In recent years many companies decentralized decision making authority.
- AT&T, GE, Eastman Kodak, Fiat, Motorola, Xerox, Ford
- Lower level managers are better informed
  - About consumer needs, competitors, technologies, market opportunities, etc.
- But they may be biased in their decisions
  - Short-term biased, status quo biased, empire builders, etc.
What is the optimal allocation of authority?

Real and Formal Authority
- How should decision making authority be allocated within organizations?
  - Formal authority: the right to decide
  - Real authority: effective control over decisions
- Shareholders have formal authority but might have little control over board of directors
- CEO has formal authority but division manager might have real authority
- A principal who has formal authority can reverse agent’s decision
  - May refrain from doing so if
    1. agent is better informed
    2. objectives are not too dissimilar
- Could it be optimal to delegate formal authority to agent?
- This commits the principal not to reverse agent’s decision
- Two potential benefits
  1. Incentives
     * agent is more willing to get informed
  2. Participation
     * reduces cost of agent’s participation
- Cost: Principal loses control
Real and Formal Authority

- $n \geq 3$ potential projects whose benefits are initially unknown
- Project $k$ yields private benefits
  - $B_k$ to the principal
  - $b_k$ to the agent
  - No project: yields 0 benefit to both
  - For each party at least one project yields sufficiently negative benefit
    - If uninformed, no project is best
- Best project for principal
  - benefit to principal $B$
  - benefit to agent $\beta b$, $\beta \in (0, 1]$
- Best project for agent
  - benefit to agent $b$
  - benefit to principal $\alpha B$, $\alpha \in (0, 1]$
- $\alpha$ and $\beta$ measure congruence between the preferences

Real and Formal Authority

- Principal and agent simultaneously choose how much effort to exert to learn about the projects
- If principal exerts effort $E$
  - she learns the benefits of all projects with probability $E$
  - pays cost $CE^2$
- If agent exerts effort $e$
  - he learns the benefits of all projects with probability $e$
  - pays cost $ce^2$
- Contracts are incomplete
  - Projects cannot be described and contracted upon ex ante
  - Initial contract can only specify which party has the formal authority
- Also assume that the agent is extremely risk averse
  - Optimal compensation is a constant wage

Real and Formal Authority

- If the party who has formal authority is informed she picks her favorite
- If she is not informed but the other party is, other party’s preferred project is picked
- If neither is uninformed, no project is picked
  - This is because for each there is one that is too bad
- P-formal authority (centralization): Principal has the formal authority
  - If agent is informed he recommends a project
    - If principal is informed she chooses her favorite project
    - If she is not informed she follows agent’s recommendation
- A-formal authority (delegation): Agent has the formal authority
  - If principal is informed she recommends a project
    - If agent is informed he chooses his favorite project
    - If he is not informed he follows principal’s recommendation

Real and Formal Authority

- Therefore, payoffs are as follows
- Under P-formal authority

$$u_P = EB + (1 - E)e\alpha B - \frac{CE^2}{2}$$
$$u_A = E\beta b + (1 - E)e b - \frac{ce^2}{2}$$

- Under A-formal authority

$$u_P = e\alpha B + (1 - e)EB - \frac{CE^2}{2}$$
$$u_A = eb + (1 - e)E\beta b - \frac{ce^2}{2}$$
Real and Formal Authority

- Each party’s choice of effort must be optimal given the other’s effort choice
  - Effort choices must constitute a Nash equilibrium
  - In equilibrium each party’s effort is a best response to the other’s effort
- Best response correspondences:
  \[
  B_P(e) = \arg\max_{E \in [0,1]} \left\{ EB + (1 - E)\alpha B - \frac{CE^2}{2} \right\}
  \]
  \[
  B_A(E) = \arg\max_{e \in [0,1]} \left\{ E\beta b + (1 - E)eb - \frac{ce^2}{2} \right\}
  \]
- \((E^*, e^*)\) is a Nash equilibrium if
  \[
  E^* \in B_P(e^*) \\
  e^* \in B_A(E^*)
  \]
  best response correspondences intersect at \((E^*, e^*)\)

Real and Formal Authority: P-formal authority

Under P-formal authority

- Principal maximizes payoff by choosing \(E\)
  \[
  \max_{E \in [0,1]} EB + (1 - E)e\alpha B - \frac{CE^2}{2}
  \]
- We assume \(b < c\) and \(B < C\)
to guarantee interior solution
- FOC must hold:
  \[
  \frac{\partial}{\partial E} u_P = B - e\alpha B - CE = 0
  \]
  Or
  \[
  E = \frac{B}{C}(1 - \alpha e)
  \]

We can solve these two equations for \(e\) and \(E\), but a graph is more useful

![Graph showing Nash Equilibrium](image)
Real and Formal Authority: P-formal authority

What happens if principal’s cost of effort decreases?

- Principal’s probability of getting informed increases
- This discourages the agent from putting in more effort

\[ u_P = e\alpha B + (1 - e)EB - \frac{CE^2}{2} \]

\[ u_A = eb + (1 - e)EB - \frac{ce^2}{2} \]

Show similarly that

\[ E = \frac{B}{C}(1 - e) \quad \text{and} \quad e = \frac{b}{c}(1 - \beta E) \]

Real and Formal Authority: A-formal authority

- Under A-formal authority Payoffs are

\[ u_P = e\alpha B + (1 - e)EB - \frac{CE^2}{2} \]

\[ u_A = eb + (1 - e)EB - \frac{ce^2}{2} \]

- Since the P cannot overrule A’s decision, A has more incentives to become informed

\[ E = \frac{B}{C}(1 - e) \quad \text{and} \quad e = \frac{b}{c}(1 - \beta E) \]
Participation View

- Agent’s choices about clothing, hairdo, out-of-work personal lifestyles has minor incentive effects but are very important for the agent
- Delegating decisions on these matters increases the agent’s utility
- As a result the principal can decrease wage
  - obtain control of other matters
  - and still ensure the agent’s participation
- To isolate these effects we will treat effort choices as fixed

Levent Kockesen (Koc University) Allocation of Authority 17 / 37

Participation View

- $k = 1, 2, \ldots, m$ separate decisions
- Let $x_k = 1$ when $P$ keeps the control and $x_k = 0$ when he delegates
- Letting $w$ be the wage, principal’s payoff function
  \[ \sum_k [(E_k + (1 - E_k)e_k \alpha_k) x_k + (e_k \alpha_k + (1 - e_k)E_k)(1 - x_k)] B_k - w \]
- Can be written as
  \[ \sum_k E_k e_k (1 - \alpha_k) B_k x_k - w + A \]
  where $A$ is expected payoff when $x_k = 0$ and independent of $x_k$
- $E_k e_k (1 - \alpha_k) B_k$ is how much payoff changes when control is transferred from agent to principal
  - Payoff changes only if both are informed by amount $(1 - \alpha_k) B_k$

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Participation View

- Agent’s payoff function
  \[ \sum_k [(E_k \beta_k + (1 - E_k)e_k) x_k + (e_k + (1 - e_k)E_k \beta_k) (1 - x_k)] b_k + w \]
- Can be written as ($D$ independent of $x_k$)
  \[ - \sum_k E_k e_k (1 - \beta_k) b_k x_k + w + D \]
- $E_k e_k (1 - \beta_k) b_k$ is how much payoff changes when control is transferred from principal to agent
  - Payoff changes only if both are informed by amount $(1 - \beta_k) b_k$

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Participation View

Principal’s problem is to choose $x_k, k = 1, 2, \ldots, m$ to maximize
\[ \sum_k E_k e_k (1 - \alpha_k) B_k x_k - w + A \]
subject to
\[ - \sum_k E_k e_k (1 - \beta_k) b_k x_k + w + D \geq \bar{u} \]
where $\bar{u}$ is agent’s outside option
- Individual rationality constraint must hold as equality
  Substituting in the constraint, principal’s problem is
\[ \max_{\{x_k\}} \sum_k E_k e_k (1 - \alpha_k) B_k x_k - \sum_k E_k e_k (1 - \beta_k) b_k x_k - \bar{u} + A + D \]
Participation View

Collecting terms, this equivalent to

\[
\max_{\{x_k\}} \sum_k E_k e_k ((1 - \alpha_k)B_k - (1 - \beta_k)b_k)x_k
\]

Solution:

\[(1 - \alpha_k)B_k > (1 - \beta_k)b_k \Rightarrow x_k = 1\]

and

\[(1 - \alpha_k)B_k < (1 - \beta_k)b_k \Rightarrow x_k = 0\]

Principal chooses control rights efficiently:

- Principal has control if resulting increase in her payoff is higher than the decrease in agent’s payoff
- Otherwise agent has the control

Empirical predictions: Participation View

- Seems to fit empirical evidence on multi-division corporations
- Division manager’s preferred decisions likely to be suboptimal for the firm (\(\alpha_k\) low) when there are externalities
  - on other divisions
  - on future managers of the division
  - on the firm as a whole
- Long-term investment decisions or those with an impact on the rest of the firm’s image or strategy (such as advertising or bargaining with unions) have been kept centralized
- But managerial decisions concerning exclusively the division, such as manufacturing, purchasing, or short-term investment, are often delegated to the division

Delegation is more likely for those decisions

- that matter little to the principal, because
  - they involve little cash flow (\(B_k\) low)
  - agent can be trusted (\(\alpha_k\) high)
- that are important to the agent
  - private benefits are high (\(b_k\) high)
  - principal cannot refrain from hurting the agent (\(\beta_k\) low)

Empirical predictions: Incentive View

- Impact of payoff and congruence parameters is less clear-cut
- One unambiguous effect
  - Increase in the agent’s trust in the principal (\(\beta_k\)) makes centralization more desirable
  - has no impact on the principal’s payoff under centralization
  - reduces the agent’s effort under delegation
Delegation and Communication

- Aghion & Tirole analyzes the effects of allocation of authority on the incentives to acquire information
- What if the agent is always better informed?
- Can the principal elicit that information?
  - If actions cannot be contracted upon (contracts are incomplete)
    - Principal will choose an expected payoff maximizing action given the agent’s report
    - Agent will choose his report strategically
- The amount of information that can be gathered from the agent depends on the divergence between the preferences
- Could it be better to delegate the decision making authority?
- Delegation also becomes less attractive as the agent’s preferences diverge more from the principal’s
- It is not clear which one is better
  - Delegation or Communication

Cheap Talk

- When the agent’s report (message) is payoff irrelevant ‘talk is cheap’
- First analyzed by
- Delegation scenario analyzed by

Cheap Talk

- Agent observes the state of the world \( \theta \in [0, 1] \)
- Principal’s prior on \( \theta \) is uniform over \([0, 1]\)
- Agent reports a message \( m \in \mathbb{R} \)
- Principal observes \( m \), updates her beliefs, and chooses an action \( y \in \mathbb{R} \)
- Payoffs
  
  \[
  U_P(y, \theta) = -(y - \theta)^2 \\
  U_A(y, \theta) = -(y - (\theta + b))^2
  \]

  where \( b > 0 \)
- Agent always prefers a higher action
  - Principal’s best action is \( \theta \)
  - Agent’s best action is \( \theta + b \)

Cheap Talk

- Is perfect communication possible?
- Suppose it is: type \( \theta \) sends \( m(\theta) \), where \( m \) is one-to-one
- Principal chooses \( \theta \) after observing \( m(\theta) \)
- But then type \( \theta \) would prefer to send \( m(\theta + b) \)
- Therefore, communication is necessarily noisy
- Crawford and Sobel showed that all equilibria are equivalent to partition equilibria
- Consider a partition of the type space into \( n \) intervals

\[
\{ [0, x_1), [x_1, x_2), \ldots, [x_{n-1}, 1) \}
\]

- All types in the same interval send the same message
Cheap Talk: Partition Equilibria

- Let us start with a two-interval equilibrium
  - All types in \([0, x)\) send \(m\)
  - All types in \([x, 1]\) send \(m' \neq m\)
- After message \(m\) principal’s beliefs are uniform over \([0, x)\) and after \(m'\) uniform over \([x, 1]\)
- Principal’s expected payoff for any \(E[\theta]\)
  \[-E[(y - \theta)^2] = -y^2 + 2yE[\theta] - E[\theta^2]\]
- FOC is
  \[y = E[\theta]\]
- She chooses \(\frac{x}{2}\) after \(m\) and \(\frac{x + 1}{2}\) after \(m'\)

Cheap Talk: Partition Equilibria

- All types in \([0, x)\) must prefer \(x/2\) to \((x + 1)/2\)
  \[-\left(\frac{x}{2} - (\theta + b)\right)^2 \geq -\left(\frac{x + 1}{2} - (\theta + b)\right)^2 \text{ for all } \theta \in [0, x)\]
- All types in \([x, 1]\) must prefer \((x + 1)/2\) to \(x/2\)
  \[-\left(\frac{x + 1}{2} - (\theta + b)\right)^2 \geq -\left(\frac{x}{2} - (\theta + b)\right)^2 \text{ for all } \theta \in [x, 1]\]
- This implies that type \(x\) must be indifferent
  - If she strictly preferred \(x\) over \((x + 1)/2\), by continuity of payoff function in type, there would be a type \(\theta > x\) who would strictly prefer \(x\) over \((x + 1)/2\)

Delegation or Communication

- If P delegates, A chooses \(\theta + b\)
- P’s expected payoff
  \[-\int_0^1 (\theta + b - \theta)^2 d\theta = -b^2\]
Delegation or Communication

- If P communicates, her expected payoff is
  \[ -\int_0^x \left( \frac{x}{2} - \theta \right)^2 d\theta - \int_x^1 \left( \frac{x+1}{2} - \theta \right)^2 d\theta \]
  where \( x = 1/2 - 2b \)
- This can be calculated to be \( -b^2 - \frac{1}{48} \)
- Delegation is better
- Dessein shows that delegation is better whenever \( b \) is such that informative equilibrium exists

Cheap Talk: Partition Equilibria

- Can be written as
  \[ x_{i+1} - x_i = x_i - x_{i-1} + 4b \]
  Each interval’s length must be 4b larger than the one before
- If the first interval has length \( \varepsilon \) and there are \( n \) intervals, we must have
  \[ \varepsilon + (\varepsilon + 4b) + (\varepsilon + 8b) + \cdots + (\varepsilon + (n-1)4b) = 1 \]
  or
  \[ n\varepsilon + 4(1 + 2 + \cdots + (n-1))b = n\varepsilon + 4\frac{(n-1)n}{2}b \]
  \[ = n\varepsilon + 2n(n-1)b = 1 \]
  For every \( n \) such that \( 2n(n-1)b < 1 \), there is \( \varepsilon > 0 \), such that there is an \( n \)-interval equilibrium

Cheap Talk: Partition Equilibria

- Most informative equilibrium is given by greatest integer \( n \) such that \( 2n(n-1)b < 1 \)
- Applying the quadratic formula, this is the greatest integer smaller than
  \[ \frac{1}{2} \left( 1 + \sqrt{1 + \frac{2}{b}} \right) \]
- Decreases in \( b \)
  - Smaller the agent’s bias, more communicative the equilibrium
- As \( b \to 0 \), this goes to infinity
  - Arbitrarily informative communication becomes possible
- There is always the completely uninformative ‘babbling’ equilibrium
Allocation of Authority: Recap

- Benefits of delegation:
  - Increases agent’s incentives to gather information
  - For tasks that are important for A but not for P increases A’s willingness to participate
  - Allows use of local information

- Cost:
  - If agent is biased, decisions are suboptimal

- Delegation is better when
  - Bias is smaller
  - P is less informed
  - Cost of information gathering for P is higher
  - Task is important for A but not for P