Too Much, Too Soon, for Too Long: The Dynamics of Competitive Executive Compensation

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- Compensation increases more when CEOs move. Custódio Ferreira Matos 2013, Falato Li Milbourn 2015.

- And, pay disclosure led to higher pay. Gipper 2021.

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  - **Endogenous outside options**.
- Termination threats undermined by future outside options available.
- Compensation externality $\Rightarrow$ equilibrium inefficient.
- **Yes**: CEOs are paid too much, too soon, and stay for too long.

Literature

- Dynamic agency in partial equilibrium

  Bolton Scharfstein 1990, Bolton Schienkman Xiong 2005, **DeMarzo Sannikov 2006**, **Biais Mariotti Plantin Rochet 2007**, Biais Mariotti Rochet Villeneuve 2010, Edmans Gabaix Sadzik Sannikov 2012, Hoffman Inderst Opp 2020.

- Competition and pay for talent

  Gabaix Landier 2008, Terviö 2008, Bettignies Chemla 2008, Edmans Gabaix Landier 2009, Glode Lowery 2015, Axelson Bond 2015, Bénabou Tirole 2016.

- Externality in general equilibrium

  Bloch Gomes 2006, Cooley Marimon Quadrini 2020.

  Corporate governance externality: Acharya Volpin 2009, **Dicks 2012**, Levit Malenko 2016.

Outline

- Illustrative Two-Period Model
- Full Dynamic Model
    - Quantitative Analysis
- Policies
- Extensions:
    - Bargaining
    - Search
    - Coordination

Illustrative Two-Period Model

Environment

- Two periods, $t = 1, 2$.

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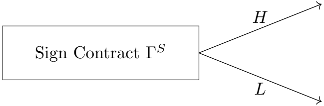

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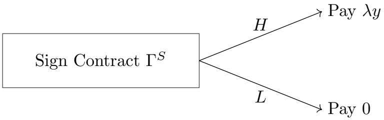

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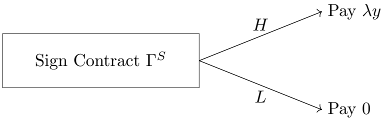

- $\Rightarrow$ Outside options:

$$R = \delta \lambda \mu - \kappa_A,$$
$$L = (1 - \lambda)\,\mu - \kappa_P.$$

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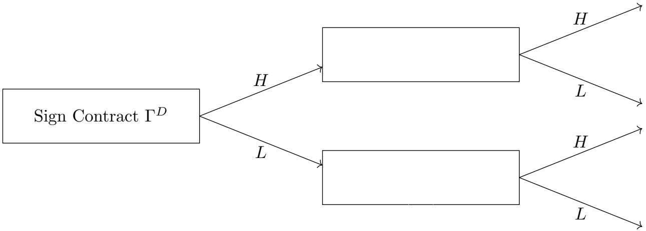

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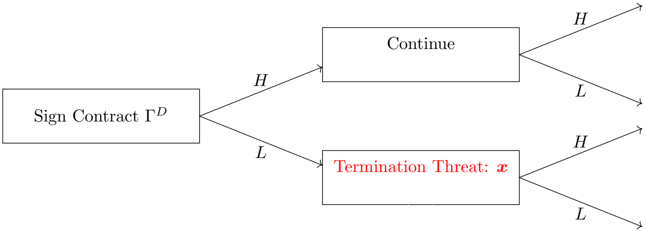

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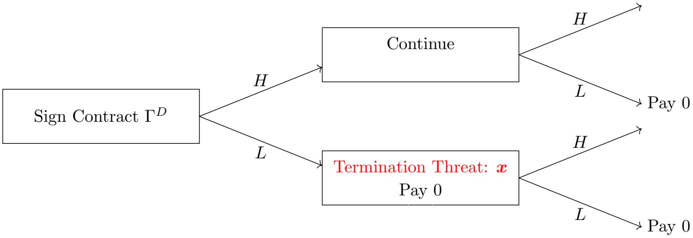

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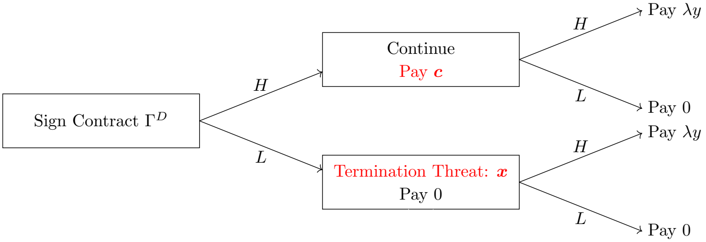

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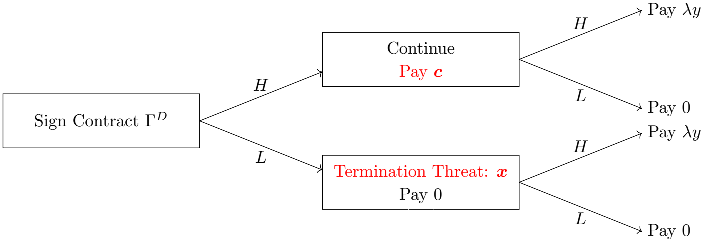

- Termination in L state reduces cost of incentive provision in H state:

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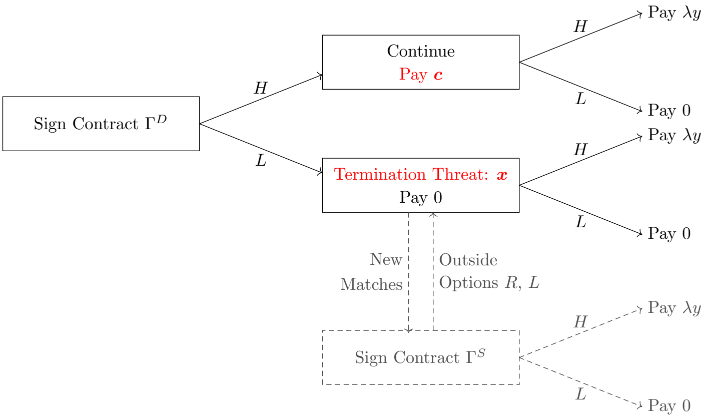

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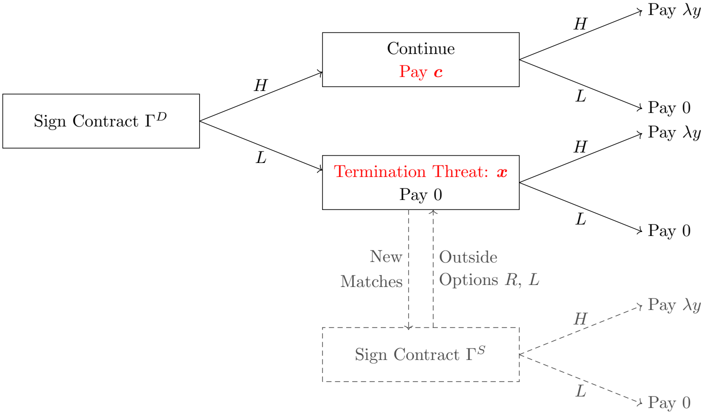

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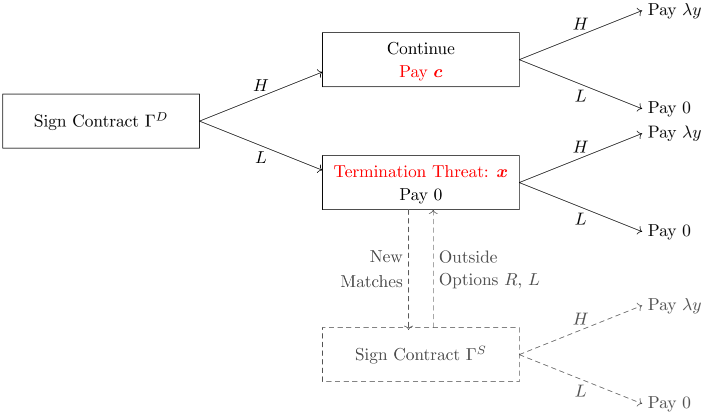

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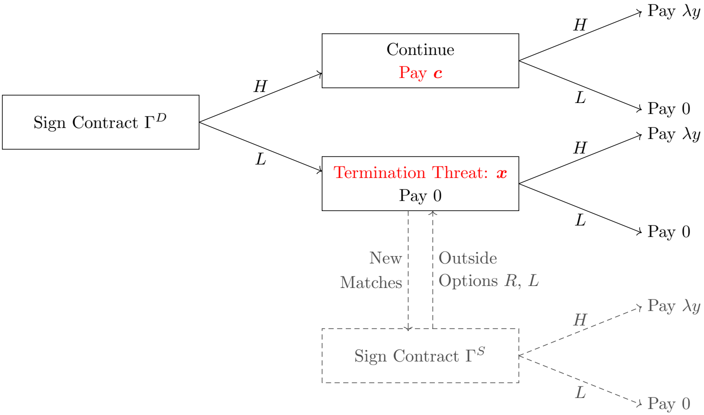

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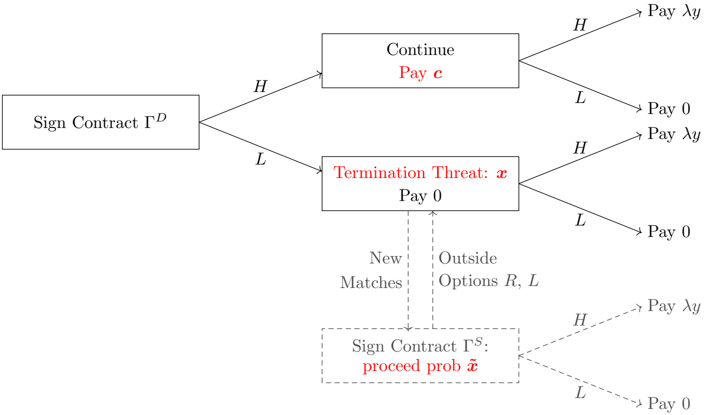

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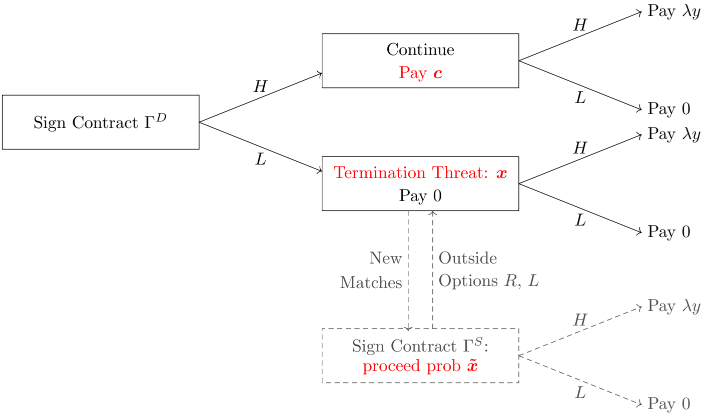

- Distorting outside options, $\tilde{x} < 1$, improves shareholder value *iff*

$$p \cdot \boldsymbol{\delta \lambda \mu} > (1 - p) \cdot \mathbf{(1 - \boldsymbol{\lambda})}\, \boldsymbol{\mu}$$

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(i) If $\kappa_A < \frac{\lambda}{1-\lambda}\kappa_P$, all outside matches are shut down, $\tilde{x}=0$.

$\kappa_A \leq \frac{1-p}{p}\kappa_P$: shareholders gain $\Delta\mu$.

$\kappa_A > \frac{1-p}{p}\kappa_P$: shareholders gain $\Delta\mu - p\kappa_A + (1-p)\kappa_P$.

(ii) If $\kappa_A \geq \frac{\lambda}{1-\lambda}\kappa_P$, outside matches prob $\tilde{x} = \frac{\kappa_A}{\lambda\mu}$.

Shareholders gain $\left(1-\frac{\kappa_A}{\delta\lambda\mu}\right)\Delta\mu$, where $\Delta \equiv p\delta\lambda-(1-p)(1-\lambda)$.

▸ General welfare criteria

Full Dynamic Model

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- Time is continuous and infinite.
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$$\Gamma = (\underbrace{C}_{\text{compensation}}, \underbrace{\tau}_{\text{termination}}), \quad \text{where} \quad C = \{C_t\}_{t \geq 0}$$

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- Principal and agent payoffs:

$$F_0(\hat{Y};\Gamma) \equiv \mathbb{E}\left[\int_0^\tau e^{-rt}(d\hat{Y}_t - dC_t) + e^{-r\tau} \underbrace{L}_{\text{liquidation value}}\right]$$

$$W_0(\hat{Y};\Gamma) \equiv \mathbb{E}\left[\int_0^\tau e^{-\gamma t}\left(dC_t + \lambda(dY_t - d\hat{Y}_t)\right) + e^{-\gamma\tau} \underbrace{R}_{\text{outside option}}\right].$$

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- Agent continuation value at time t:

$$W_t(\hat{Y};\Gamma) \equiv \mathbb{E}\left[\int_t^\tau e^{-\gamma(s-t)}\left(dC_s + \lambda(dY_s - d\hat{Y}_s)\right) + e^{-\gamma(\tau-t)} R\right].$$

Principal-agent problem

- Principal:

$$\max_{\Gamma, W_0} \; F_0(Y;\Gamma) \tag{$\mathcal{P}$}$$

s.t.

$$W_0(Y;\Gamma) \geq W_0 \qquad \text{(Promise Keeping)}$$

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- Solution Γ^* delivers

$$W_0^* = W_0(Y;\Gamma^*) \quad \text{and} \quad F_0^* = F_0(Y;\Gamma^*)$$

Equilibrium definition

Definition 1: *An equilibrium consists of* Γ^*, W_0^*, F_0^*, R^*, *and* L^* *such that:*

I) Given (R^*, L^*), (Γ^*, W_0^*) solves the problem $(\mathcal{P})$.

II) Manager outside option and firm liquidation value satisfy

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- Two-step characterization:
  1. **Partial equilibrium** I) $\Rightarrow$ DeMarzo Sannikov 2006.
     (a). optimal incentive contract design Γ.
     (b). starting compensation level W_0.
  2. **General equilibrium** II): endogenous outside options (R, L).

Optimal incentive contract

Lemma 3: *The optimal incentive contract Γ has the following features:*

I) **Pay-performance sensitivity.** Manager initial value W_0 and evolves:

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II) **Deferral.** A payout threshold $\bar{W}$ such that

$$dC_t = \begin{cases} 0, & \text{if } R \leq W_t < \bar{W} \\ W_t - \bar{W}, & \text{if } W_t \geq \bar{W}. \end{cases}$$

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III) **Termination.** When continuation value W_t hits outside option R:

$$\tau = \min\{t | W_t = R\}.$$

Optimal incentive contract

Corollary 1: *Given (R, L), firm value $F(W; R, L)$ concave and satisfies:*

$$rF(W;R,L) = \mu + \boldsymbol{\gamma W} F'(W;R,L) + \frac{1}{2}\boldsymbol{\lambda}^2\sigma^2 F''(W;R,L), \text{ if } R \le W < \bar{W}$$
$$F'(W;R,L) = -1, \qquad \text{if } W \ge \bar{W}$$

with boundary conditions

$$\underbrace{F(\boldsymbol{R};R,L) = L}_{\text{termination}} \quad \text{and} \quad \underbrace{rF(\bar{\boldsymbol{W}};R,L) = \mu - \gamma\bar{W}}_{\text{payout}}$$

Equilibrium compensation

Proposition 1: *Equilibrium compensation* W_0^* *is characterized by:*

$$F'(W_0^*; R^*, L^*) = 0$$

▸ Assumption and existence

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- Restrict to *time-invariant* contract Γ. Pareto improvements

Equilibrium inefficiency

Proposition 2: *Socially-optimal compensation* W_0^p *is characterized by*

$$F'(W_0^p; R^p, L^p) + \underbrace{\frac{\partial}{\partial R} F(W_0^p; R^p, L^p)}_{\text{compensation externality}<0} \leq 0, \quad \text{with } = \text{ if } W_0^p > \kappa_A.$$

▸ One-sided firm coordination

Equilibrium inefficiency

Proposition 2: *Socially-optimal compensation* W_0^p *is characterized by*

$$F'(W_0^p; R^p, L^p) + \underbrace{\frac{\partial}{\partial R} F(W_0^p; R^p, L^p)}_{\text{compensation externality}<0} \leq 0, \quad \text{with } = \text{ if } W_0^p > \kappa_A.$$

▸ One-sided firm coordination

Corollary 2: *Equilibrium features overcompensation:*

$$W_0^* > W_0^p.$$

Insufficient deferral and termination

- Deferral:

$$S(W) = \mathbb{E}\left[e^{-r(\tau_C - t)} | W_t = W\right], \text{ where } \tau_C = \min\left\{t : W_t = \bar{W}\right\}$$

- Turnover:

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Proposition 3: *Equilibrium features too little deferral:*

$$\bar{W}^* - W_0^* < \bar{W}^p - W_0^p.$$

Agents paid too soon and too low turnover:

$$S^*(W_0^*) > S^p(W_0^p) \quad \text{and} \quad T^*(W_0^*) < T^p(W_0^p).$$

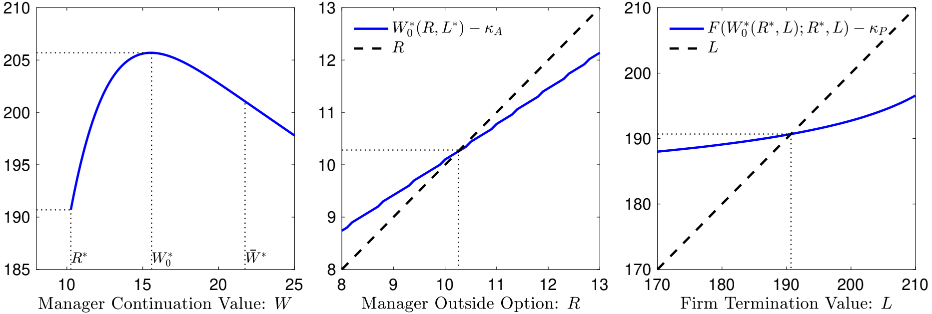
Quantitative Analysis

Table: Parameters

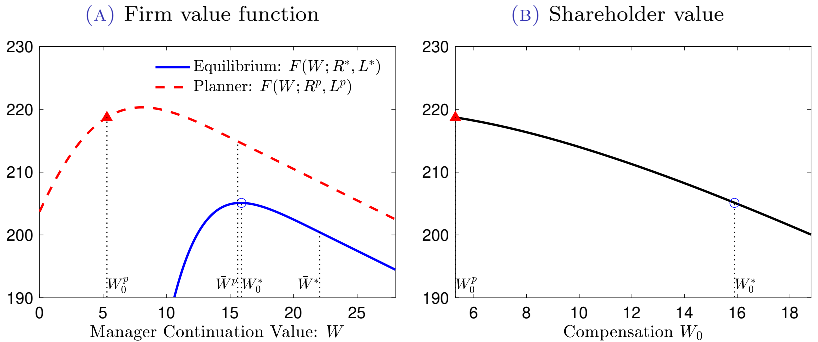
Parameter	Value	Moment	Data
Principal discount rate r	0.04	Annual interest rate	4%
Agent discount rate γ	0.09	Ward 2023; Chen at al. 2023	
Cash flow mean μ	10	Normalization	
Cash flow volatility σ	9	Fraction with operating losses	10-15%
Severity of moral hazard λ	0.29	Ward 2023	
Principal termination cost κ_P	15	Firing cost CEO replacement	6%
Agent termination cost κ_A	5.3	Forced turnover	2%

Equilibrium compensation

(A) Firm value $F(W; R^*, L^*)$ (B) Equilibrium condition: R (C) Equilibrium condition: L



Equilibrium overcompensation



▸ Pareto improvements ▸ Equal welfare weights

Comparative statics

Overcompensation worsens when:

- Moral hazard more severe, $\lambda \uparrow$. ▸ Moral hazard
- Termination less costly for managers, $\kappa_A \downarrow$. ▸ Manager termination cost
- Termination more costly for firms, $\kappa_P \uparrow$. ▸ Firm termination cost

Policies and extensions

Noncompete clauses

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- Noncompetes limit agents' outside options $\Rightarrow$ mitigate agency friction.
- Complex trade-off. Principals may overuse noncompetes if unregulated.

  Franco Mitchell 2008; Bond Newman 2009; Shi 2023. Chen Li Thakor Ward 2023.

Compensation tax

- **Managerial compensation tax**: alter the firm's objective function

$$\mathbb{E}\left[\int_0^\tau e^{-rt}((1-\alpha_0)dY_t + \alpha_1 W_t - (1+\alpha_I)dC_t) + e^{-r\tau}L\right].$$

  - Higher managerial compensation tax $\alpha_I \implies \downarrow$ Overcompensation.
  - State dependent corporate tax $\alpha_0, \alpha_1 \implies \uparrow$ Deferral.

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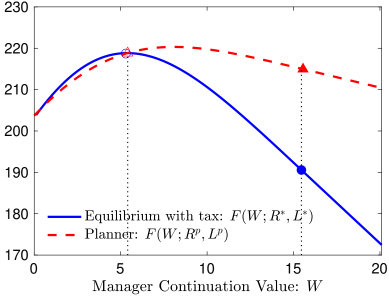

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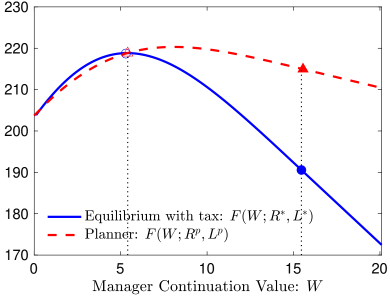

- *Million-dollar rule*: exempt performance pay with a significant deferral component, e.g., stock-options with long vesting periods.

Extensions: endogenous termination costs

- Managers search for new jobs. Firms post vacancies: posting cost k.
- Matching rate for firms and workers η.
  - Matching function $M(u, v) = \eta u^{1-a} v^{a}$.
  - Equivalent measure of vacancies v and managers u.

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- Endogenous termination costs:

$$\Rightarrow \kappa_A = \frac{\gamma W_0}{\eta + \gamma} \quad \text{and} \quad \kappa_P = \frac{r F_0 + k}{\eta + r}$$

Extensions: endogenous termination costs

Lemma 5: *In the search equilibrium,*

- Equilibrium compensation W_0^* as in Proposition 1.
- Optimal compensation W_0^p:

$$F'(W_0^p; R^p, L^p) + \frac{\eta}{\eta + \gamma} \frac{\partial}{\partial R} F(W_0^p; R^p, L^p) = 0.$$

Extension: bargaining

- Principal and agent bargain over compensation W_0.
- Agent bargaining weight β.

$$\max_{W_0} \; (F(W_0; R, L) - L)^{1-\beta} (W_0 - R)^{\beta} .$$

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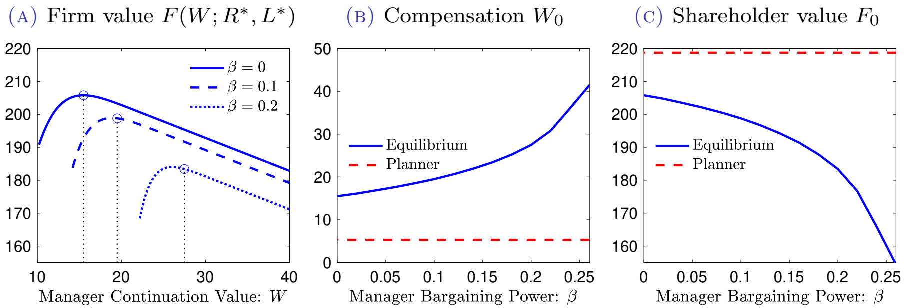
Lemma 6: *If* $\beta \leq \frac{\kappa_A}{\kappa_A + \kappa_P}$,

- Equilibrium compensation W_0^* is characterized by

$$F'(W_0^*; R^*, L^*) = -\frac{\beta}{1-\beta} \frac{\kappa_P}{\kappa_A}.$$

- Stronger agent bargaining power, overcompensation worsens, $\frac{\partial W_0^*}{\partial \beta} > 0$.

Extension: bargaining



Extension: one-side coordination ▸ Back

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Lemma 7: *When firms accounts for endogenous liquidation value,*

- Equilibrium compensation W_0^* as in Proposition 1.

- When max initial firm value, liquidation value is also maximized:

$$\frac{\partial L}{\partial W_0} \propto F'(W_0; R^*, L) = 0$$

EXTENSION: ONE-SIDE COORDINATION ▸ BACK

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$$\frac{\partial L}{\partial W_0} \propto F'(W_0; R^*, L) = 0$$

- Compensation externality solely via agent outside option.

Conclusion

- A general-equilibrium model:
  - **Dynamic moral hazard** $\Rightarrow$ *termination as incentive device.*
  - **Endogenous outside options**.

- Each principal-agent fails to internalize impact on the outside options.
- $\Rightarrow$ In turn effectiveness of termination threats for incentive provision.

- Private-optimal contract is NOT socially optimal.
- GE forces executives paid too much, too soon, and stay for too long.

- Implications for contract and compensation regulation.

Appendix slides

Equal welfare weights: two-period model ▸ BACK

Lemma 11: *Under a social welfare function that puts equal weights on the principals and the agents,*

(i) If $p\delta\lambda > (1-p)(1-\lambda) + \delta^2\lambda$, equilibrium features overcompensation.

(ii) Under Lemma 1.(ii), if $(1-p)\kappa_P > (p-\delta)\kappa_A$, equilibrium features undercompensation.

Parameter assumption

BACK

Let

$$W_0(R, L) = \underset{W_0}{\operatorname{argmax}} \, F(W_0; R, L).$$

Assumption 1: *The termination costs satisfy*

$$\begin{aligned} 0 <& \kappa_A \leq W_0(0,0) \\ F(\kappa_A; 0, \bar{L}) - F(0; 0, \bar{L}) \leq& \kappa_P \leq F(W_0(0,0); 0, 0) - F(W_0(0,0) - \kappa_A; 0, 0), \end{aligned}$$

where $\bar{L}$ satisfies $W_0(0, \bar{L}) = \kappa_A$.

Pareto improvements ▸ back1 ▸ back2

- Relax policy constraint to allow *time-varying* contracts.

Pareto improvements ▸ BACK1 ▸ BACK2

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Proposition 5: *If planner can selectively intervene in future contracts:*

- ***Future matches***: cut compensation $W^p_{0,f} \leq W^p_0 < W^*_0$.
- ***Time-0 matches***: improve shareholder value while preserving pay

$$F(W^*_0; R^p, L^p) > F(W^*_0; R^*, L^*).$$

Pareto improvements

▸ Back1 ▸ Back2

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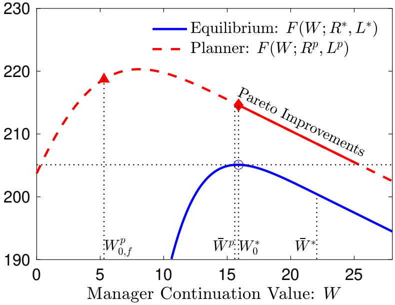
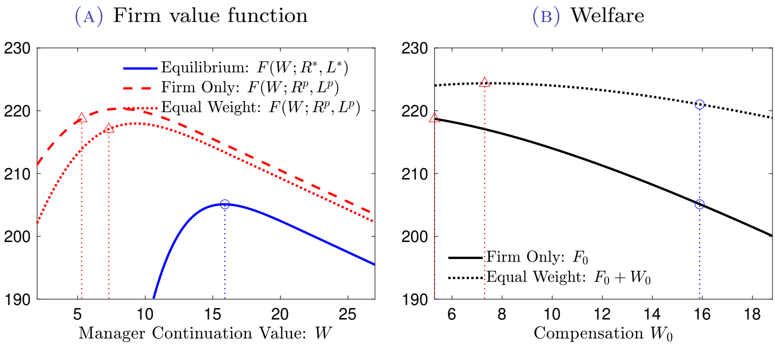


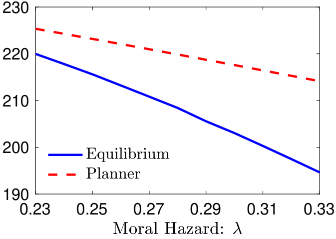
Welfare criteria

▸ Back

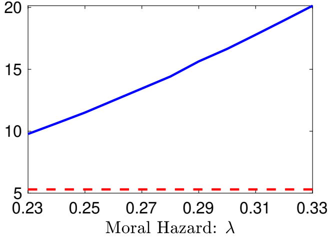


Severity of moral hazard ▸ Back

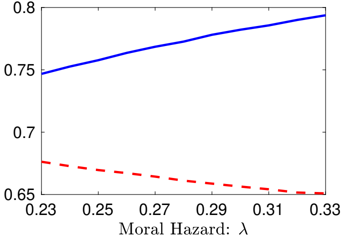
(A) Firm value $F(W_0; R, L)$



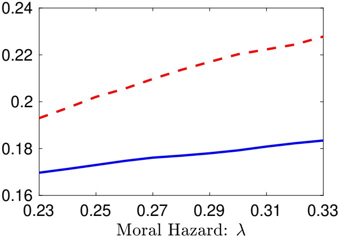
(B) Compensation W_0



(C) Deferral $S(W_0)$

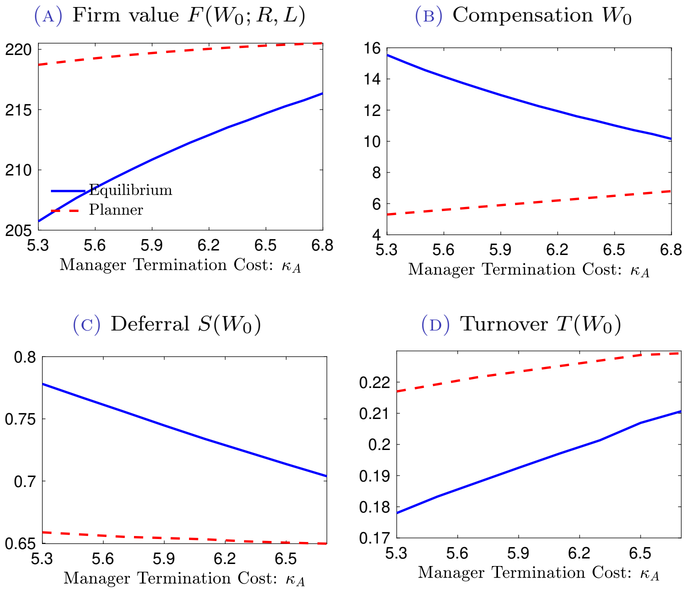


(D) Turnover $T(W_0)$



Manager termination cost

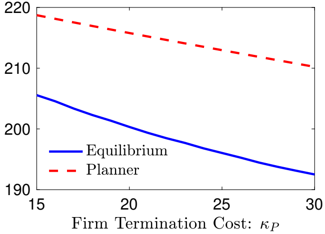
Back



Firm termination cost

▸ Back

(A) Firm value $F(W_0; R, L)$



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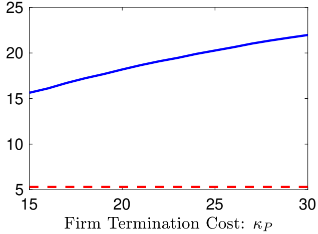

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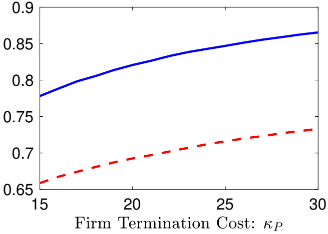

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