Managerial Labor Market Competition and Incentive Contracts

Lunch Seminar, Department of Economics, VU

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Introduction
Stylized Facts

- A typical executive compensation package:
  \[
  \text{total pay} = \text{salary} + \text{performance-based pay} \\
  \quad \quad \quad \text{(bonus, stocks, options, etc.)}
  \]
  \[
  30\% \quad 70\%
  \]

- Performance-based incentives
  \[
  \delta = \frac{\Delta \text{Wealth (in dollars)}}{\Delta \text{Firm Value (in percentage)}}
  \]
Stylized Facts

1. Firm-size premium in total compensation
   - Compensation is higher in larger firms.
   - A 1% increase in firm size leads to 0.45% increase in total compensation.

2. Firm-size premium in compensation growth
   - Starting with the same total compensation, compensation growth is higher in larger firms.
   - A 1% increase in firm size leads to 10% increase in compensation growth rate.

3. Firm-size premium in performance-based incentives
   - Controlling for total compensation, performance-based incentives are higher in larger firms.
   - A 1% increase in firm size leads to a 0.35% increase in performance-based incentives.
Managerial Labor Market Competition

• IBM proxy statement 2018:
  • “battle for talent”
  • targets to the 50th percentile among a large group of benchmark companies inside and outside the industry.
  • further adjust the individual compensation according to “the skills and experience of senior executives that are highly sought after by other companies and, in particular, by IBM’s competitors.”
Managerial Labor Market Competition

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  - further adjust the individual compensation according to “the skills and experience of senior executives that are highly sought after by other companies and, in particular, by IBM’s competitors.”

- Johnson & Johnson proxy statement 2018:
  - “competitiveness” as the first guiding principle
  - compare executive compensation against “appropriate peer companies that are of similar size and complexity, ... to attract, retain, and motivate high-performing executives”
Research Questions

• How does the managerial labor market competition impact the incentive contracts?

• Explain empirical puzzles:
  • Firm-size premium in total compensation
  • Firm-size premium in compensation growth
  • Firm-size premium in performance-based incentives
Research Questions

• How does the managerial labor market competition impact the incentive contracts?

• Explain empirical puzzles:
  • Firm-size premium in total compensation
  • Firm-size premium in compensation growth
  • Firm-size premium in performance-based incentives
Road Map

1. Model
   - embed dynamic moral hazard into an equilibrium search framework
   - poaching offers impact *compensation level* and *incentives*

2. Data & Reduced-form Evidence
   - examine model assumptions and implications

3. Structural Estimation
   - predict firm-size premiums without targeting on them

4. Policy Implications
Related Literature

• Assignment models
  • on compensation level: Tervio (2008), Gabaix and Landier (2008)
  • on incentives: Edmans et al. (2009), Edmans and Gabaix (2011)

• Moral hazard models
  • Gayle and Miller (2009), Gayle et al. (2015): moral hazard is more severe / the quality of signal (about effort) is poorer in larger firms

• Dynamic contract literature
  • moral hazard: Spear and Srivastava (1987), etc.
  • limited commitment: Thomas Worrall (1988, 1990), etc.

• Labour search literature
  • sequential auction: Postel-Vinay and Robin (2002), etc.
The Model
Set Up: Moral Hazard

Discrete time and infinite periods

Executives:

- risk averse, \( u(w) - c(e), e \in \{0, 1\}, c(1) = c, c(0) = 0, \)
  \[
  u(w) = \frac{w^{1-\sigma}}{1 - \sigma}
  \]
- effort \( e \) stochastically increases executive productivity \( z \in \mathcal{Z} \)
- \( z \) is persistent, follows a discrete Markov Chain process
  - \( \Gamma(z' | z) \) when take the effort, \( \Gamma^s(z' | z) \) when shirk
- die with \( \delta \in (0, 1) \), the match breaks up, the job disappears
Set Up: Moral Hazard

Discrete time and infinite periods

Executives:
- risk averse, $u(w) - c(e)$, $e \in \{0, 1\}$, $c(1) = c$, $c(0) = 0$,
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Firms:
- firm size $s \in \mathcal{S}$, exogenous and permanent
- production (cash flow) $y(s, z) = \alpha_0 s^{\alpha_1} z$, $\alpha_0, \alpha_1 \in (0, 1]$. 
Set Up: Managerial Labor Market

Managerial Labor Market:

- search frictional and allows on-the-job search
- with $\lambda_1 \in (0, 1)$ sample an outside firm $s'$ from $F(s')$

Sequential Auction:

- Bertrand competition between current firm $s$ and outside firm $s'$
- Each firm has a bidding frontier, $\overline{W}(z, s)$, defined by
  \[ \Pi(z, s, \overline{W}(z, s)) = 0 \]
  - $\overline{W}(z, s)$ increases in $z$ and $s$
  - if $s' < s$, renegotiate with the current firm
  - if $s' > s$, transit to the poaching firm
Contracting Problem

Firms maximize profits

\[
\Pi(z, s, V) = \max_{w, W(z', s')} \sum_{z' \in Z} \sum_{s' \in S} \left[ y(s, z') - w + \tilde{\beta} \Pi(z', s, W(z', s')) \right] \tilde{F}(s') \Gamma(z'|z)
\]

subject to

\[
V = u(w) - c + \tilde{\beta} \sum_{z' \in Z} \sum_{s' \in S} W(z', s') \tilde{F}(s') \Gamma(z'|z), \quad \text{(PKC)}
\]

\[
\tilde{\beta} \sum_{z' \in Z} \sum_{s' \in S} W(z', s') \tilde{F}(s') \left( \Gamma(z'|z) - \Gamma^s(z'|z) \right) \geq c, \quad \text{(IC)}
\]

\[
W(z', s') \geq \min\{\overline{W}(z', s'), \overline{W}(z', s)\}, \quad \text{(PC-Executive)}
\]

\[
W(z', s') \leq \overline{W}(z', s). \quad \text{(PC-Firm)}
\]
The Equilibrium

An stationary equilibrium is defined by

- value functions \( \{W^0, W, \Pi\} \);
- optimal contracts \( \sigma = \{w, W(z', s')\} \) for \( z' \in \mathbb{Z} \) and \( s' \in \mathcal{S} \);
- \( \Gamma(z'|z) \) follows the optimal effort choice;
- a distribution of executives across employment states evolving according to flow equations.
The Optimal Contract
The Optimal Contract

\(\text{wage} \)
The Optimal Contract

\[ wage \]

\[ t \]
The Optimal Contract

\( \text{wage} \)

\( t \)
The Optimal Contract

\[ wage \]

\[ t \]

![Graph showing wage over time](image)
The Optimal Contract

wage

\[ t \]

\[ 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10 \quad 11 \quad 12 \]
The Optimal Contract
The Optimal Contract

\[\text{wage} \]

\[t\]

\[0\]

\[1\]

\[2\]

\[3\]

\[4\]

\[5\]

\[6\]

\[7\]

\[8\]

\[9\]

\[10\]

\[11\]

\[12\]
The Optimal Contract

wage

\[ t = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \]
The Optimal Contract

\[ \text{wage} \]

\[ t \]
The Optimal Contract

The diagram illustrates the relationship between wage and time (t), with wage values plotted at various points along the time axis. The graph shows a fluctuating relationship, indicating changes in wage at different time intervals.
The Optimal Contract

\( \text{wage} \)

\( t \)

0 1 2 3 4 5 6 7 8 9 10 11 12
The Optimal Contract

wage

\[ t \]
The Optimal Contract

\( wage \)

\[ \begin{array}{c}
0 \\
1 \\
2 \\
3 \\
4 \\
5 \\
6 \\
7 \\
8 \\
9 \\
10 \\
11 \\
12 \\
\end{array} \]

\[ \begin{array}{c}
wage \\
0 \\
1 \\
2 \\
3 \\
4 \\
5 \\
6 \\
7 \\
8 \\
9 \\
10 \\
11 \\
12 \\
\end{array} \]
The Optimal Contract
The Optimal Contract

wage

$\begin{align*}
\text{wage} & \\
0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12
\end{align*}$
The Optimal Contract

induced by sequential auction with outside firm
The Optimal Contract
The Optimal Contract

wage

$t$

$0$

$1$

$2$

$3$

$4$

$5$

$6$

$7$

$8$

$9$

$10$

$11$

$12$
The Optimal Contract

\[\text{wage}\]

\[t\]

\[0\quad 1\quad 2\quad 3\quad 4\quad 5\quad 6\quad 7\quad 8\quad 9\quad 10\quad 11\quad 12\]

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The Optimal Contract
Why does compensation grow faster in larger firms?
Three sets of poaching offers

Three sets of outside firms \( s' \):

- \( \mathcal{M}_1 : s' \geq s \), lead to job turnovers
- \( \mathcal{M}_2 : s' < s \), improve compensation, no job turnovers
- \( \mathcal{M}_3 : \) other or no outside firms

The continuation value of an executive is

\[
\sum_{s' \in \mathcal{M}_1} F(s') \mathbb{E}[W(z', s)] + \sum_{s' \in \mathcal{M}_2} \mathbb{E}[W(z', s')] F(s') + \sum_{s' \in \mathcal{M}_3} F(s') \mathbb{E}[W(z')]
\]

- labor market driven
- promise driven
$\mathcal{M}_2 : \Delta w > 0$

$\mathcal{M}_3 : \Delta w = 0$
\( M_2 : \Delta w > 0 \)

\( M_3 : \Delta w = 0 \)
\( \mathcal{M}_2 : \Delta w > 0 \)

\( \mathcal{M}_3 : \Delta w = 0 \)
\[ M_2 : \Delta w > 0 \]

\[ M_3 : \Delta w = 0 \]
Why do performance-based incentives increase in firm size?
Incentive Compatibility Constraint

What is the incentive out of $W(z')$?

$$I[W(z')] \equiv \tilde{\beta} \left\{ \sum_{z'} W(z') \Gamma(z'|z) - \sum_{z'} W(z') \Gamma^S(z'|z) \right\}.$$
Incentive Compatibility Constraint

What is the incentive out of $W(z')$?

$$\mathcal{I}[W(z')] \equiv \tilde{\beta} \left\{ \sum_{z'} W(z') \Gamma(z'|z) - \sum_{z'} W(z') \Gamma^s(z'|z) \right\}.$$ 

Sets of outside firms $s'$:

- $\mathcal{M}_1 : s' \geq s$, lead to job turnovers
- $\mathcal{M}_2 : s' < s$, improve compensation, no job turnovers
- $\mathcal{M}_3 :$ other or no outside firms

The incentive compatibility constraint is

$$\sum_{s' \in \mathcal{M}_1} F(s') \mathcal{I}[\overline{W}(z', s)] + \sum_{s' \in \mathcal{M}_2} \mathcal{I}[\overline{W}(z', s')] F(s') + \sum_{s' \in \mathcal{M}_3} F(s') \mathcal{I}[W(z')] \geq c.$$
\[ M_1 : \mathcal{I}[\overline{W}(z', s_1)] \]

\[ M_2 : \mathcal{I}[\overline{W}(z', s')] \]

\[ M_3 : 0 \]
\( M_1 : \mathcal{I}[\overline{W}(z', s_1)] \)

\( M_2 : \mathcal{I}[\overline{W}(z', s')] \)

\( M_3 : 0 \)
\[\mathcal{M}_1 : \mathcal{I}[\overline{W}(z', s_1)]\]

\[\mathcal{M}_2 : \mathcal{I}[\overline{W}(z', s')]\]

\[\mathcal{M}_3 : 0\]
\[ \mathcal{M}_1 : I[\overline{W}(z', s_1)] \quad > \quad \mathcal{M}_1 : I[\overline{W}(z', s_2)] \]

\[ \mathcal{M}_2 : I[\overline{W}(z', s')] \quad = \quad s(w) \quad > \quad s(w) \]

\[ \mathcal{M}_3 : 0 \quad = \quad \mathcal{M}_3 : 0 \]
Incentives from \( \overline{W}(z', s) \) decrease in \( s \)
Incentives from $\overline{W}(z', s)$ decrease in $s$

**Proposition**

Suppose the executives’ utility is of the CRRA form and the cost of effort $c = \bar{c}(s)$, then $I(\overline{W}(z', s))$ decreases in $s$ if

$$\sigma > 1 + \frac{s^{1-\alpha_1}}{\alpha_1} \psi'(s), \quad (1)$$

where $\psi(s)$ is a function of $s$ that is positive and increasing in $s$.

**Intuition**

- a higher $s$ leads to higher certainty equivalent of $\overline{W}(z', s)$
- a higher certainty equivalent leads to lower marginal utility of extra wealth
Summary

• How does the managerial labor market competition impact the incentive contracts?
  Competition impacts both compensation level and incentives.

• Why does compensation grow faster in larger firms?
  Larger firms are more capable of countering outside offers.

• Why do performance-based incentives increase in firm size?
  Poaching offers generate labor market incentives that substitute for performance-based incentives.
Data & Reduced-form Evidence
Assemble a new dataset

- merge ExecuComp and BoardEX + hand-collected data in LinkedIn
- ExecuComp: annual records on top executives’ compensation
- BoardEX: detailed executive employment history

Define job turnovers

- Job-to-job transition: leaves the current firm, and starts to work in another firm within 180 days.
- Exit: otherwise.
Reduced-form Evidence

1. Managerial labor market is active.
   - job-to-job transition rate 5%
   - stable over years and across industries

2. Executives climb job ladders towards larger firms.
   - about 60% of job-to-job transitions are towards larger firms
   - for the rest, 20% of them are promotions from non-CEO to CEO

3. Executives in larger firms have less job-to-job transitions.
   - Cox model, a 1% increase in firm size leads a 8.3% lower hazard of job-to-job transitions.
4. Firm-size growth premium is higher in industries where managerial labor market is more active. 

- job-to-job transition rate (industry-year level)
- general ability index (Custódio et al. 2013)
- fraction of insider CEO (Martijn Cremers and Grinstein 2013)

5. Firm-size incentive premium is higher in industries where managerial labor market is more active.
Estimation
Model Specifications

- utility function of CRRA form
  \[ u(w) = \frac{w^{1-\sigma}}{1-\sigma} \]

- production function (cash flows)
  \[ y(s, z) = e^{\alpha_0 s^{\alpha_1} z} \]

- productivity process by AR(1), discretized by Tauchen (1989)
  \[ z_t = \rho_0(e) + \rho z_{t-1} + \epsilon_t \]

- poaching firm distribution by truncated log-normal \( F(s) \)
## Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta$</td>
<td>the death probability</td>
</tr>
<tr>
<td>$\lambda_1$</td>
<td>the offer arrival probability</td>
</tr>
<tr>
<td>$\rho_z$</td>
<td>the AR(1) coefficient of productivity shocks</td>
</tr>
<tr>
<td>$\mu_z$</td>
<td>the mean of productivity shocks for $e = 1$</td>
</tr>
<tr>
<td>$\sigma_z$</td>
<td>the standard deviation of productivity shocks</td>
</tr>
<tr>
<td>$\mu_s$</td>
<td>the mean of $F(s)$</td>
</tr>
<tr>
<td>$\sigma_s$</td>
<td>the standard deviation of $F(s)$</td>
</tr>
<tr>
<td>$c$</td>
<td>cost of efforts</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>relative risk aversion</td>
</tr>
<tr>
<td>$\alpha_0, \alpha_1$</td>
<td>production function parameters</td>
</tr>
</tbody>
</table>
### Moments and Estimation

#### A. Targeted Moments

<table>
<thead>
<tr>
<th>Moments</th>
<th>Data</th>
<th>Model</th>
<th>Estimates</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Rate</td>
<td>0.0691</td>
<td>0.0691</td>
<td>$\delta = 0.0695$</td>
<td>0.0127</td>
</tr>
<tr>
<td>J-J Transition Rate</td>
<td>0.0498</td>
<td>0.0473</td>
<td>$\lambda_1 = 0.3164$</td>
<td>0.0325</td>
</tr>
<tr>
<td>$\hat{\rho}_{profit}$</td>
<td>0.7683</td>
<td>0.6299</td>
<td>$\rho_z = 0.8004$</td>
<td>0.0366</td>
</tr>
<tr>
<td>Mean($profit$)</td>
<td>0.1260</td>
<td>0.1144</td>
<td>$\mu_z = 0.0279$</td>
<td>0.0014</td>
</tr>
<tr>
<td>Var($profit$)</td>
<td>0.0144</td>
<td>0.0160</td>
<td>$\sigma_z^2 = 0.1198$</td>
<td>0.0044</td>
</tr>
<tr>
<td>Mean($\log(size)$)</td>
<td>7.4515</td>
<td>7.4806</td>
<td>$\mu_s = 1.2356$</td>
<td>0.0365</td>
</tr>
<tr>
<td>Var($\log(size)$)</td>
<td>2.3060</td>
<td>2.1610</td>
<td>$\sigma_s = 2.5795$</td>
<td>0.1211</td>
</tr>
<tr>
<td>Mean($\log(wage)$)</td>
<td>7.2408</td>
<td>7.2665</td>
<td>$\alpha_0 = -1.5534$</td>
<td>0.0147</td>
</tr>
<tr>
<td>Var($\log(wage)$)</td>
<td>1.1846</td>
<td>0.8960</td>
<td>$\alpha_1 = 0.5270$</td>
<td>0.0217</td>
</tr>
<tr>
<td>$\beta_{wage-size}$</td>
<td>0.3830</td>
<td>0.2822</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_{delta-wage}$</td>
<td>1.1063</td>
<td>1.1997</td>
<td>$\sigma = 1.1038$</td>
<td>0.0030</td>
</tr>
<tr>
<td>Mean($\log(delta)$)</td>
<td>8.4994</td>
<td>8.478</td>
<td>$c = 0.0814$</td>
<td>0.0259</td>
</tr>
<tr>
<td>Var($\log(delta)$)</td>
<td>3.4438</td>
<td>3.35872</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Predictions on the empirical puzzles

B. Untargeted Moments

<table>
<thead>
<tr>
<th>Moments</th>
<th>Data</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{\text{wage-size}}$</td>
<td>0.112</td>
<td>0.1450</td>
<td>Firm-size growth premium</td>
</tr>
<tr>
<td>$\beta_{\text{delta-size}}$</td>
<td>0.3473</td>
<td>0.3122</td>
<td>Firm-size incentive premium, tdc1 controlled</td>
</tr>
<tr>
<td>$\beta_{\text{delta-size-nowage}}$</td>
<td>0.6044</td>
<td>0.6507</td>
<td>Firm-size incentive premium, tdc1 not controlled</td>
</tr>
</tbody>
</table>

- These moments are not targeted.
- They are predicted by the estimated model.
- The model quantitatively captures the two premiums.
Policy Implication
Policy: Spillover effect

• Spillover effect: more fierce bids from a group of firms
  1. boosts the executive pay in those firms
  2. increases the pay in all firms that are higher on the job ladder
• instead of focusing on large firms
• more effective: lower the willingness to bid in small and medium firms
• possible ways (has been proposed or implemented)
  • more independent compensation committee
  • greater mandatory pay (or pay ratio) disclosure
  • say-on-pay legislation, etc.
Spillover effect

The model with worse governance in small firms
The Benchmark Model
The model with worse governance in large firms

log of delta
firm size (10 groups)
Conclusion
Conclusion

- Managerial labor market competition impacts the incentive contracts: level and incentives.
  1. Larger firms are more capable of countering outside offers.
  2. Poaching offers generate labor market incentives which decrease in firm size.

- Structure estimates show the model captures the firm size premium in compensation growth and performance-based incentives.
Thanks you for your attention.

http://bohuecon.github.io
No Moral Hazard, Full Commitment

\[ \text{wage} \]

\[ t \]

\[ 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10 \quad 11 \quad 12 \]
Only Moral Hazard

\[ \text{wage} \]

\[ t \]

\[ \begin{array}{cccccccccccccc}
0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \\
\end{array} \]
Only Limited Commitment

\[ \text{wage} \]

\[ t \]

\[ 0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11 \ 12 \]
Job-to-job transition rate over age

![Graph showing job-to-job transition rate over age. The rate peaks around age 40 and decreases as age increases, reaching a lower rate after age 65.]
Exit rate over age
# Climb the Job Ladder

Table 3: Change of firm size upon job-to-job transitions

<table>
<thead>
<tr>
<th>Panel A: All executives</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm size proxy</td>
<td>Total obs.</td>
<td>Firm size decrease obs. (%)</td>
<td>Firm size increase obs. (%)</td>
</tr>
<tr>
<td>Market Cap</td>
<td>2567</td>
<td>985 (39%)</td>
<td>1582 (61%)</td>
</tr>
<tr>
<td>Sales</td>
<td>2617</td>
<td>1051 (40%)</td>
<td>1566 (60%)</td>
</tr>
<tr>
<td>Book Assets</td>
<td>2616</td>
<td>1038 (40%)</td>
<td>1578 (60%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Across age groups</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age groups</td>
<td>Total obs.</td>
<td>Firm size decrease obs. (%)</td>
<td>Firm size increase obs. (%)</td>
</tr>
<tr>
<td>≤ 40</td>
<td>100</td>
<td>34 (34%)</td>
<td>66 (66%)</td>
</tr>
<tr>
<td>[40, 45)</td>
<td>381</td>
<td>135 (35%)</td>
<td>246 (65%)</td>
</tr>
<tr>
<td>[45, 50)</td>
<td>701</td>
<td>262 (37%)</td>
<td>439 (63%)</td>
</tr>
<tr>
<td>[50, 55)</td>
<td>766</td>
<td>304 (40%)</td>
<td>462 (60%)</td>
</tr>
<tr>
<td>[55, 60)</td>
<td>261</td>
<td>179 (43%)</td>
<td>82 (67%)</td>
</tr>
<tr>
<td>[60, 65)</td>
<td>73</td>
<td>52 (39%)</td>
<td>21 (61%)</td>
</tr>
<tr>
<td>[65, 70)</td>
<td>30</td>
<td>7 (25%)</td>
<td>23 (75%)</td>
</tr>
<tr>
<td>≥ 70</td>
<td>6</td>
<td>1 (16%)</td>
<td>5 (84%)</td>
</tr>
</tbody>
</table>
### Table 4: Job-to-Job Transitions and Firm Size

<table>
<thead>
<tr>
<th></th>
<th>Job-to-Job Transition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>log(Firm Size)</td>
<td>0.917****</td>
<td>0.972*</td>
</tr>
<tr>
<td></td>
<td>(0.0109)</td>
<td>(0.0139)</td>
</tr>
<tr>
<td>Age</td>
<td>0.985****</td>
<td>0.967***</td>
</tr>
<tr>
<td></td>
<td>(0.00273)</td>
<td>(0.0112)</td>
</tr>
<tr>
<td>log(tdc1)</td>
<td></td>
<td>0.830****</td>
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<tr>
<td></td>
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<td>(0.0150)</td>
</tr>
<tr>
<td>Market-Book Ratio</td>
<td>0.942****</td>
<td>0.939****</td>
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<td>1.035**</td>
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<td>(0.0142)</td>
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<td>0.905****</td>
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<td>(0.0197)</td>
<td>(0.0199)</td>
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<td>Year FE</td>
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</tr>
<tr>
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<td>chi2</td>
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<td>log(firm size)$_{-1}$</td>
<td>$\Delta \log(tdc1)$</td>
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</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>log(firm size)$_{-1}$</td>
<td>0.112***</td>
<td>0.154***</td>
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<tr>
<td></td>
<td>(0.00903)</td>
<td>(0.0129)</td>
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<tr>
<td>log(firm size)$_{-1}$\times EE90</td>
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<td>0.0711*</td>
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<tr>
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<td></td>
<td>(0.0403)</td>
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<tr>
<td>log(firm size)$_{-1}$\times EE190</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log(firm size)$_{-1}$\times gai</td>
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<td>log(firm size)$_{-1}$\times inside CEO</td>
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<tr>
<td>log(tdc1)$_{-1}$</td>
<td>-0.290***</td>
<td>-0.390***</td>
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<td></td>
<td>(0.0200)</td>
<td>(0.0262)</td>
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</tr>
<tr>
<td>Other controls</td>
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</tr>
<tr>
<td>Observations</td>
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<td>106819</td>
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<tr>
<td>adj. $R^2$</td>
<td>0.157</td>
<td>0.216</td>
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Table 2: Performance-based incentives increases with firm size

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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<th>(5)</th>
<th>(6)</th>
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<tr>
<td>log(firm size)</td>
<td>0.604***</td>
<td>0.347***</td>
<td>0.525***</td>
<td>0.529***</td>
<td>0.561***</td>
<td>0.571***</td>
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<td></td>
<td>(0.0141)</td>
<td>(0.0247)</td>
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<td>0.359*</td>
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<td>\times E^E90</td>
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<td>(0.118)</td>
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<tr>
<td>\times g^ai</td>
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<td>(0.00156)</td>
<td></td>
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<tr>
<td>log(firm size)</td>
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<td></td>
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<td>-0.000458*</td>
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<td>(0.000202)</td>
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<td>-0.251***</td>
<td>-0.304***</td>
<td>-0.253***</td>
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<tr>
<td></td>
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<td>(0.00173)</td>
<td>(0.00173)</td>
<td>(0.00267)</td>
<td>(0.00173)</td>
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<td>Dummies</td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Other controls</td>
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<td>Observations</td>
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<td>128006</td>
<td>125858</td>
<td>125858</td>
<td>75747</td>
<td>125858</td>
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<tr>
<td>adj. $R^2$</td>
<td>0.442</td>
<td>0.514</td>
<td>0.521</td>
<td>0.521</td>
<td>0.531</td>
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If labor market incentives are ignored ...
CEO’s of "Small Firms" in S&P 500

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Cap millions</th>
<th>tdc1 000’s</th>
<th>delta 000’s/%</th>
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</thead>
<tbody>
<tr>
<td>INCYTE CORP</td>
<td>446.408</td>
<td>2432.9734</td>
<td>60.939838</td>
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<tr>
<td>WESTROCK CO</td>
<td>547.828</td>
<td>2800.668</td>
<td>130.96215</td>
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<tr>
<td>ENVISION HEALTHCARE CORP</td>
<td>678.6906</td>
<td>1777.991</td>
<td>217.729</td>
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<tr>
<td>PRICELINE GROUP INC</td>
<td>886.0817</td>
<td>1775.531</td>
<td>165.73476</td>
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<tr>
<td>LKQ CORP</td>
<td>889.9763</td>
<td>2602.093</td>
<td>473.70974</td>
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<tr>
<td>REGENERON PHARMACEUTICALS</td>
<td>897.3801</td>
<td>3094.134</td>
<td>566.14187</td>
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<td>SKYWORKS SOLUTIONS INC</td>
<td>1113.547</td>
<td>2638.243</td>
<td>128.10688</td>
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<td>CENTENE CORP</td>
<td>1130.155</td>
<td>4584.605</td>
<td>344.02299</td>
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<td>ALASKA AIR GROUP INC</td>
<td>1194.977</td>
<td>950.098</td>
<td>99.525198</td>
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<td>HOLOGIC INC</td>
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<td>2709.708</td>
<td>428.10996</td>
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<td>ACUITY BRANDS INC</td>
<td>1328.171</td>
<td>1102.528</td>
<td>133.42285</td>
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<tr>
<td>ANSYS INC</td>
<td>1368.129</td>
<td>3738.803</td>
<td>431.01562</td>
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<tr>
<td>GARTNER INC</td>
<td>1474.909</td>
<td>8945.338</td>
<td>158.65569</td>
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## CEO’s of "Large Firms" in S&P 500

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Cap millions</th>
<th>tdc1 000's</th>
<th>delta 000's/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME WARNER INC</td>
<td>79965.89</td>
<td>18545.215</td>
<td>1212.9513</td>
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<tr>
<td>CONOCOPHILLIPS</td>
<td>80163.26</td>
<td>35442.729</td>
<td>4520.5571</td>
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<tr>
<td>UNITED PARCEL SERVICE INC</td>
<td>82439.55</td>
<td>3120.042</td>
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<td>VERIZON COMMUNICATIONS INC</td>
<td>83233.88</td>
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<td>HOME DEPOT INC</td>
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<td>AT&amp;T INC</td>
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<td>PEPSICO INC</td>
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<td>CHEVRON CORP</td>
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<td>EXXON MOBIL CORP</td>
<td>344490.6</td>
<td>48922.808</td>
<td>3843.027</td>
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</table>


Edmans, Alex, Xavier Gabaix, and Augustin Landier (2009), “A multiplicative model of optimal ceo incentives in market equilibrium. review of financial studies.”


