The Short-Termism Trap: Competition for Informed Investors under Stock-Based CEO Compensation

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Short-termism

- Corporate short-termism–companies systematically take too short a view and do not invest enough for the long term–has been criticized often, and is widely believed (e.g., McKinsey study)
- One common view is that CEOs of publicly listed companies have short-term pressure from the financial markets

Stock-based compensation

Does stock-based compensation promote long-term value of firms?

- Stock prices are informative about firms' future value
- Properly designed stock-based compensation can mitigate agency problems (e.g., Holmstrom and Tirole, 1993)
- Thus, it allows firms to pursue longer-term projects

This is a bright side of stock-based compensation

Competition for informed trading

This paper: a dark (GE) side of stock-based compensation

- Prices are more useful if they are informative
- Firms must attract informed trading to benefit more from prices
- But, informed investors capital is limited
  (Dow and Han, 2018; Dow, Han and Sangiorgi, 2021)
- Competition for informed trading can lead to corporate decisions that are privately optimal but socially inefficient

Preview of Results

Information-based channel for corporate short-termism. Mechanism:

- Investors with limited capital have incentives to produce (and trade on) information with shorter horizon
  - Long-term information is slow to be incorporated into prices
- Firms react to this by shortening project maturities
  - This behaviour is privately optimal
  - But, there is a negative externality on other firms
- Competition for informed trading results in excessive short-termism (compared to a second-best (constrained efficient) benchmark)

Literature on corporate short-termism

- Narayanan (1985); Stein (1989)
  - Managerial short-termism arises against the wishes of shareholders
- Optimal incentive scheme in Bolton, Scheinkman, and Xiong (2006)
  - But, market pricing is inefficient
- Short-termism emerges as a coordination failure in Piccolo (2022)
- Short-termism emerges as second-best outcome in Edmans, Gabaix, Sadzik, and Sannikov (2012), Varas (2018), Takor (2021), in Hackbarth, Rivera, and Wong (2021)
- Socially excessive (not second-best) short-termism
  - Milbradt and Oehmke (2015). Long-term projects are more costly to finance, so LT types pretend they are ST types (maturity rat race)
  - Thanassoulis (2013), Chemla, Rivera, and Shi (2021). Firms compete for managers and short-termism transmits through the labour market
  - No equity market in these models, not an information story

Literature on corporate short-termism (empirical)

Empirical literature mainly suggest shorter term incentives lead to apparently short-termist decisions; effects on value less clear

- Edmans, Fang, and Lewellen (2017). Options vesting correlated with cuts to investment
- Ladika, Sautner, (2020): (nearly random) accelerated option vesting lead to higher earnings in the short term, higher equity sales
- Cremers, Pareek and Sautner, (2021). More short term investors (admitted to Russell 2000) means cuts to LT investment, increase in earnings. Temporary increase in value
- Gianetti and Yu, (2019). Firms with more short term investors respond better to change
- Edmans, Fang, Huang (2021). Vesting options lead to more share repurchases, more M&A (also interpreted as boosting share price in short term)

Roadmap

1. Setup
   - Corporate sector
   - Financial sector
2. Optimal choices
   - Price efficiency
   - Contracts
   - Maturity choice
3. Equilibrium
   - Properties
   - Benchmarks
   - Comparative statics
4. Extensions
   - Salary cap
   - Long-term investors
5. Conclusions

Setup

Three-period economy ($t = 0, 1, 2$) with:

(1) A corporate sector
- N firm-manager pairs

(2) Financial markets
- Continuum (unit mass) of informed investors
- Market makers
- Noise traders

Firms

- N firms; each firm starts at $t = 0$ with a project
- Its owners choose the project duration and the management contract
- Project duration: probability τ it will liquidate late at $t = 2$ (otherwise it liquidates early at $t = 1$)
- At liquidation, firm n's output is

$$V^n \equiv f(\tau^n) + R^n, \text{ where } R^n = \begin{cases} \Delta V & \text{if the project is successful } (S) \\ 0 & \text{otherwise } (F) \end{cases}$$

- $f(\cdot)$ is increasing: long-term projects are more efficient
- Payoffs are independent across firms

Managers

- Firms need a manager to run the project
- Manager's effort choice $e \in \{L, H\}$ is private information
- Success probability

$$\rho(e^n) = \begin{cases} \rho_H & \text{if } e^n = H \\ \rho_L & \text{if } e^n = L \end{cases}, \text{ where } \rho_H > \rho_L$$

Each manager:

- has utility

$$u\left(w^n\right) - \mathbb{1}_{\{e^n = H\}} K$$

- is subject to limited liability and an outside option
- exits the economy in $t = 1$ with probability $\delta \in [0, 1]$

Stock markets

Each firm's stock (a claim on the project payoff) is traded at $t = 0, 1$ (after projects have been chosen) among:

- A risk-neutral market maker
- Noise traders. Order flow in firm n: $Z^n \sim U[-\bar{z}/2, \bar{z}/2]$
- A mass μ^n of informed traders (endogenous)

Informed Investors

Each informed investor:

- is risk-neutral
- can produce information about one firm
- can hold at most one unit of one stock (either long or short)
- must exit the economy in $t = 1$ with probability $\gamma \in (0, 1)$

Information

- Investors who investigate firm n receive signal $s^n \in \{G, B\}$
- Signals are informative about managerial effort:

$$\sigma_G \equiv pr\left(s^n = G \,|e^n = H\right)$$
$$\sigma_B \equiv pr\left(s^n = G \,|e^n = L\right)$$

  where $\sigma_G > \sigma_B$

- Signals are sufficient statistic for project outcome (Holmstrom and Tirole 1993)

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Stock prices and information revelation

In $t = 0$, the price of stock n is either fully-revealing or non-revealing

Lemma

If μ^n mass of informed traders trade on private information on stock n, the probability of information revelation for stock n at $t = 0$ is

$$\lambda^n = \frac{\mu^n}{\bar{z}}$$

Trading at $t = 1$ is uninteresting: noise traders reverse their positions with probability γ at $t = 1$ (no new information)

Financial Market Equilibrium

- Investors' expected trading gains should be the same for all stocks:

$$(1-\lambda^n)(1-\gamma\tau^n) = (1-\lambda^m)(1-\gamma\tau^m), \quad \text{for all } n, m \in \mathcal{N} \qquad (1)$$

  - Mispricing-duration tradeoff: if $\tau^m > \tau^n$, then $\lambda^m < \lambda^n$
- Because there is one unit mass of informed investors,

$$\sum_{n=1}^{N} \lambda^n = \frac{1}{\bar{z}} \qquad (2)$$

Proposition

- *Given $\{\tau^n\}_{n\in\mathcal{N}}$, there is a unique $\{\lambda^n\}_{n\in\mathcal{N}}$ that satisfies Eqs. (1)-(2).*
- *λ^n is decreasing in τ^n and increasing in τ^m for all $m \neq n$*

When a firm decreases its τ, it has negative externality on other firms

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Optimal contracts

- States relevant for the contract:
  - (i) price reveals the good signal ($\omega = G$)
  - (ii) price reveals the bad signal ($\omega = B$)
  - (iii) price is non-revealing and the manager stays until success ($\omega = S$)
  - (iv) price is non-revealing and the manager stays until failure ($\omega = F$)
  - (v) price is non-revealing and the manager exits before outcome ($\omega = \emptyset$)
- An optimal contract minimizes the shareholders' wage bill

$$\mathcal{W}^n(\tau^n) \equiv \min_{\{w_G^n, w_B^n, w_S^n, w_F^n, w_\emptyset^n\}} E\left[\tilde{w}^n\right],$$

subject to the manager's PC, IC, and limited liability

Optimal contracts (cont'd)

Proposition

- *There exists a unique optimal contract and it is such that* $w_B^{*n} = w_F^{*n} = w_\emptyset^{*n} = 0$ *and* $w_G^{*n} > w_S^{*n} > 0$
- *The wage bill* $\mathcal{W}^n$ *is increasing and convex in* τ^n.

Intuition:

- Wage bill is decreasing in price efficiency
- Price efficiency is decreasing in project duration
- Therefore, long-term projects carry a higher agency cost

Maturity choice

- Firm n's optimization problem:

$$\max_{\tau^n \in [0,1]} \mathcal{V}^n(\tau^n) - \mathcal{W}^n(\tau^n) \tag{3}$$

  - $\mathcal{V}^n(\tau^n)$ is the expected project's payoff given $e = H$
  - $\mathcal{W}^n(\tau^n)$ is the wage bill under the optimal contract
- Given other firms' $\{\tau^m\}_{m \in \mathcal{N} \setminus \{n\}}$, there is a unique solution τ^{*n} to (3)

Maturity choice (cont'd)

Proposition

Firms' maturity choices are strategic complements: $\frac{\partial \tau^{*n}}{\partial \tau^{m}} > 0$ *for* $m \neq n$

- When a firm shortens its τ, it increases its λ at the cost of others
- Other firms' agency cost goes up
- Other firms also shorten τ to regain price informativeness

Equilibrium

Definition

An equilibrium consists of project maturity choices $\{\tau^n\}_{n\in\mathcal{N}}$, price informativeness $\{\lambda^n\}_{n\in\mathcal{N}}$, and compensation contracts $\{\tilde{w}^n\}_{n\in\mathcal{N}}$ s.t.,

1. Each τ^n maximizes firm value in Eq. (3) given $\{\tau^m\}_{m\in\mathcal{N}\setminus\{n\}}$
2. $\{\lambda^n\}_{n\in\mathcal{N}}$ satisfy investors' indifference condition Eq. (1) and the informational resource constraint Eq. (2)
3. Each $\tilde{w}^n$ minimizes the expected cost of managerial compensation

Equilibrium (cont'd)

Theorem

There exists a unique equilibrium; it is symmetric and interior

In equilibrium,

$$\lambda^n = \frac{1}{N\bar{z}} \quad \text{for all } n \in \mathcal{N}$$

- Price efficiency is the same regardless of equilibrium τ
- Competition for informed trading leads to a loss in shareholder value

Benchmarks

We study two benchmark cases:

(i) No financial market (autarky)

(ii) Informed investors cannot switch among stocks (exogenous information). This corresponds to the second-best case:

$$\max_{\tau^s \in [0,1]} \sum_{n=1}^{N} [\mathcal{V}^n(\tau^s) - \mathcal{W}^n(\tau^s)]$$

Theorem

- *Exogenous information has longest maturity and shareholder value*
- *Endogenous information may have shorter maturity than autarky*

Equilibrium is constrained inefficient

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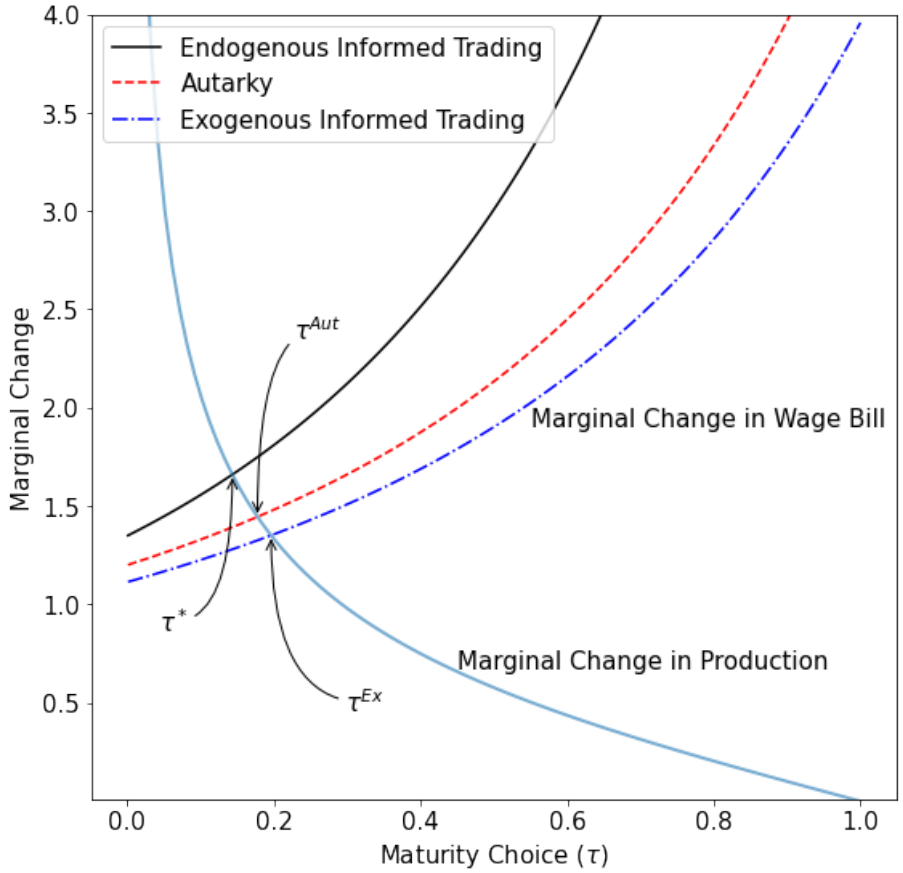
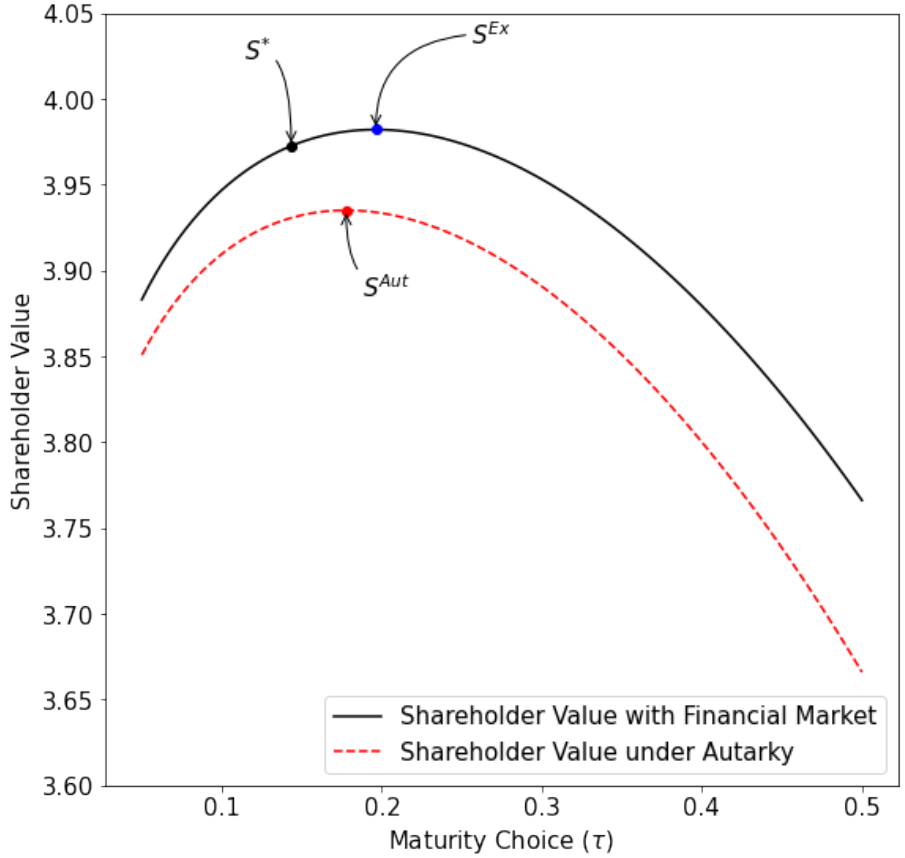


(a) Maturity Choice



(b) Shareholder Value

Figure: **Equilibrium Short-termism and Shareholder Value.**

Comparative statics

Proposition

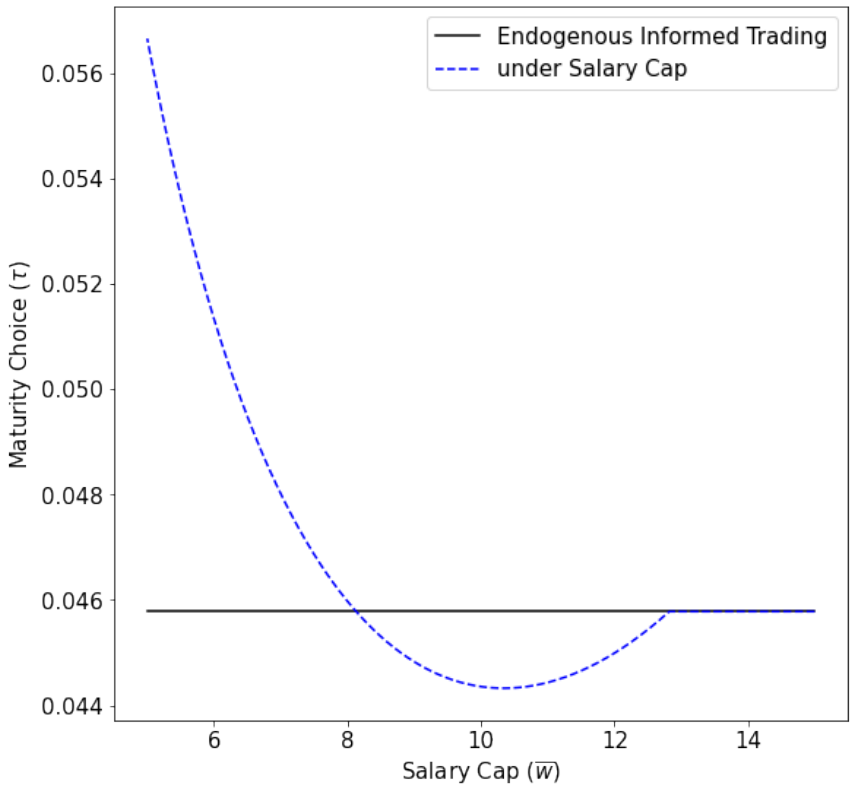
1. *(Competition) Fixing $N\bar{z}$, higher competition (larger N) induces more short-termism and lower shareholder value*
2. *(Investor short-termism) A shift in investor preferences toward early consumption induces more short-termism and lower shareholder value*
3. *(Agency problem) An increase in managers' impatience or effort cost induces more short-termism and lower shareholder value*

- In (1) and (2), competition for informed trading is more intense
- (3) also holds in the second best, but there is an amplification effect (strategic complementarities)

Salary cap

Augmented the contracting problem by the constraint that

$$w_G^n, w_B^n, w_S^n, w_F^n, w_\emptyset^n \leq \bar{w}.$$



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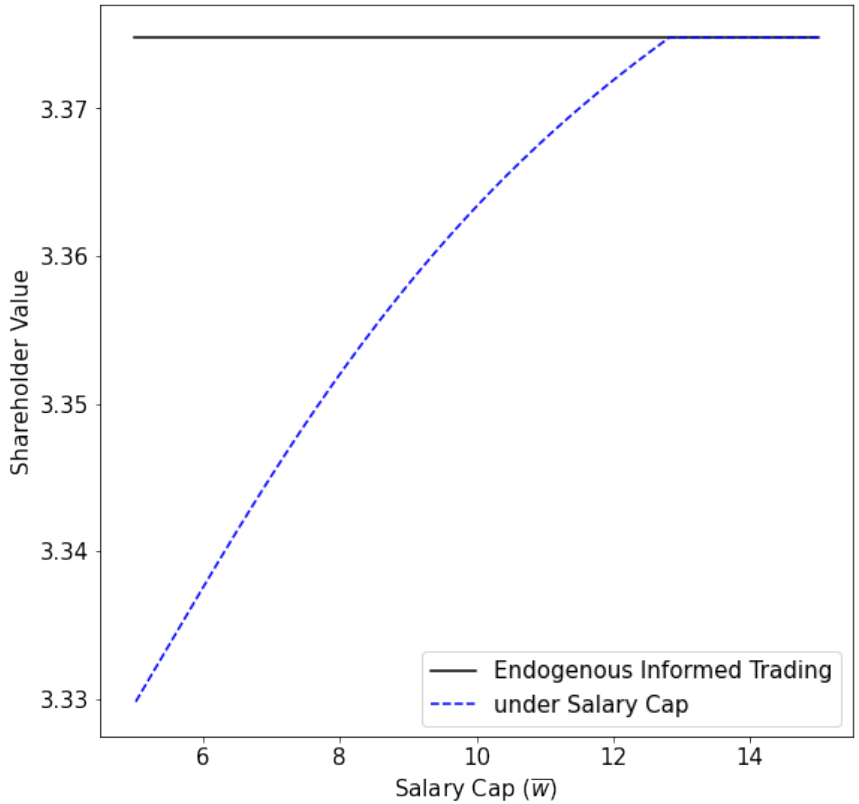

(b) Shareholder Value

Figure: **Equilibrium Short-termism and Shareholder Value under Salary**

Symmetric equilibrium with long-term investors

- A fraction μ of "long-term investors" stay until $t = 2$
- A fraction $1 - \mu$ "short-term investors" exit in $t = 1$ with prob. γ

Proposition

(i) *For $\mu \leq \mu^* < 1/N$, the equilibrium is identical to the case without long-term investors*

(ii) *For $\mu \geq 1 - 1/N$, equilibrium is identical to case with exogenous informed trading*

(iii) *For $\mu \in [1/N, 1 - 1/N)$, there is no symmetric equilibrium*

- Long-term investors have no impact if their mass is small

Clientele equilibrium

Proposition

- *For* $1-(N-1)\,\bar{z} < \mu < 1-\frac{1}{N}$ *there exists a clientele equilibrium in which a fraction* α_S *choose maturity* τ_S *and a fraction* $1-\alpha_S$ *of firms choose maturity* τ_L*, where* $\tau^* < \tau_S < \tau_L < \tau^{Ex}$
- *Short-term investors invest in short-term firms and long-term investors invest in long-term firms*

- Ex-ante identical firms become ex-post heterogeneous
- Long-term firms are more productive but have less informative prices

Conclusion

- Competition for investor "attention" (limited capital, not bounded rationality) leads to excessive short-termism that destroys firm value
- Informed investors' "short term" preferences transmit to firms

Equilibrium in the financial market: details

Given informed investor i's choice to produce information on stock n, we can represent the maximization problem as follows:

$$J_0^n \equiv \max_{x_i^n(0)\in\{-1,0,1\}} -E[P^n(0)|s^n]x_i^n(0)+\gamma\Gamma^n(s^n)x_i^n(0)+(1-\gamma)\mathrm{E}[J_1^n(x_i^n(0),P^n(0))|s^n],$$

where

$$\Gamma^n(s^n) \equiv (1-\tau^n)\mathrm{E}[V^n|s^n] + \tau^n\mathrm{E}[P^n(1)|s^n],$$

and

$$\begin{aligned} J_1^n(x_i^n, P^n(0)) \equiv{}& \mathrm{E}[V^n|s^n]x_i^n \\ &+ \tau^n(1-|x_i^n|)\max_{x_i^n(1)\in\{-1,0,1\}} \mathrm{E}[(V^n - P^n(1))|s^n, P^n(0)]x_i^n(1). \end{aligned}$$

Evidence on stock price short-termism

Empirical evidence consistent with long-term information not fully incorporated into prices and delivering abnormal long-term returns:

- high R&D expenditures (Lev and Sougiannis (1996))
- advertising expenditures (Chan, Lakonishok, and Sougiannis (2001))
- patent citations (Deng, Lev, and Narin (1999))
- software development costs (Aboody and Lev (1998)),
- employee satisfaction indexes (Edmans (2011))