A double moral hazard model of organization design

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Introduction

- We develop a model in which the organization structure is chosen to mitigate MH problems in:
  - The selection of projects (managerial MH)
  - The implementation of projects (MH in teams)

- We consider a firm with 2 agents, 2 projects, and 2 tasks
  - (Multi)divisional structure (M-form): each agent gets a full responsibility for one project and performs both tasks on this project
  - (Unitary) functional structure (U-form): each agent specializes in one task and performs it on both projects

- The main idea:
  - DIV is more efficient ex post but also more susceptible to managerial MH problem in projects’ selection
  - The optimal organizational structure trades off ex post efficiency and managerial MH
The organizational structure

Divisional structure

[Diagram shows a divisional structure with a manager at the top, leading to two divisions: Division 1 and Division 2. Each division has two levels of management: p1-m1, p2-m2.]

Functional structure

[Diagram shows a functional structure with a manager at the top, leading to two departments: Department p and Department m. Each department has two levels of management: p1-p2, m1-m2.]
Related literature

- **Chandler (1962):** "Structure follows strategy:" as firms grow and adopted more diverse product lines, the difficulties in coordinating functions across different product lines induces a switch from U-form to the M-form

- **Williamson (1970, 1975):** Diversified firms must follow the M-form to alleviate communication overload

- **Aghion and Tirole (EER, 1995):** Under the U-form agents specialize, so the firm saves on training cost. However, the M-form enables agents to better signal their ability to the external job market and therefore strengthens their incentives to exert effort

- **Rotemberg (JEMS, 1999):** Under the U-form agents who perform similar tasks are grouped together so the firm gains more info. about the optimal way to perform tasks. Under the M-form, agents who work on different tasks are grouped together so the firm can better coordinate different tasks with each other.
More related literature

- **Qian, Roland, and Xu (2006):** Under the U-form coordination between tasks can be done on a company-wide basis so fewer managers are needed to coordinate tasks. Under the M-form, divisions are self-contained so there is no need for costly cross-division communication.

- **Maskin, Qian, and Xu (RES, 2000):** The U-form exploits economies of scale by grouping similar tasks in the same division, but the M-form provides better incentives by promoting yardstick competition between different self-contained divisions.

- **Besanko, Régibeau, and Rockett (2005):** Under the U-form, compensation can be tied directly to the agents’ performance. Under the M-form, compensation is tied to additional profitability measures and hence it is more costly to motivate risk-averse agents. This result however may be reversed if there are asymmetries in the effect of tasks on profits, or significant positive externalities across tasks.

- **Harris and Raviv (2002):** Under the U-form the firm hires 2 middle managers, each coordinates two similar tasks. Under the M-form, each middle manager coordinates two different tasks. Which is better depends on the likelihood of various cross task interactions and on the CEO’s opportunity cost of coordinating company-wide interactions.
The model

- The firm has a three-level hierarchy:
  - A manager - screens projects and recommend them to the board of directors
  - Board of directors – approves/rejects the manager’s recommendations
  - Two agents (middle managers, business units, or simply employees) – implement projects

- If the board rejects the manager's selection, the game ends and all agents get a payoff of 0
Projects

- All projects yield R if they succeed and 0 if they fail:
  - H-type projects can always be discovered and require an initial investment $I < R$
  - L-type projects are discovered with prob. $\alpha$ and require 0 investment

- The manager can conceal L-type projects $\Rightarrow$ When the manager recommends H-type projects the board does not know if he did or did not discover L-type projects

- $\alpha$ measures the importance of managerial ability or the importance of managerial MH
Preferences

- The board of directors is a perfect agent for outside investors ⇒ the board prefers L-type projects

- The manager prefers H-type projects:
  - The manager likes to expensive projects
  - H-type projects enhance the manager's general human capital whereas L-type projects only contribute to his firm-specific human capital
  - L-type projects are “traditional,” whereas H-type projects are more “innovative” and the manager likes “cutting edge” technologies
  - The manager is emotionally attached to H-type projects

- Monetary incentive are insufficient to induce the manager to recommend L-type projects

- The manager will recommend 2 H-type projects if he expects that the board of directors will approve them. O/w he will recommend L-type projects (if he discovers them)
Projects' implementation

- The 2 agents need to perform 2 tasks on each project to enhance their chances to succeed.

- For concreteness, we refer to the tasks as production (p) and marketing (m).

- Each agent can perform at most 2 tasks ⇒ the firm can at most adopt 2 projects.

- The prob. that a project succeeds is

\[ q(e_p, e_m) = e_p + e_m \]
M-form (divisional structure)

- Each project is assigned to one agent who performs both tasks on that project
- The firm has 2 divisions, each is fully responsible for one project
- Agent j's cost of implementing its project:

\[ C^d(e_{pj}, e_{mj}) = \gamma e_{pj}^2 + \gamma e_{mj}^2 - \frac{\rho e_{pj}e_{mj}}{2}, \]

\( \gamma \geq 1, \) and \( \rho \in (-1, 1) \) measures the complementarily between tasks p and m

- \( 0 < \rho < 1 \) - the joint production of the two task exhibits economies of scope (more efficient to perform the two tasks jointly)
- \(-1 < \rho < 0 \) - there are diseconomies of scope (more efficient to specialize and perform each task separately)
U-form (functional structure)

- Each agent specializes in one task and performs it on both projects.
- The two agents are “production department” and “marketing department.”
- The cost that agent $i$ incurs when performing task $i$ on projects 1 and 2 is

$$C^f(e_{i1}, e_{i2}) = \gamma e_{i1}^2 + \gamma e_{i2}^2 - \frac{\sigma e_{i1} e_{i2}}{2},$$

- $\sigma \in (-1, 1)$ measures economies of scale
  - $0 < \sigma < 1$ - economies of scale
  - $-1 < \sigma < 0$ – diseconomies of scale
The timing

- The manager screens projects and recommends 2 projects to the board of directors.
- The board either accepts or rejects the manager’s recommendation.
- If no projects are recommended, the game ends.
- If the board accepts the manager's recommendation, it signs incentive contracts with the two agents.
- The agents implement the selected projects and payoffs are realized.
The contracting problem under the M-form

\[
\begin{align*}
\text{Max} & \quad q_j(e_{pj}, e_{mj})(R - W_j) \\
\text{subject to} & \quad e_{pj}, e_{mj} \in \text{Argmax}_{\hat{e}_{pj}, \hat{e}_{mj}} q_j(\hat{e}_{pj}, \hat{e}_{mj}) W_j - C^d(\hat{e}_{pj}, \hat{e}_{mj}) \\
q_j(e_{pj}, e_{mj}) W_j - C^d(e_{pj}, e_{mj}) & \geq 0,
\end{align*}
\]
The contracting problem under the U-form

\[
\begin{align*}
\text{Max} & \quad q_1(e_{p1}, e_{m1})(R - W_{p1} - W_{m1}) + q_2(e_{p2}, e_{m2})(R - W_{p2} - W_{m2}) \\
\text{s.t.} & \quad e_{p1}, e_{p2} \in \text{Argmax}_{\hat{e}_{p1}, \hat{e}_{p2}} q_1(\hat{e}_{p1}, e_{m1}) W_{p1} + q_2(\hat{e}_{p2}, e_{m2}) W_{p2} - C_f, \\
& \quad e_{m1}, e_{m2} \in \text{Argmax}_{\hat{e}_{m1}, \hat{e}_{m2}} q_1(e_{p1}, \hat{e}_{m1}) W_{m1} + q_2(e_{p2}, \hat{e}_{m2}) W_{m2} - C_f, \\
& \quad q_1(e_{p1}, e_{m1}) W_{p1} + q_2(e_{p2}, e_{m2}) W_{p2} - C_f(e_{p1}, e_{p2}) \geq 0, \\
& \quad q_1(e_{p1}, e_{m1}) W_{p1} + q_2(e_{p2}, e_{m2}) W_{m2} - C_f(e_{m1}, e_{m2}) \geq 0,
\end{align*}
\]
Expected profits

- Solving the contracting problems, the expected ex post profits per project are:

- **M-form:**
  \[ \pi_d = \frac{R^2}{4\gamma - \rho} \]

- **U-form:**
  \[ \pi_f = \frac{R^2}{2(4\gamma - \sigma)} \]

- \( \pi_d > \pi_f \) due to MH in teams
The optimal structure
Implications

- If $\pi^f \leq I \leq \pi^f$, then all else equal, the functional structure becomes optimal for a wider set of parameters as

- $I \uparrow$ (H-type projects are more costly)
- $R \downarrow$ (all projects generate a higher return upon success)
- $\rho \downarrow$ (there are weaker economies of scope)
- $\sigma \uparrow$ (there are stronger economics of scale)
Implications

- Relative to firms with a divisional structure, firms with a functional structure
  - have fewer but more profitable projects
  - have projects that are less likely to succeed ($q^d > q^f$)
  - have projects with a smaller variance of gross returns (the divisional structure is optimal for a wider set of values of $R$ than the functional structure)
  - pay a lower expected compensation to their agents (the expected compensation of the agents is $\pi^d$ under the divisional structure and $\alpha \pi^f$ under the functional structure)
Discussion

- The firm may wish to choose an ex post inefficient functional structure in order to mitigate the manager's incentive to recommend H-type projects.

- Can the firm achieve this goal by other means?
  - Threaten to fire the manager if he recommends H-type projects.
  - Distort the agents' compensation such that they will implement H-type projects inefficiently.
  - Hire inefficient agents such that H-type projects will become unprofitable.
Narrow business strategies (NBS)

- Adopt a strategy that imposes a technological constraint that prevents the firm from implementing H-type projects
  - Advantage: the firm can mitigate managerial MH without adopting an ex post inefficient organizational structure
  - Disadvantage: the firm forgoes H-type projects even if they are profitable and even if there are no L-type projects around

- Suppose that with prob. $\mu$, H-type projects require an initial investment $I_1$ and with prob. $1-\mu$ they require an initial investment $I_2$, where $I_1 < \pi_f < I_2 < \pi_d$
  - $I = I_1$: managerial MH under both organizational structures
  - $I = I_2$: managerial MH only under the divisional structure (the board of directors rejects H-type projects)
Expected payoffs under NBS

- Under NBS, the firm focuses exclusively on L-type projects, so it adopts the ex post efficient divisional structure and adopts L-type projects with prob. $\alpha$. With prob. $1-\alpha$, it does not adopt any projects.

- The expected per-project profit of the firm under NBS:

$$O_N^N = \alpha \pi^d$$
Expected payoffs without NBS

- Under the M-form, the firm will always have H-type projects:

\[ O^d = \pi^d - \mu I_1 - (1 - \mu) I_2 \]

- Under the U-form, the firm will have H-type projects with prob. \( \mu \) and L-type projects with prob. \( (1-\mu)\alpha \):

\[ O^f = \mu(\pi^f - I_1) + (1 - \mu)\alpha \pi^f \]
When is NBS desirable?

$I_1=1$, $I_2=8$, $R=3$, $\gamma=0.5$, $\rho=0$, $\sigma=0.4$.

$O^N \uparrow$ with $\alpha$

$O^f \uparrow$ with $\alpha$
When is NBS optimal?

- $\alpha$ is high (info. MH is “important”)

- $\mu$ is small (H-type projects are not “that bad”)

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Managerial overload

- Williamson (1975, 1985) argues that managerial overload is a critical reason for why the M-form is more efficient.

- Assume $n \geq 2$ projects.

- The manager can costlessly discover H-type projects, but incurs disutility $\psi(\alpha_1, ..., \alpha_n)$ when discovering $n$ L-type projects.

- The manager gets benefit $B$ per each adopted project.

- With prob. $\alpha_1\alpha_2...\alpha_n$ the manager discovers $n$ L-type projects, with prob. $(1-\alpha_1)\alpha_2...\alpha_n$, $\alpha_1(1-\alpha_2)...\alpha_n$, ..., $\alpha_1\alpha_2...(1-\alpha_n)$, he discovers exactly $n-1$ L-type projects, and so on.

- The expected utility of the manager when selecting $\alpha_1, \alpha_2, ..., \alpha_n$ is

$$B\sum_{i=1}^{n} \alpha_i - \psi \left( \sum_{i=1}^{n} \phi(\alpha_i) \right)$$
Managerial overload

If \( \psi(\alpha_1, ..., \alpha_n) \) exhibits decreasing returns, the manager will choose \( \alpha_1^* = ... = \alpha_n^* = \alpha^* \), where \( \alpha^* \) is decreasing with \( n \).

We get managerial overload: when \( n \) grows, \( \alpha^* \) falls. Hence, it is “less important” to mitigate managerial MH so the firm prefers the more ex post efficient M-form.
Conclusion

- The organizational structure of the firm is chosen by trading off ex post efficiency against mitigating managerial MH.
- M-form is more efficient ex post but more susceptible to managerial MH.
- U-form can overcome info. MH.
- U-form is attractive when managerial skills are particularly important.
- Firms with M-form should have more projects, but their projects are on average less profitable.
- The variance of net profitability should be larger for firms with M-form.
- Adopting NBS and focusing exclusively on L-type projects could be profitable only when managerial skills are important and the managerial MH problem is severe.