Risking Other People’s Money: Gambling, Limited Liability, and Optimal Incentives

Peter DeMarzo, Dmitry Livdan, Alexei Tchistyi
Stanford University
U.C. Berkeley
Motivation

• Financial meltdown 2008
  • Ex ante unlikely outcome
  • Ex post AIG, Lehman, Citi, Merrill Lynch, etc. suffered high losses
  • Losses were caused by divisions trading highly risky securities
  • Investors were unable to either monitor or understand actions taken by managers

• Managers enjoy limited liability and their compensation is performance based
Moral Hazard and Optimal Contracting

• Managers may seek private gain by taking on *tail risk*
  • Earn bonuses based on short-term gains
  • Put firm at risk of rare disasters
  • Limited liability leaves them insufficiently exposed to downside risk
  • Is this the result of inefficient contracting?

• Standard contracting models
  • Focus on effort provision
  • Static and dynamic models
  • Rewards for high cash flows can be optimal
  • But does this contract lead to excessive risk-taking?
Static Model: Related Literature

  • Double Moral Hazard Problem
    • Effort increases output, but is privately costly
    • Riskier projects have higher output but greater chance of failure
  • First-best is not implementable (unlike single moral hazard case)
  • Second-best involves higher failure risk
    • Effort and Investment are generally too low
  • Optimal contract difficult to characterize / quantify
  • What are the implications for dynamic contracts?
One-Period Model

• Principal hires agent/manager to run the project

• New output $Y$, subject to two-dimensional agency problem:
  • Divert output / shirk for private benefit ($\lambda$)
  • Gamble ($\rho < \delta D$)

• How does the possibility of gambling affect contracting?
One-Period Model

- Contract specifies payoffs \((w_0, w_1, w_d)\)
  - \(w_d = 0\)
  - \(w_1 \geq w_0 + \lambda\)

- No Gambling:
  - \(\rho (w_1 - w_0) \leq \delta w_0 \iff w_0 \geq \rho \lambda / \delta\)
  - Agent must receive sufficient rents to prevent gambling
    - Exp. payoff \(= w_0 + \mu \lambda \geq \rho \lambda / \delta + \mu \lambda = \lambda (\mu + \rho / \delta) \equiv w^{s}\)

- Gambling:
  - Reduce agent rents: \(w_0 \geq 0\)
    - Exp. payoff \(= w_0 + (\mu + \rho) \lambda \geq \lambda (\mu + \rho) \equiv w^{g} < w^{s}\)
  - Suffer expected loss: \(\delta D - \rho \equiv \Delta\)
One-Period Model

• Low risk is more profitable to principal than high risk if

\[ \mu - w^s \geq \mu - \Delta - w^g \]

\[ \Delta \geq \lambda \left( \rho / \delta - \rho \right) \]

• For small \( \delta \) principal would prefer to implement high risk project or not to undertake any project

• Gambling is more costly to prevent when probability of disaster is low

  • Limited liability prohibits harsh punishment of agent for gambling,
  • Expected loss \( \delta w_0 \) is low when \( \delta \) is low,
  • Unless agent’s compensation \( w_0 \) and \( w^s \) are high
Contract Conditional on Disaster

• If we cannot punish agent for gambling it may be cheaper to reward him for not gambling ex post

• Can the agent be rewarded for not gambling ex post?
  • Oil spills
    • Absence does not mean gambling did not occur – perhaps we just got lucky?
  • Earthquakes
    • If the building survives an earthquake, that is evidence that the builder did not cut corners
  • Financial crisis
    • If a bank survives it while other banks fail, that is evidence that the bank did not gamble
Bonus for not Gambling

- No gambling: pay bonus $b$ if no loss ($-D$) given disaster
  \[ \rho (w_1 - w_0) \leq \delta (w_0 + b) \]

- Contract without gambling that maximizes principal payoff:
  \[ w_d = 0, \ w_0 = 0, \ w_1 = \lambda, \ b = \lambda \rho / \delta. \]

- Bonus $b$ may be large, but expected bonus payment is not
  \[ \delta b = \lambda \rho \]

- Exp. payoff for Agent = \[ \lambda \mu + \delta b = \lambda \mu + \rho \lambda \equiv w^g \]

- In that case, no gambling is always optimal
Implementation Using Put Options

- Agent is given out-of-money put options on companies that are likely to be ruined in the "disaster" state
  - Caveat: Agent can collect the payoff from the options only if his company remains in a good shape

- Potential downside of using put options
  - Creates incentives to take down competitors

- Comprehensive cost-benefit analysis is needed
Dynamic Model

• A simple model (DS 2006)
  • Cumulative cash flow: \( dY = \mu \, dt + \sigma \, dZ \)
  • Agent can divert cash flows and consume fraction \( \lambda \in (0, 1] \)
  • Alternative interpretation: drift \( \mu \) depends on agent’s effort
    • Earn private benefits at rate \( \lambda \) per unit reduction in drift

• Gambling with tail risk
  • Gambling raises drift to \( \mu + \rho \): \( dY = (\mu + \rho) \, dt + \sigma \, dZ \)
  • Disaster arrives at rate \( \delta \), destroying the franchise and existing assets \( D \) if the agent gambled
The Contracting Environment

- Agent reports cash flows
- Contract specifies, as function of the history of cash flows:
  - The agent’s compensation $dC_t \geq 0$
  - Termination / Liquidation
    - Agent’s outside option = 0
    - Investors receive value of firm assets, $L < \mu/r$
- Contract curve / value function:
  $p(w) = \max \text{ investor payoff given agent’s payoff } w$
- Provide incentives via cash $dC_t$ or promises $dw_t$
- Tradeoff: Deferring compensation eases future IC constraints, but costly given the agent’s impatience
Example

- First Best = 100
  - $\mu = 10$, $r = 10\%$, $\gamma = 12\%$, $\sigma = 8$, $L = 50$, $\lambda = 1$
- Cash if $w > 56$
  - $w^c = 56$
- Gamble if $w < 40$
  - $\rho = 2$, $\delta = 5\%$, $w^s = 40$, $D = 0$
- Compare to pure cases
  - Longer deferral of compensation

![Graph showing investor and agent functions with LT debt and credit line annotations.](image)
Summary

• The double moral hazard problem is likely to be important in firms where risk-taking can be easily hidden.
• The need to provide incentives to share cash flows or exert effort means that some excessive risk-taking may be unavoidable.
• Risk-taking is likely to take place:
  - Probability of disaster is low.
  - After a history of poor performance, when the agent has little “skin” left in the game.
• As a result, optimal policies will have increased reliance on deferred compensation.
• When the “safe” practices can be verified ex-post, we can mitigate risk-taking via bonuses.
• When effort costs are convex, we should expect reductions in effort incentives as a means to limit risk-taking, with a jump to high powered incentives in the gambling region.