# Voting in Shareholder Meetings

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# Introduction

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  - shareholders hold managers accountable through votes on various issues
  - voting outcomes affect the firm's value

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  - shareholders typically hold different numbers of shares
  - shareholders have common objectives (i.e. they care to maximize the firm's value)
  - shareholders are imperfectly and asymmetrically informed
  - issues emerge exogenously or endogenously (i.e. management's proposals)

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  - shareholders are imperfectly and asymmetrically informed
  - issues emerge exogenously or endogenously (i.e. management's proposals)
- Intergovernmental entities with a well-defined purpose like ECB, NATO, IMF, etc.
- **Our main objective**: Identify the features of the voting mechanism that matter most for efficiency of outcomes in this setting.

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  - **voting efficiency:** does it help shareholders aggregate the available information efficiently?

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  - **voting efficiency:** does it help shareholders aggregate the available information efficiently?
  - **selection:** does it provide incentives to the management to propose good reforms and to veto bad ones?
- **When the proposal is exogenous we care only about voting efficiency**
- When the proposal is endogenous we care about both.

# Introduction

- According to the literature, **voting efficiency** is affected by the mechanism through:
  - **allocation of voting rights:** should number of votes depend on the number of shares? what if shareholdings and information precision are not (or, even, negatively) correlated)? (Nitzan and Paroush 1982; Azrieli 2018)

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  - **quota requirement for reform approval:** simple or super majority?

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  - **quota requirement for reform approval:** simple or super majority?

    (Austen-Smith and Banks 1996; Maug and Rydqvist 2009)
  - **flexibility in abstention:** should shareholders be allowed to abstain? if so, should they be allowed to abstain on any fraction of their votes? (Feddersen and Pesendorfer 1996; Bar-Isaac and Shapiro 2020)

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  - **1) the other two features of the voting system become irrelevant, and**
  - **2) the mechanism achieves full-information equivalence.**

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- **We prove that with maximum flexibility in abstention:**
  - **1) the other two features of the voting system become irrelevant, and**
  - **2) the mechanism achieves full-information equivalence.**
- Optimal intervention does not depend on the exact parametrization (e.g. correlation between shareholdings and information quality); ex-post equilibrium; uncertainty/ambiguity regarding the quality of information that other voters hold; no trade; misaligned shareholders)

# The Model

- Firm with a set $N = \{1, 2, ..., n\}$ of shareholders, with $n > 2$
  - shareholder $i \in N$ holds $d_i \in \mathbb{N}$ shares, with $\sum_{i \in N} d_i = m$
  - share distribution: $d = (d_1, d_2, ..., d_n)$
  - fraction of shares held by $i$: $h_i = \frac{d_i}{m}$
- Two alternatives: $K = \{A, B\}$
  - $A$ is proposal by management (for now, quality exogenous)
  - $B$ is status quo
- State-dependent preferences
  - Two states: $\Omega = \{\alpha, \beta\}$, with even prior
  - Shareholders' preferences:

$$\begin{aligned} u_i(A|\alpha) &= h_i,\ \ u_i(A|\beta) = -h_i, \\ u_i(B|\alpha) &= u_i(B|\beta) = 0. \end{aligned}$$

# The Model

- Each shareholder $i$ receives a signal $s_i \in S = [0, 1]$
  - distributed according to $F_i(\cdot|\omega)$, admits density $f_i(\cdot|\omega)$
  - conditional on the state, signals drawn independently
- The type of player $i$ is $t_i = \frac{f(s_i|\alpha)}{f(s_i|\beta)} \in T_i$

  **Assumption 1.** $t_i$ weakly increasing in $s_i$.

  - shareholders receiving higher signals attach larger probability to $\alpha$

  **Assumption 2.** $\exists \delta_i \in (0, 1)$ such that $\frac{f_i(0|\alpha)}{f_i(0|\beta)} = \delta_i$ and $\frac{f_i(1|\alpha)}{f_i(1|\beta)} = 1/\delta_i$.

  - no shareholder with arbitrarily precise information about the state
- For some results:

  **Assumption 3.** $t_i$ is continuous and $T_i = T \ \forall i$.

  - all types possible for one shareholder are possible for any other
- Allow for arbitrarily large differences in the expected information quality of two shareholders

- A voting mechanism $V$ associates a voting rule to $d$: $V(d) = \{X, w\}$
  - ballot space $X = (X_1, X_2, ..., X_n)$ with $X_i \subseteq \mathbb{R}$
  - threshold $w \in \mathbb{R}$
- Each shareholder $i \in N$ chooses $x_i \in X_i$
- The outcome is

$$G^w(x) = \begin{cases} A & \text{if} \quad \sum_{i \in N} x_i > w \\ AB & \text{if} \quad \sum_{i \in N} x_i = w \\ B & \text{if} \quad \sum_{i \in N} x_i < w. \end{cases}$$

where $AB$ denotes the fair lottery between $A$ and $B$.

We consider a broad class of voting mechanisms:

## Definition

A voting mechanism $V$ associates to any share distribution $d$ a voting rule $V(d) = \{X, w\}$, where $X = (X_1, X_2, ..., X_n)$ with $X_i \subseteq \mathbb{R}$ and $w \in \mathbb{R}$, and is such that each shareholder $i \in N$ chooses $x_i \in X_i$ and the outcome is [a]

$$G^w(x) = \begin{cases} A & \text{if} \quad \sum_{i \in N} x_i > w \\ AB & \text{if} \quad \sum_{i \in N} x_i = w \\ B & \text{if} \quad \sum_{i \in N} x_i < w. \end{cases}$$

where $AB$ denotes the fair lottery between $A$ and $B$.

[a] All results can be easily extended to a more general formulation of the voting rule $V(d) = \{X, w_A, w_B\}$ with $w_A \leq w_B$, where the outcome is A if $\sum_{i \in N} x_i > w_A$, B if $\sum_{i \in N} x_i < w_B$, and AB if $\sum_{i \in N} x_i \in [w_A, w_B]$.

# The Model

## Voting Mechanisms

- **1P1V** mechanism, $V^{1P1V}$

  $V^{1P1V}(d) = \{\times_{i\in N}\{-1,1\},0\}$
- **1P1V-D** mechanism, $V^{1P1V}$

  $V^{1P1V}(d) = \{\times_{i\in N}[-1,1],0\}$
- **1S1V** mechanism, $V^{1S1V}$

  $V^{1S1V}(d) = \{\times_{i\in N}\{-d_i, -d_i+1, -d_i+2, ..., d_i\},0\}$

Two extreme variants of *1S1V*

- **1S1V-R** mechanism, $V^{1S1V-R}$

  $V^{1S1V-R}(d) = \{\times_{i\in N}\{-d_i, d_i\},0\}$
- **1S1V-D** mechanism, $V^{1S1V-D}$

  $V^{1S1V-D}(d) = \{\times_{i\in N}[-d_i, d_i],0\}$.

  A voting rule $\{X, w\}$ is a continuous voting mechanism if there exists $(\psi_i)_{i\in N} \in \times_{i\in N} int(X_i)$, such that $\sum_{i\in N}\psi_i = w$

# The Model

- For each mechanism:
  - strategy is $\sigma_i : T \to \Delta(X_i)$
  - $\hat{\sigma}_i(x)$ denotes a potential realization of the random variable $\sigma_i(x)$
- We focus on Bayesian Nash Equilibria (BNE)

# Welfare Benchmarks

- Two benchmarks for different purpose:
  - Efficiency
  - Comparison of mechanisms
- Based on decision of common-value shareholders with different information

# Welfare Benchmarks

- **Efficiency**
- If common-value shareholders know the signal profile

**Definition**

Efficient outcome $E$: $A$ if $\Pr(\alpha|s) > \frac{1}{2}$, $B$ if $\Pr(\beta|s) > \frac{1}{2}$, $AB$ otherwise.

- Natural implementation notion:

**Definition**

$V$ is efficient if it implements the efficient outcome in a BNE.

# Welfare Benchmarks

- **Comparison of mechanisms**
- If common-value shareholders know the state

**Definition**

Correct outcome is $A$ in state $\alpha$, $B$ in state $\beta$.

- Focus on ex-ante probability of implementing the correct outcome

**Definition**

Voting mechanism $V$ dominates voting mechanism $V'$ given a share distribution $d$ if (i) for every BNE of $V'(d)$, there is a BNE of $V(d)$ such that the ex-ante probability of implementing the correct outcome is higher under $V$ than $V'$; and (ii) for every BNE of $V(d)$, there is a BNE of $V'(d)$ such that the ex-ante probability of implementing the correct outcome is lower under $V'$ than $V$. If, moreover, either (i) or (ii) (or both) hold strictly, we say that $V$ strictly dominates $V'$.

# Comparing Mechanisms

## Lemma

$\Pr(\alpha|s) > \frac{1}{2} \Leftrightarrow \sum_{i \in N} \ln(t_i) > 0$. *(Nitzan and Paroush, 1982)*

## Proof.

First, note that

$$\Pr(\alpha|s) = \frac{\prod_{i \in N} f_i(s_i|\alpha)\Pr(\alpha)}{\prod_{i \in N} f_i(s_i|\alpha)\Pr(\alpha) + \prod_{i \in N} f_i(s_i|\beta)\Pr(\beta)}$$

Thus, $\Pr(\alpha|s) > 1/2$ requires

$$\begin{aligned} \prod_{i \in N} f_i(s_i|\alpha) &> \prod_{i \in N} f_i(s_i|\beta), \text{ or} \\ \sum_{i \in N} \ln\left(\frac{f_i(s_i|\alpha)}{f_i(s_i|\beta)}\right) &> 0. \end{aligned}$$

$\square$

# Comparing Mechanisms

Consider a group of voters with the type space $T = \{\frac{1}{e^{10}}, \frac{1}{e}, e, e^{10}\}$.

- $V = \{\times_{i \in N}\{-10, -1, 1, 10\}, 0\}$ allows them to secure the efficient outcome if they each cast $\ln(t_i)$ votes in favor of $A$.
- Such a mechanism also makes the "inefficient" outcome (i.e., $A$ when $\Pr(\alpha|s) < \frac{1}{2}$ and $B$ when $\Pr(\alpha|s) > \frac{1}{2}$) attainable, since a voter of type $t_i$ could cast $-\ln(t_i)$ votes in favor of $A$.
- Under $V' = \{\times_{i \in N}\{-10, 10\}, 0\}$ neither the efficient or the inefficient outcome is attainable.

# Comparing Mechanisms

**Definition**

Consider two voting mechanisms, $V$ and $V'$, with associated rules $V(d) = \{X, w\}$ and $V'(d) = \{X', w\}$. If $X'_i \subseteq X_i$ for every shareholder $i$ and every share distribution $d$, then $V$ is said to have a richer ballot space than $V'$.

We are now ready to state our first main result.

**Proposition**

*If a finite mechanism $V$ has a richer ballot space than mechanism $V'$, and $d$ is such that there is no decisive shareholder, then $V$ dominates $V'$.*

- Sketch of the proof:
  - (Best) McLennan (1998), and any outcome under $V'$ can be reproduced under $V$ by simply replicating the strategy
  - (Worst) Any BNE is equivalent in terms of welfare to a profile of monotone strategies (reordering method). A profile of monotone strategies is at least as good as a constant equilibrium.

# Comparing Mechanisms

**Corollary**

*1S1V weakly dominates both 1S1V-R and 1P1V. For some values of the parameters, the dominance is strict.*

Strict dominance? numerical example

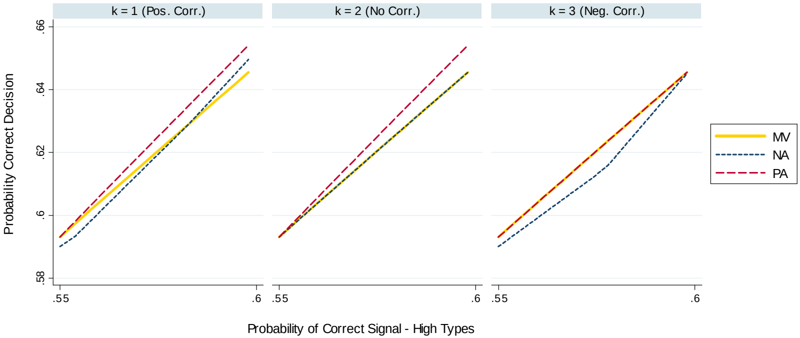
# Comparing Mechanisms

## Binary example

- Firm with six shareholders
  - shareholders 1 to 3 hold $k \in \{1, 2, 3\}$ shares each
  - shareholders 4 to 6 hold $4 - k$ shares each
- Binary signals, $s_i \in \{a, b\}$
  - $p(a|\alpha) = p(b|\beta) = .55$ for shareholders $1 - 3$
  - $p(a|\alpha) = p(b|\beta) = p_H \in [.55, 1)$ for shareholders $4 - 6$

# Comparing Mechanisms

## Binary example



# Efficient Mechanism

- To be efficient, the voting mechanism must have a ballot space at least as rich as signal space
- We can achieve a full characterization of
  - voting mechanisms that lead to efficiency in equilibrium
  - complete set of efficient equilibria corresponding to each such mechanism

# Continuous Voting

## Proposition

*$V^{1S1V-D}(d)$, admits a unique (up to admissible multiplicative and additive constants) efficient BNE, $\sigma^{1S1V-D}$, and it is such that $\sigma_i^{1S1V-D}(t_i) = c \ln t_i + \kappa_i$ with $\sum_{i \in N} \kappa_i = 0$ and $c \in \left(0, \min\left\{\frac{-d_i - \kappa_i}{\ln \delta}, \frac{-d_i + \kappa_i}{\ln \delta}\right\}\right]$ for every $i \in N$.*

- Sketch of the proof:
  - observation: $\Pr(\alpha | s) > \frac{1}{2} \Leftrightarrow \sum_{i \in N} \log(t_i) > 0$
  - equilibrium strategy means $A$ wins iff $\sum_{i \in N} c \log(t_i) > 0 \rightarrow$ efficient
  - $\sigma$ maximizing ex ante welfare is equilibrium
  - uniqueness? every $\sigma \in \Sigma^*_{V^{1S1V-D}}$ must be such that
    - $sgn\left(\sum_{i \in N} \widehat{\sigma}(t_i)\right) = sgn\left(\sum_{i \in N} \ln(t_i)\right)$
    - only strategies above satisfy that condition

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- Two features of *1S1V-D* contrast with the previous rules
  1. $\sigma^{1S1V-D}$ independent of the information technology of others
     *1S1V-D* remains efficient when uncertainty/ambiguity about info. technology
  2. Efficient equilibrium for *any* majority requirement
  3. Efficiency does not depend on the allocation of votes

## Proposition

*A mechanism is efficient iff it is a continuous voting mechanism.*

# Robustness

- We explore the robustness of the
  - efficiency of continuous mechanisms
  - dominance of mechanisms with richer ballot spaces
- We focus on the following
  1. Partisan shareholders**
  2. Endogenous information*

# Robustness

## Partisans

- Disagreement among shareholders not only information asymmetries, also differences in preferences (Bolton et al., 2020)
  - differences in portfolio allocation (Cohen and Schmidt 2009), business ties (Davis and Kim 2007, and Cvijnovic et al. 2016), reputational concerns (Chevalier and Ellison 2009), and political and social goals (Woidtke 2002)

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- Model with two additional types of shareholders: $A$ and $B$

$$\forall D \in \{A, B\}, \forall \omega \in \{\alpha, \beta\}, \quad \begin{cases} u_i^A(d,\omega) & = h_i \times \mathbf{1}_{\{D=A\}} \\ u_i^B(d,\omega) & = h_i \times \mathbf{1}_{\{D=B\}} \end{cases}$$

- Fraction of shares held by partisans: $h_A$ and $h_B$

# Robustness

## Partisans

- Two cases:
  - $h_A$ and $h_B$ are common knowledge
  - $h_A$ and $h_B$ are **not** common knowledge*
- The mechanisms distribute power "similarly".

# Robustness

## Partisans

### Proposition

*Consider that $h_A$ and $h_B$ are common knowledge. Then: (i) if a finite mechanism $V$ has a richer ballot space than mechanism $V'$ –but the two mechanisms distribute power similarly– and $d$ is such that there is no decisive voter, then $V$ dominates $V'$; and (ii) if $d$ is such that $h_C > |h_A - h_B|$, then $V^{1S1V-D}$, admits an efficient BNE.*

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- Intuition:

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- Intuition:
  - partisans have one undominated strategy: vote $+d_i$ or $-d_i$
  - say $h_A > h_B \rightarrow$ as if mechanism biased against $B$
  - other shareholders compensate for bias

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- Intuition:
  - partisans have one undominated strategy: vote $+d_i$ or $-d_i$
  - say $h_A > h_B \longrightarrow$ as if mechanism biased against $B$
  - other shareholders compensate for bias
  - two modifications to efficient strategy:
    - ★ rescale strategy by factor $\left(1 - \frac{h_A - h_B}{h_C}\right)$ to leave room for compensation
    - ★ include $d_i \times \frac{h_A - h_B}{h_C}$ points in favor of $B$ on her ballot

# Robustness

## Partisans

- Presence of known number of partisans can reinforce dominance of *1S1V* over *1S1V-R*

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## Partisans

- Presence of known number of partisans can reinforce dominance of *1S1V* over *1S1V-R*
- Why?
  - presence of partisans makes information aggregation under *1S1V-R* less efficient
  - problem: shareholders cannot at the same time reveal their information and compensate for the bias
  - evident when one allows for asymmetric strategies
    - under *1S1V-R*, some shareholders specialize in compensating for the bias and others in sharing information (i.e., they vote sincerely)
    - information of shareholders who compensate for the bias is lost

# Robustness

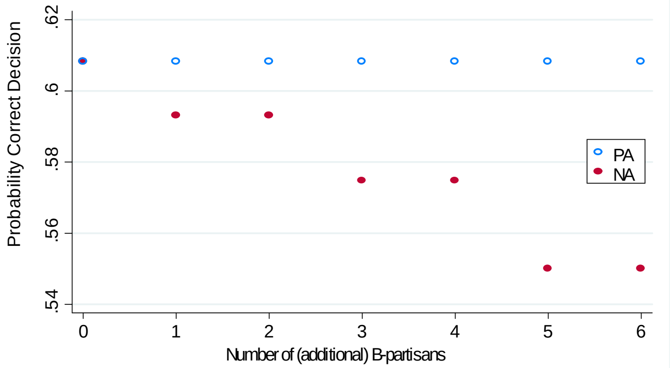
## Partisans

- Presence of known number of partisans may reinforce dominance of *1S1V* over *1S1V-R*

# Robustness

## Partisans

- Presence of known number of partisans may reinforce dominance of *1S1V* over *1S1V-R*
- Example with 7 voters, $\Pr(s_\alpha|\alpha) = \Pr(s_\beta|\beta) = 0.55$ (w/o partisans no difference)



# Conclusion

- We study information aggregation in shareholder meetings
  - Unknown correlation between shareholdings and information quality
- We compare the performance of different mechanisms
  - Special focus on abstention flexibility
- Exogenous proposal
  - Abstention flexibility more important than allocation of voting weights/proper setting of quota requirements
  - Robust in several directions
- Endogenous proposal
  - Trade-off between selection and voting efficiency underlying the comparison of *1P1V-D* and *1P1V*

Thank you!