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# Playlist

“Conflict of Interest”, Binky Mack

“Disagree”, Chantal Kreviazuk

“Hide and Seek”, Ani di Franco

“Did You Get My Message?”, Jason Mraz

“Joint Venture”, Staffan William-Olsson

“Silent Agency”, Silent Agency

# Playlist

“Everybody’s got something to hide except  
for me and my monkey”, The Beatles

“Till the money comes”, Jonathan Coulton

“Hidden Track”, Alanis Morissette

“In Hiding”, Pearl Jam

“Patent on the Better”, Engine Down

“Hidden Place”, Bjork

“Patent Pending”, Heavens

# Incentive Pay

SI 680, Information Economics

Jeff MacKie-Mason

# Milgrom & Roberts vs. MS-PC

- Is their model different than MS-PC?
- Not really
  - MR generally ignore the (PC) constraint, though they mention in passing
  - They explicitly assume P can observe an imperfect indicator of effort:  $z = e + x$ ,  $x$  random
  - They allow for another indicator  $y$  correlated with  $x$  but not affected by  $e$
  - They assume optimal contracts will be linear:  $t(z,y) = \alpha + \beta(z + \gamma y)$
  - They assume a particular utility function for A ("certainty-equivalent", or mean-variance preferences)
  - They assume "first-order condition" approach sufficient
- But these are just details: the structure of the model and the qualitative results are the same

# Why model? (Does anyone do this in the real world?)

- Breaks the problem down into components to examine and understand each in isolation (cf. lab experiments)
- Organizes the key factors and their implications
- For high value problems, provides a modeling framework for quantifying and solving

# Informativeness Principle

- IP: "Factor in any performance measure that allows reducing the error in estimating the agent's effort, and exclude any measure that increases the estimation error"
- So, extra indicators ( $y$ ) should be included if they improve informativeness
  - In mean-variance model, include anything in pay formula that reduces variance of estimated  $e$ ; that is,  $\text{Var}(x + \gamma y)$  ( $e$  is effort observation noise)
  - Pick the weights on indicators ( $\gamma$ ) to min variance:  
 $\gamma = -\text{cov}(x, y) / \text{var}(y)$
  - If  $\text{cov}(x, y) = 0$ ,  $y$  is uninformative so  $\gamma = 0$

# Application: Comparative Evaluation

- Should performance pay be based on
  - performance of co-workers
  - performance of workers elsewhere (or performance of other companies)?
- "Not fair!" Agent can't control what others do
- "Informative!" If performance of others helps sort out whether observable is due to effort vs. good luck vs. strong market, etc.
- Form of benchmarking:
  - Intertemporal: own past performance? others performance?
  - If own past performance, then might not want to do better to avoid ratchet effect



# Incentive Intensity Principle

- If pay takes form  $t(z,y) = \alpha + \beta (z + \gamma y)$ , then  $\beta$  measures the *intensity* of the incentives: how much pay varies with effort
  - $z = e + x$ , so  $\partial t / \partial e = \beta$
- IIP: "Optimal intensity depends on 4 factors:
  - incremental profits from add'l effort
  - precision of estimating effort
  - agent's risk tolerance
  - agent's responsiveness to incentives

# IIP cont.

- Marginal profitability:
  - we talked about this before: not worth inducing higher effort if it doesn't pay enough to exceed the incentives cost
- Risk tolerance:
  - the more risk averse, the more costly are incentives so give less intense
- Precision of estimating effort
  - strong incentives more effective when easier to infer effort
- Elasticity of effort to incentives
  - stronger incentives when they have greater impact on choice of effort

# Monitoring Intensity Principle

- MIP: "Spend more on improving monitoring when incentive intensity  $\beta$  is higher"
  - If Principal can invest in better measurement / monitoring, then
  - If incentive intensity is high, better to have more precise measures of performance

# Equal Compensation Principle

- ECP: "If agent's effort on multiple desirable activities cannot be separately monitored, then the marginal payoff to the agent for each must be equal, or those with lesser marginal payoffs will receive zero effort"
- Agent is "producing" utility: optimal behavior requires equalizing the marginal payoff from effort on different activities
  - If P has indicators for each, can tune pay to provide some incentives for each
  - If some activities can't be measured, unequal compensation will lead to distortions in effort
  - Worst case: fixed payment (e.g., salary)

# ECP cont.

- If class grade based only on exams, students might not prepare for class discussions (not all incentives monetary!)
- If programmer paid based on lines of active code, tend to
  - do zero documentation
  - write bloatware
  - do little quality assurance testing

# MR Summary

- Informativeness: structure pay to maximize informativeness
- Incentive Intensity: "Optimal intensity depends on 4 factors:
  - incremental profits from add'l effort
  - precision of estimating effort
  - agent's risk tolerance
  - agent's responsiveness to incentives
- Monitoring Intensity: "Spend more on improving monitoring when incentive intensity  $\beta$  is higher"
- Equal Compensation: "If some activities can't be measured, unequal compensation will lead to distortions in effort"

# Eisenhardt summary

|                         | Behavior-based contracts | Outcome-based contracts |
|-------------------------|--------------------------|-------------------------|
| Info systems            | +                        | -                       |
| Outcome uncertainty     | +                        | -                       |
| Agent risk aversion     | +                        | -                       |
| Principal risk aversion | -                        | +                       |
| Degree of goal conflict | -                        | +                       |
| Task programmability    | +                        | -                       |
| Outcome measurability   | -                        | +                       |
| Length of relationship  | +                        | -                       |