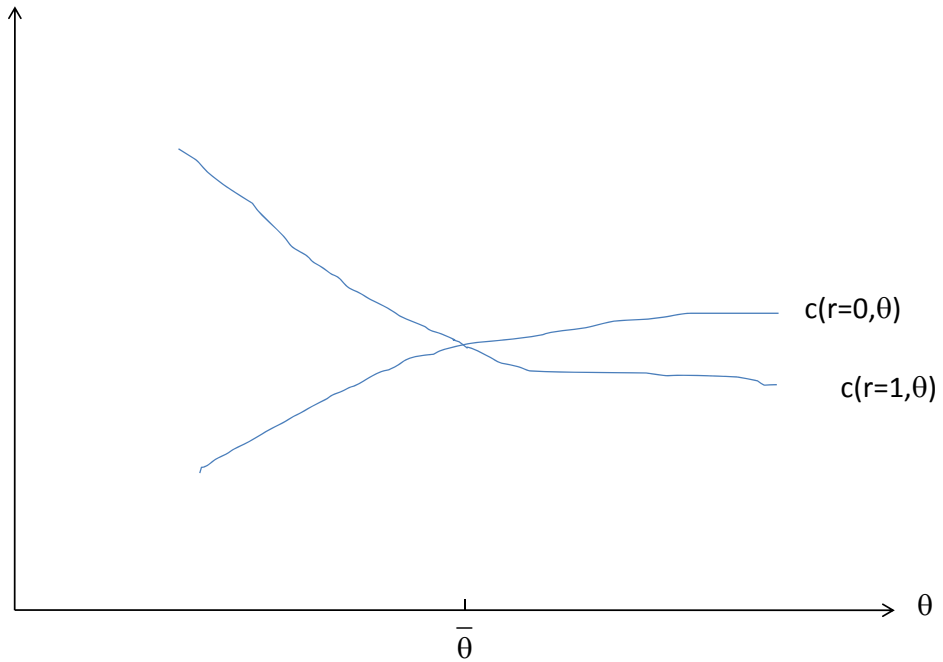
$$LR(r=1,\theta) = \frac{\hat{a}\bar{\theta} + (1-\hat{a})\theta}{a\bar{\theta} + (1-a)\theta}$$

If bank wants a_h then $\frac{\partial LR(r=1,\theta)}{\partial \theta} > 0 \Rightarrow \frac{\partial c(r=1,\theta)}{\partial \theta} < 0$
Similarly, $\frac{\partial c(r=1,\theta)}{\partial \theta} > 0$

If bank wants a_l then pays a wage.

Compensation to Implement Low Correlation Action

Assume interiority for simplicity



Note: Can use Innes (1990) to get rid of non-monotonicity in r for $\theta > \bar{\theta}$.

A Sufficient Condition: Two-Action Case

Good action - a_h
Bad action - a_l

A *sufficient* condition for bad action to be taken

$$\sum_{\theta} h(\theta) \sum_{r} f(r, \theta | a_l) U(c(r, \theta)) \geq \sum_{\theta} h(\theta) \sum_{r} f(r, \theta | a_h) U(c(r, \theta)).$$

If expected value of compensation weighted by utility is bigger for bad action than safe action, then bad action taken.

Relative Performance and Bank Risk in General

Compensation that discourages correlation

- Reward when agent does differently than the bank
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Follows from likelihood ratios

Monitoring

All banks use processes and controls

- Traders receive risk limits. Risk management monitors them.
- Loan officers generate loans. Loan review committee assesses.
- Consumer credit applications. Must fit within a set of parameters.

Udell (1989) study of loan review at Midwestern banks.

- The higher the portfolio risk the more the bank invested in loan review.

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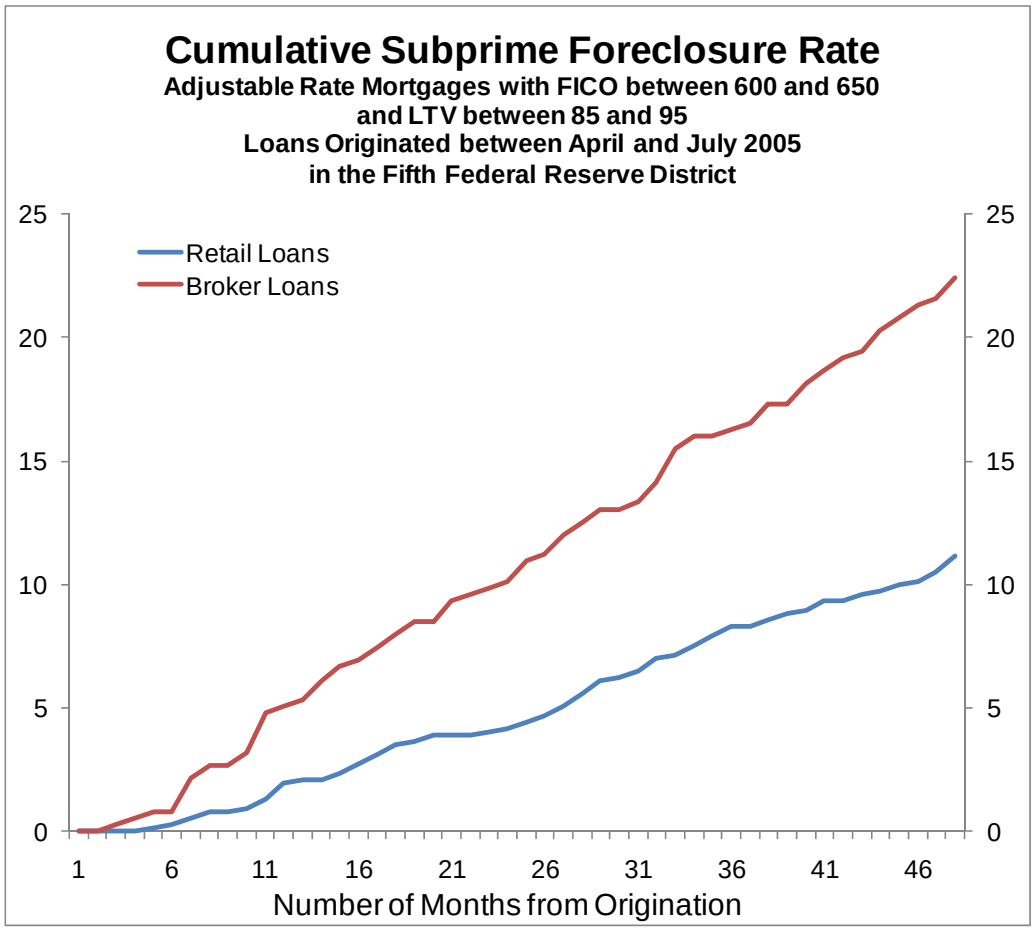
Monitoring and control environment affect compensation-risk connection

Subprime: Role of Orignator Channel



Source: Calculations based on data provided by LPS Applied Analytics

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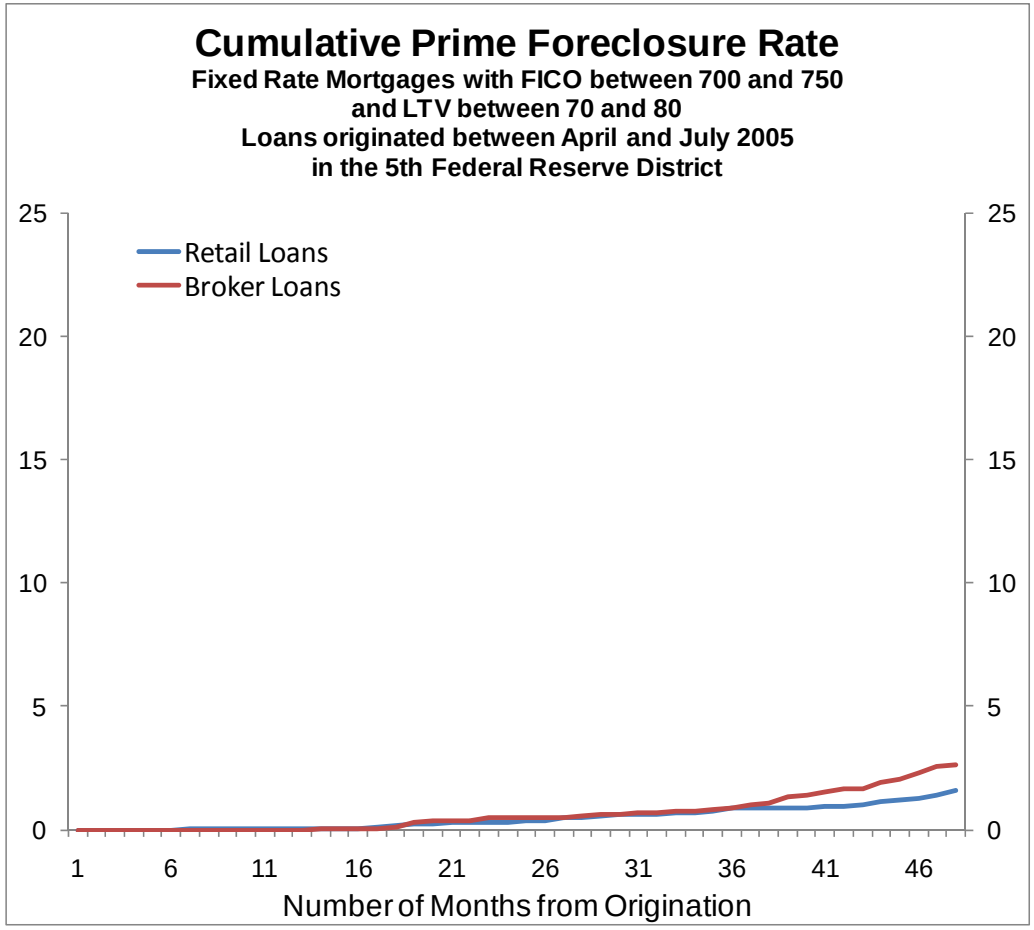

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Variety of ways to model - audits, collusion

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One implication: Want to pay loan reviewer on loan performance.

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Alternative to regulating compensation - Could just assess quality of loan review to determine if bank is taking risk.
In practice - this is equivalent to assessing bank's internal processes.

Summary of Results

- No correlation - don't care about compensation
- Perfect correlation - low wages create risk
- Pay that generates correlation should be main concern
  - Described good and bad relative performance contracts
- Organizational structure important
  - Affects compensation
  - Provides alternative tools to compensation for controlling risk

Extensions: Applications of Organizational Economics

Other important features of bank activities that are relevant for compensation

- Persistence (Jarque and Prescott (2010))
  - Many lending decisions have long-term effects.
- Team production
- Heavy use of discretion in management pay
  - Soft information?
- Separation of duties
  - To deal with collusion
- Use of audits
- Career concerns

A Concluding Comment

One big lesson of contract theory/organization economics literature.

- Optimal contracts are highly sensitive to features of the environment, e.g., technology, likelihood ratios, info assumptions, monitoring, etc.
- Need field work and empirical studies to determine the right model