Communication, corporate governance, and organizational structure

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How dispersed information affects decisions

- Information is typically dispersed
  - Decision-makers are not perfectly informed
  - Other agents often know additional information
- How does this information affect decisions?
Motivation

Decision-makers often get advice from informed but biased agents

- Top executive and divisional manager
- Financial advisor advising a client on portfolio allocation
- VC and entrepreneur
- Investment banker advising a buyer or seller in M&A
- Board and CEO
- Managers and proxy advisors advising shareholders on voting
- Shareholders advising management: activists, advisory votes

Questions

- How much information can be communicated?
- How to design decision-making processes to maximize efficiency?
- How does private, unobserved communication explain observed phenomena?
Outline

1. Cheap talk communication
   • Crawford and Sobel 1982

2. Allocation of control rights
   • Dessein 2002

3. Corporate finance and governance applications

4. Dynamic communication
   • Grenadier, Malenko, Malenko 2016
Strategic information transmission

- When a biased agent communicates his information to the decision-maker, he has incentives to “misreport”
  - to tilt the decision-maker towards his preferred decision
- This makes communication less effective

Questions

- How much information can be communicated?
- How efficient are decisions?
Example: Board and CEO

Shareholders

Elect

Board of directors

Monitors
Has full decision-making authority

Managers
Two players

- Sender
  - has private information $\theta$ and communicates it
  - e.g., CEO knows information about project payoff
- Receiver
  - takes action $a$
  - e.g., board decides how much to invest in a project
Setup: Timeline

1. S privately observes state $\theta$
   - $\theta \sim F(\cdot), f(\cdot)$ on $[\underline{\theta}, \bar{\theta}] = [0, 1]$
   - We will focus on uniform distribution (and quadratic preferences), but the paper is more general
     - other common distribution: binary

2. S sends message $m \in M$ to R
   - information is non-verifiable, so S can misreport

3. R chooses action $a \in \mathbb{R}$
Setup: Payoffs

\[ U^R (a, \theta) = - (a - \theta)^2 \]
\[ U^S (a, \theta, b) = - (a - (\theta + b))^2 \]

- Receiver’s optimal action is \( \theta \)
- Sender’s optimal action is \( \theta + b \)
  - E.g., \( b > 0 \) from empire-building
  - Note: S still cares about fundamentals. Otherwise, no communication at all is possible.

**Talk is “cheap”:** message \( m \) does not affect S’s payoff

- unlike in costly signaling games (e.g., Spence on education)
  - signaling is costly but credible
  - cheap talk communication is costless but less credible
Bayes-Nash equilibrium

- Sender’s message strategy \( m : [\theta, \bar{\theta}] \rightarrow M \) and
- Receiver’s action strategy \( a : M \rightarrow \mathbb{R} \) such that

\[
m(\theta) \in \max_m \mathcal{U}^S(a(m), \theta, b)
\]

\[
a(m) \in \arg \max_a \mathbb{E}[\mathcal{U}^R(a, \theta) | m] = \mathbb{E}[\theta | m]
\]

\[
= \arg \max_a \int_{\theta}^{\bar{\theta}} \mathcal{U}^R(a, \theta) \, p(\theta | m)
\]

where \( p(\theta | m) \) are beliefs given Bayes rule

- if \( q(m | \theta) \) is prob. of \( m \) given \( \theta \), \( p(\theta | m) = \frac{q(m | \theta) f(\theta)}{\int q(m | \theta) f(\theta) d\theta} \)
1. Uninformative ("babbling") equilibrium always exists

- E.g., S always sends the same message
  - many other ways to construct eqm, e.g., random messages
- R ignores messages and takes action $\mathbb{E} [\theta]$
  - given this, S is indifferent $\Rightarrow$ optimal to "babble"
2. Fully informative equilibrium exists only if \( b = 0 \)

- In such eqm, \( m(\theta_1) \neq m(\theta_2) \), so R knows state for sure
  \( \Rightarrow \) Given \( m(\theta) \), R takes \( a = \theta \)
- But then, S wants to send \( \tilde{m} = m(\theta + b) \)
3. Informative equilibria have a “partition” structure

- Points \( 0 = \theta_0 < \theta_1 < \ldots < \theta_{N-1} < \theta_N = 1 \)
- All S types in \([\theta_{i-1}, \theta_i]\) send the same message
  - and hence induce the same action of R
Structure of informative equilibria

- Intuition: Close types must send the same message
  - otherwise low type would mimic high type to induce a higher $a$
- Types at cutoff points are indifferent
  $\Rightarrow$ types just to the left don't mimic types just to the right
Characterizing partition equilibria

1. Optimality for $R$:

$$a_i = \mathbb{E}[\theta | m_i] = \frac{\theta_{i-1} + \theta_i}{2}$$

2. Optimality for $S$ (indifference of cutoff types):

$$(a_i - (\theta_i + b))^2 = (a_{i+1} - (\theta_i + b))^2$$
Characterizing partition equilibria

1. Optimality for R:

\[ a_i = \mathbb{E}[\theta|m_i] = \frac{\theta_{i-1} + \theta_i}{2} \]

2. Optimality for S (indifference of cutoff types):

\[ (a_i - (\theta_i + b))^2 = (a_{i+1} - (\theta_i + b))^2 \]

\[ \Rightarrow \theta_{i+1} - \theta_i = \theta_i - \theta_{i-1} + 4b \]
Partition size is increasingly large (by 4b)

\[ \theta_{i+1} - \theta_i = \theta_i - \theta_{i-1} + 4b \]

- “Larger” messages are more noisy ⇒ exaggeration is costly ⇒ S is induced to tell the truth
  - Larger bias b ⇒ stronger incentive to exaggerate ⇒ larger increase in partition size
- “Common sense” interpretation:
  - If a person who prefers large projects recommends a “large” project, his message is not very informative
  - If he recommends a “small” project, this is more revealing
Characterizing partition equilibria

\[ \theta_{i+1} - \theta_i = \theta_i - \theta_{i-1} + 4b \]

- Second-order difference equation \( \Rightarrow \) using \( \theta_0 = 0 \), solution is
  \[ \theta_i = \theta_1 i + 2i (i - 1) b \]

- Using \( \theta_N = 1 \) for a given \( N \), we get unknown \( \theta_1 \)

- There are multiple equilibria with different \( N \), as long as \( 2N (N - 1) b < 1 \) \( \Leftrightarrow \) \( N \leq N_{\text{max}} \)
Selecting among equilibria

- There are multiple equilibria with different $N$ for $N \leq N_{\text{max}}$
  - $N = 1$ gives the uninformative one
  - $N = N_{\text{max}}$ gives the most informative one

- Ex-ante expected utilities
  \[
  EU^R = -\sigma^2 \\
  EU^S = - (\sigma^2 + b^2)
  \]
  where $\sigma^2$ is residual variance; $\sigma^2 \downarrow N$ for $N \leq N_{\text{max}}$
  - S would be better off if he could commit not to lie, but cannot

- The most informative equilibrium Pareto-dominates all others $\Rightarrow$ typically selected
Properties of the most informative equilibrium

\[ 2N(N - 1)b < 1 \iff N \leq N_{\text{max}} = \left\lfloor -\frac{1}{2} + \frac{1}{2}\sqrt{1 + \frac{2}{b}} \right\rfloor \]

where \( \left\lfloor x \right\rfloor \) is the smallest integer greater than or equal to \( x \)

- **More aligned preferences \( \Rightarrow \) more informative communication**
  - As \( b \downarrow \), \( N_{\text{max}} \) and expected utility of R and S \( \uparrow \)
  - If \( b \to 0 \), \( N_{\text{max}} \to \infty \): full communication
  - If \( b \geq \bar{b} (= \frac{1}{4}) \), \( N_{\text{max}} = 1 \): only babbling equilibrium

- Source of inefficiency is **information loss**
  - not bias directly, because R is the **decision-maker** and “de-biases” messages
Other models of strategic communication

1. Cheap talk: non-verifiable information

2. Voluntary disclosure of verifiable information
   - S can stay silent but cannot misreport

3. Bayesian persuasion
   - S commits to a mapping from states to R’s signals
     - i.e., info is also verifiable, but S “designs” its distribution
   - Kamenica-Gentzkow 2011

- Different results; different applications
Outline

1. Cheap talk communication
   - Crawford and Sobel 1982

2. Allocation of control rights
   - Dessein 2002

3. Corporate finance and governance applications

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Allocation of control rights

- If uninformed principal has control over decisions:
  - decisions are unbiased
  - but agent’s information is partly lost

- What if principal delegates control to the agent?
  - decisions are biased
  - but agent’s information is not lost

- What is the optimal allocation of control rights?
Applications

- Top executive and divisional manager
- Board and CEO
- VC and entrepreneur
- Financial advisor advising a client on portfolio allocation
Consider the Crawford-Sobel (1982) setup
  - We will focus on the uniform-quadratic setup
  - Dessein’s setup is more general

**Principal** = Receiver; **Agent** = Sender

**When does P prefer to delegate authority to A?**
Keeping authority vs. Delegating

**P keeps authority**

- Partial communication with $N(b) = N_{max}$ partitions
- $P$ chooses $\frac{\theta_i + \theta_{i-1}}{2}$ - unbiased, but not fully informed
- $P$’s expected utility $= -$ residual variance, or

$$E_{keep}[U^P] = -\frac{1}{12N(b)^2} - \frac{1}{3}b^2 \left( N(b)^2 - 1 \right)$$

**P delegates authority to A**

- $A$ chooses $a_A = \theta + b$ - informed but biased
- $P$’s expected utility is $-E(a_A - \theta)^2$:

$$E_{delegate}[U^P] = -b^2$$
Key takeaways

Trade-off:

Delegate $\Rightarrow$ loss of control (biased decision)

vs.

Keep authority $\Rightarrow$ loss of information (less informed but unbiased decision)
Key takeaways (cont.)

- **As bias $b$ increases, P is worse off in both regimes**
  - Communication is worse, so $\mathbb{E}_{keep}[U^P]$ decreases
  - A’s decisions are more biased, so $\mathbb{E}_{delegate}[U^P]$ also decreases

- **When bias $b$ is large, delegation is inferior**
  - P’s loss from delegation is unlimited
  - P’s loss from keeping authority is limited: the worst is an uninformed decision based on priors
Comparison for small biases

- When bias is large, delegation is inferior
- As bias decreases, both regimes give P higher payoff
- Which dominates when bias $b$ is small?

- Dessein’s result: **Delegation is superior when $b$ is small**
  - uniform-quadratic setup:
    - delegation $\Rightarrow$ P’s loss is second-order in $b$
    - communication $\Rightarrow$ P’s loss is first-order in $b$
  - shows this also holds for some more general setups
Predictions

- Dessein’s predictions: Delegation is more likely when
  1. Agent’s information advantage is large relative to his bias
  2. Principal is more risk-averse
     - unbiased actions with large variance under P’s authority

- Large theoretical literature, but scarce empirical evidence
  - Organizational economics: determinants of decentralization
    - Acemoglu et al. 2007; Bloom et al. 2014; Huang et al. 2017; Dessein et al. 2018
  - Finance settings: VC contracts, board control
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Some finance applications

- **Financial markets**
  - Benabou-Laroque 1992: informed agent 1) manipulates prices through public messages, 2) trades before or after

- **Financial analysts**
  - Ottaviani-Sorensen 2006: unbiased sender, cares about his reputation for ability

- **Mergers and acquisitions; auctions**
  - Levit 2017: board advises target shareholders whether to accept a takeover offer
  - Quint-Hendriks 2018: nonbinding bids prior to binding
  - Malenko-Tsoy 2019: auction design when bidders learn their private valuations from biased advisors (investment bank/CEO)

- **Corporate governance**
  - board-CEO relationships; shareholder activism; voting
Application of Dessein 2002 to board-CEO

- Board = Principal
  - by law, has full decision-making authority
- CEO = Agent
  - better informed but biased
- **Implication**: Board should delegate decisions for which CEO’s information is large relative to his bias

- Does the board have commitment power to delegate?
  - e.g., irreversible or very costly to reverse decisions
  - across decisions: through weaker governance
    - dual class shares; less independent board; CEO-chairman
What is unique to board-CEO relationships?

1. **Advisory role is important**
   - industry executives, finance experts, lawyers, academics
   - Hence P is also informed
     - two-sided private information

2. **Dual advisory and monitoring roles**
   - Board advises CEO, but also interferes with his decisions
   - How do the two roles interact?
     - Adams-Ferreira 2007; Levit 2018
Harris-Raviv 2008: Two-sided private information

- Outside directors and Manager/insiders

\[ U_O = - (a - \theta)^2 \]
\[ U_M = - (a - (\theta + b))^2 \]

and

\[ \theta = \theta_O + \theta_M \]

where \( \theta_O \sim U [0, A_O] \) and \( \theta_M \sim U [0, A_M] \) are independent

- \( A_O, A_M \) measure importance of each player’s information

- Outsider control vs. Manager control
  - party with control gets advice from party without control
Two-sided private information

- Outsider control: O’s action after getting message $m$ is
  \[ a^*_O = \theta_O + \mathbb{E} [\theta_M | m] \]

- But then for M:
  \[ a^*_O - (\theta + b) = \mathbb{E} [\theta_M | m] - \theta_M - b \]
  which is the same as without O’s private information
  - M can perfectly predict the effect of his messages on his utility
  - hence we can solve the standard Crawford-Sobel setup

- Generally: similar trade-off between info loss and biased decisions
  - delegation is more likely when Manager’s info is important relative to his bias and Outsiders’ info
    - e.g., dual class shares in high-tech firms
Private information of the board

- Main difference due to two-sided private information:
  - Outsiders can use their info to decide whether to delegate
  - i.e., allocation of control becomes state-contingent

- **Result**: If $b > 0$, outsiders delegate control to M iff $\theta_O > \bar{\theta}$
  - i.e., delegation is more likely when O’s private information is consistent with M’s bias

- **Reason**: when O communicate to M, partitions are smaller when $\theta_O$ is large $\Rightarrow$ less information is lost for large $\theta_O$ $\Rightarrow$ loss from delegation is lower
Private information of the board

- Harris-Raviv 2005, 2008, 2010: take conflict of interest $b$ as given
  - Ask: Given $b$, should board delegate decisions?
- Adams-Ferreira 2007; Chakraborty-Yilmaz 2017; Malenko 2014:
  - Ask: What is the optimal board composition, i.e., $b$?

- Key takeaway: **Less independent boards can be optimal**
  - to improve communication between boards and managers
  - to use managers’ information better
Dual advisory and monitoring role

- Adams-Ferreira (JF 2007); Levit (JF forthcoming):
  - Advising = communicating to M, with M choosing a
  - Monitoring = affecting a, fully or partially

Conclusions: These two roles conflict, for two very different reasons:

- Adams-Ferreira: Board’s info relies on M giving info to the board
  - M will not give info because of monitoring
  - Implications: friendly boards; two-tier boards
- Levit: advising → M takes action → costly intervention by board
  - Communication is less informative if intervention is possible
Levit (2018): Setup

Timing

1. P observes $\theta \sim U [\theta, \bar{\theta}]$ and sends message $m$
2. A chooses project size $a \in \mathbb{R}$
3. P decides how much to intervene, $\Delta$ at cost $\delta C (\Delta)$
   - final project size is $a - \Delta$

We will focus on quadratic preferences and cost $\delta \Delta^2$

- $U_P = - (a - \theta)^2$, $U_A = - (a - (\theta + b))^2$
- but results are more general
Analysis: Intervention stage

- After A chooses $a$, P chooses $\Delta$ to maximize
  
  $$- (a - \Delta - \theta)^2 - \delta \Delta^2$$

  $\Rightarrow$ P chooses $\Delta^* = \frac{a-\theta}{1+\delta}$

  - if $\delta > 0$, P does not fully “undo” the agent’s bias
Analysis: Communication stage

Anticipating $\Delta^* (a) = \frac{a - \theta}{1 + \delta}$, at the communication stage:

- P maximizes
  $$- (a - \Delta^* - \theta)^2 - \delta \Delta^*$$

- P’s ideal action is $a_P = \theta$
  - maximizes his utility from the action
  - minimizes his costs of intervention
Anticipating $\Delta^* (a) = \frac{a - \theta}{1+\delta}$, at the communication stage:

- A maximizes
  
  $$- (a - \Delta^* - (\theta + b))^2$$

- A’s ideal action satisfies $a_A = \theta + b + \Delta^* (a_A) \Rightarrow$
  
  $$a_A = (\theta + b) + \frac{b}{\delta}$$

- A’s ideal action “overshoots” relative to the action that is eventually implemented
Analysis: Communication stage

- P’s ideal action is $\theta$
- A’s ideal action is $(\theta + b) + \frac{b}{\delta}$

- Since “effective” bias exceeds $b$, communication is worse
  - this negative effect is strongest when $\delta$ is small or $b$ is large

- Intuition:
  - A expects intervention $\Rightarrow$ deliberately “overshoots” as if his bias is larger $\Rightarrow$ P has even stronger incentives to understate fundamentals

- This negative effect of intervention can dominate
  - P can be better off without the power to intervene
Other governance applications

Shareholder activism

- Levit (JF forthcoming)
- Levit (RFS 2019): effect of public campaigns and exit on communication

Shareholder voting

- Voting on many issues is non-binding and hence, effectively, is similar to communication
- Proxy advisors’ recommendations to shareholders
  - Levit-Tsoy (2019): multiple receivers & uncertainty about S’s bias
  - Ma-Xiong (2019): Bayesian persuasion
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   - Bizzotto et al 2018; Ely 2017; Ely-Szydlowski 2017; Orlov et al 2018
Role of commitment

We have assumed **limited commitment** by the Principal

- Dessein: **P can commit not to overrule A** when giving authority

- But **P cannot commit how he reacts to A’s messages**
  - otherwise would be better off

- Contracts are incomplete, hence allocation of authority matters
Limited commitment by Principal

- P cannot commit how he reacts to A's messages
  - action $a(m)$ is *ex-post optimal* for P

- Otherwise, mechanism design approach and revelation principle
  - P commits to actions as a function of A's messages; all information is truthfully reported

  - Optimal mechanism can be implemented via *constrained delegation*: A picks from a restricted “delegation set”
    - Dessein 2002: unconstrained delegation
    - E.g. Holmström 1984; Melumad-Shibano 1991; Alonso-Matouschek 2008; Amador-Bagwell 2013

- As we will see, time can indirectly give P this commitment power
Motivation

- Most decisions are not purely static:
  - many decisions are about **timing**: bringing a new product, shutting down a plant, drilling an oil well
  - most decisions can be delayed

Questions

- How do firms make timing decisions?
  - How does information flow from lower to upper levels?
  - What decisions should be delegated?
Preview of results

Timing decisions have different economics from static decisions:

- Asymmetry between “delay bias” and “early exercise bias”
  - E.g., shutting down a plant vs. product launch
  - Reason: Irreversibility of time

- Delay bias:
  1. Often full communication of information, but too late
  2. Irreversibility of time gives commitment power
  3. Delegation never helps

- Early exercise bias:
  1. Noisy communication
  2. Delegation helps if the bias is low
Simple example

- P decides on **timing** $t$ of taking an action
  - time moves continuously from 0; no discounting
  - general setting: call option exercise

- Optimal timing depends on parameter $\theta \sim U [1, 2]$

\[
U^P(t, \theta) = -(t - \theta)^2 \\
U^A(t, \theta, b) = -(t - (\theta + b))^2
\]

P’s optimal timing: $\theta$
A’s optimal timing: $\theta + b$

- $b < 0$: bias towards earlier exercise (e.g., product launch)
- $b > 0$: bias towards later exercise (e.g., plant closure)
Comparing static and dynamic communication

1. **Static**: A only communicates to P at $t = 0$
   - identical to Crawford-Sobel
   - *direction of the bias does not matter*

2. **Dynamic**: A communicates to P continuously
   - *direction of the bias is crucial*
Static communication

- A sends a single message at $t = 0$; P decides when to exercise

Most informative equilibrium:

1. $b = \frac{1}{8}$ (late exercise bias)

\[ m_1 \quad t_1 = 1 \frac{1}{8} \]

\[ m_2 \quad t_2 = 1 \frac{5}{8} \]

2. $b = -\frac{1}{8}$ (early exercise bias)

\[ m_1 \quad t_1 = 1 \frac{3}{8} \]

\[ m_2 \quad t_2 = 1 \frac{7}{8} \]
Dynamic communication: Timing

Heuristic timing of events over \([t, t + dt]\):

1. A decides on message \(m_t\) to send to P
2. P decides whether to exercise or not
   - If P exercises, the game ends, and players receive payoffs
   - Otherwise, the game continues
Dynamic communication: Late exercise bias

Consider **late exercise bias**: $b = \frac{1}{8} > 0$

- $A$'s optimal timing is $t_A^* = \theta + b$

**Cutoff equilibrium:**

- $A$ sends message $m = 0$ ("wait") while $t < t_A^*$ and message $m = 1$ ("exercise") once $t \geq t_A^*$

- $P$ **follows recommendation** until $\tau^* = 2 - b$
  - if gets $m = 0$ ("wait"), waits
  - if gets $m = 1$ ("exercise"), exercises

- $P$ exercises at $\tau^* = 2 - b$ if $A$ still recommends to wait
Late exercise bias: Why is this equilibrium?

P: After getting the message to “exercise”

- If P gets the first message to “exercise” at $t$, infers $\theta = t - b$
- But his optimal timing to exercise has already passed
  $\Rightarrow$ finds it optimal to exercise
- Ideally, would have “gone back in time” and exercised at $t - b$, but cannot
- P cannot “de-bias” A’s messages $\Rightarrow$ follows them
  - In a static problem, “de-biasing” always occurs
Late exercise bias: Why is this equilibrium?

P: Before getting the message to “exercise”

- P trades off waiting for information vs. delay
- At time $t$, P knows that $t < \theta + b \iff \theta > t - b$
- At first, it is optimal to wait, to get more info from A
- But as time goes by, value of waiting for A’s info declines
  - So at some point, P exercises
Late exercise bias: Why is this equilibrium?

**P**: Before getting the message to “exercise”

- P knows that $\theta > t - b$

- **Strategy**: P waits until $\tau$ and then exercises
  - $\theta < \tau - b$: A will recommend to exercise at $\theta + b < \tau$, resulting in P’s loss of $b^2$
  - $\theta > \tau - b$: P will exercise at $\tau$, resulting in P’s loss of $(\tau - \theta)^2$

\[
\tau^* = \arg \min_{\tau} \frac{1}{2 - (t - b)} \left( \int_{t-b}^{\tau-b} b^2 \, d\theta + \int_{\tau-b}^{2} (\tau - \theta)^2 \, d\theta \right) = 2 - b
\]
Late exercise bias: Why is this equilibrium?

**A: Why it is optimal to recommend exercise at** $t_A^* = \theta + b$

- If $\theta < \tau^* - b$, gets his most preferred timing
  - information is fully revealed for these types
  - but timing is delayed relative to P’s optimum

- If $\theta > \tau^* - b$, would like to delay beyond $\tau^*$, but cannot benefit from deviating since P does not delay beyond $\tau^*$
Dynamic communication: Early exercise bias

Consider *early exercise bias*: $b = -\frac{1}{8}$

- A’s optimal timing is $t_A^* = \theta - \frac{1}{8}$

**A similar equilibrium does not exist:**

- Suppose A recommends to “wait” until $t_A^*$, and recommends to “exercise” at $t_A^*$
- If P gets the first message to “exercise” at $t$, infers $\theta = t + \frac{1}{8}$
- Then P optimally exercises at $t + \frac{1}{8}$
- But then A has incentives to recommend earlier exercise

In a general setting, show that all equilibria have a partition structure
Takeaways

• With a late exercise bias, P follows A’s recommendations
  • time gives P commitment power not to overrule A
  • commitment power makes communication efficient

• With an early exercise bias, time does not give commitment

• Implications for optimal allocation of control
  • Delegation is less valuable under late exercise bias
  • Direction of the bias is crucial for optimal allocation of control
Implications for allocation of control

Grenadier-Malenko-Malenko (2016) show in a more general setup:

1. Communication equilibrium implements the optimal mechanism with commitment when A is biased towards late exercise
   - but not when A is biased towards early exercise

2. Hence, delegation is never superior to centralization under late exercise bias
   - Decisions like plant closures should never be delegated

3. But delegation is optimal if bias is small under early exercise bias
   - Decisions like product launches should be delegated if the agent’s bias is small enough
Conclusions

- Relevant information is often dispersed. Decision-makers get advice from informed but biased parties.

- Conflicts of interest limit effective communication and thus hinder efficiency.

- Allocation of control crucially affects how informative and unbiased decisions are.