

# Executive compensation, implicit incentives, and competition

Herbert Dawid  
*Bielefeld University*

Michael Neugart  
*Technical University of Darmstadt*

# Outline

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# 1. Introduction

- ▶ Evolution of CEO compensation
  - ▶ Before 1970s: Low levels of pay, little dispersion, moderate pay-performance link
  - ▶ After 1970s: Tremendous increase in executive compensation, differences in pay across managers widening, CEO incentives tied closer to firm performance
  - ▶ Median average CEO pay (in 2000 dollars) of 50 largest firms in U.S. in 2000-2005: \$9.2m; as opposed to \$1.2m during 1970-1979
  - ▶ Median ratio of CEO pay to other highest pay executives: 1.4 prior to 1980 and 2.6 during 2000-2005
- ▶ Performance pay has gained substantial share; e.g, share of options was 11% during 1970-1979 and 37% during 2000-2005. See Murphy (1999), Aggarwal (2008), or Frydman and Jenter (2010); data from Frydman and Saks (2010)

## 2. Literature

- ▶ Result of powerful managers setting pay and extracting rents
  - ▶ Bebchuk and Fried (2004): rent extraction occurs through forms of pay that are less observable
  - ▶ Kuhnen and Zwiebel (2009): rent extraction because firing is costly and replacement will also extract rents
  - ▶ Acharya and Volpin (2010): higher compensation by some firms (with weak governance) have negative externality on better governed firms through competition for managers

- ▶ Optimal contracting in competitive market for managerial talent
  - ▶ Rosen (1981, 1982); Himmelberg and Hubbard (2000); Baker and Hall (2004): firm size and scale effects
  - ▶ Murphy and Zabojnik (2004): shift in skills demanded
  - ▶ Hermalin (2005): stricter monitoring of CEOs with higher job instability is compensated by higher pay
  - ▶ Murphy (2002); Hall and Murphy (2003): tax policies and accounting rules favoring option compensation
  - ▶ Product market (de)regulation:
    - ▶ Schmidt (1997): ambiguous effects because two countervailing channels – (a) increase of effort through higher risk of liquidation, (b) decrease in effort through lower profits
    - ▶ Raith (2003): with free entry and exit of firms effect (b) vanishes
    - ▶ Evidence from banking industry for higher CEO pay after deregulation: Hubbard and Palia (1995); Cunat and Guadalupe (2009)

### 3. Question and framework of analysis

- ▶ We ask whether
  - ▶ firms have an incentive to introduce performance related compensation packages,
  - ▶ how they fare if they do so, and
  - ▶ how these incentives may change in a competitive industry environment.
- ▶ Our analysis recurs to an agent-based model as an analytical treatment appears impossible because CEO pay
  - ▶ changes efforts of workers with different abilities who
  - ▶ work in heterogenous firms of changing size.

- ▶ More specifically:
  - ▶ Performance pay related to a firm's (past) profits
  - ▶ CEOs are internally recruited based on individual performance
  - ▶ Effort choice of workers is driven by
    - ▶ compensation package of firm
    - ▶ ability of workers
    - ▶ size of firm
    - ▶ composition of workforce in firm (and effort choices of other workers)
    - ▶ profits of firm which is also driven by competitiveness of industry environment in which a firm operates

## 4. Agent-based model

### Firms and market environment

- ▶ Output  $q$  of firm  $i$  at time  $t+1$ :  
 $q_{i,t+1} = a_{j_{i,1,t}}^\delta \sum_{w \in J_{i,2,t}} a_w (1 + e_{w,t})^\alpha$  for  $0 < \alpha < 1$ , and with  $a$  as ability and  $e$  being effort
- ▶ Price  $p = \alpha - \beta q_{i,t} - comp \cdot \beta \sum_{k \neq i} q_{k,t}$  clears the market; with  $comp \geq 0$  parameterizing competitiveness, and  $\alpha, \beta > 0$
- ▶ Costs  $c$  for firm  $i$  at time  $t$  are:  $c_{i,t} = l_{i,t} + L_{i,2,t}$  with  $l$  as CEO payment and wages for all other workers normalized to one
- ▶ Employment follows  $L_{i,2,t+1} = L_{i,2,t} + 1$  if  $MR_{i,t} > MC_{i,t}$  and  $L_{i,2,t+1} = L_{i,2,t} - 1$  if  $MR_{i,t} < MC_{i,t}$



## Workers

- ▶ Up or out model of worker careers within firms
- ▶ Set of workers at firm  $i$  on level  $j$  at time  $t$  is  $|J_{i,j,t}| = L_{i,j,t}$
- ▶ Workers have abilities  $a_w$  with  $w = 1, \dots, W$ .
- ▶ Specifically, there are two types of abilities high and low denoted by  $a_h$  and  $a_l$ .
- ▶ There is a fraction  $x$  of the high ability type and a fraction  $1 - x$  of the low ability type in the economy.

- ▶ Wages on lower level are normalized to 1
- ▶ CEO compensation (tournament price) is a fixed amount plus a fraction of profits of the firm  $l_{i,t} = l_0 + l_1 \pi_{i,t}$
- ▶ Effort costs are  $\gamma e_{w,t}$
- ▶ The probability that a worker  $w$  is selected for the higher hierarchy by firm  $i$  in period  $t$  writes (Tullock success function)

$$P(w, i, t) = \frac{a_w(1 + e_{w,t})}{\sum_{w' \in J_{i,2,t}} a_{w'}(1 + e_{w',t})}$$

## Effort choices

- ▶ Within a particular firm the distribution of high and low skilled workers is known
- ▶ The high and low types choose effort  $e_h$  and  $e_l$  maximizing expected payoffs given by

- ▶  $\max_{e_h} (l-1) \frac{(1+e_h)a_h}{(1+e_h)a_h + (L-1-L_l)(1+e_h)a_h + L_l(1+e_l)a_l} - \gamma e_h$  and

- ▶  $\max_{e_l} (l-1) \frac{(1+e_l)a_l}{(1+e_l)a_l + (L-L_l)(1+e_h)a_h + (L_l-1)(1+e_l)a_l} - \gamma e_l$

with  $L$  denoting the number of workers in a particular firm, and  $0 \leq L_l \leq L$  being the the number of workers with low abilities.

Optimal choices follow from first order conditions and write for

- ▶ high ability workers:

$$e_h^* = e_h = \frac{1}{\gamma}(l-1) \frac{(L-1)a_l[L_l(a_h-a_l)+a_l]}{[(L-L_l)a_l+L_la_h]^2} - 1$$

- ▶ low ability workers:

$$e_l^* = \frac{1}{\gamma}(l-1) \frac{(L-1)a_h[(L-L_l)(a_l-a_h)+a_h]}{[(L-L_l)a_l+L_la_h]^2} - 1$$

Effort is

- ▶ increasing in  $l$
- ▶ ...

## 5. Simulation

- ▶ Parameters:
  - ▶ 10 firms
  - ▶ High ability workers have 10% higher ability
  - ▶ Share of high ability workers 40%
  - ▶ CEO earns 1.5 times the fix wage of a normal worker plus a share of the profits
- ▶ Simulation
  - ▶ 200 iterations
  - ▶ Batch runs with 40 replications
- ▶ Treatments
  - ▶ Product market competition
  - ▶ Performance pay varied between 0 and 0.14 of firm's (past) profits

Figure: Ratio of profits for **one** firm deviating in terms of performance pay  
*No competition* *Competition*

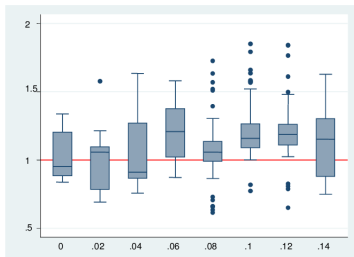
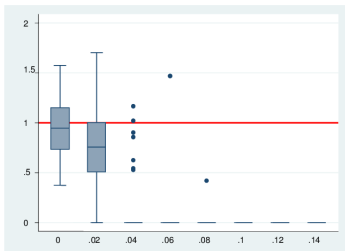


Figure: Ratio of profits for **five** firms deviating in terms of performance pay, competitive case

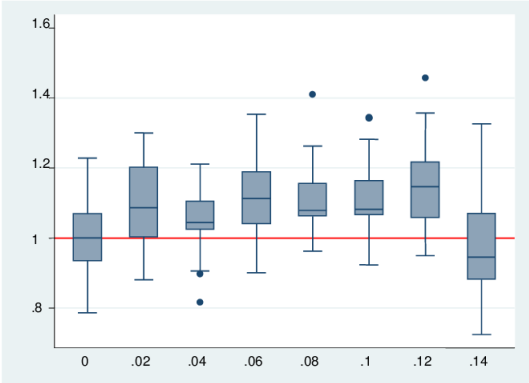


Figure: Average profits in market as performance pay is varied for all firms, competitive case

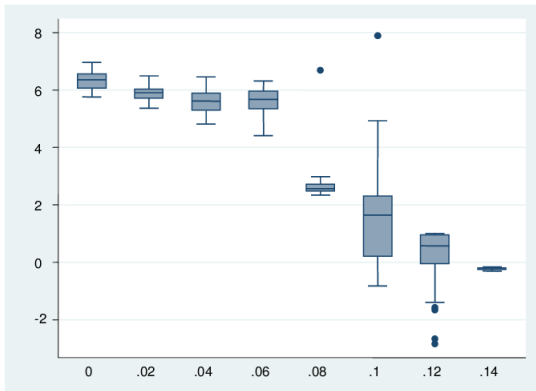
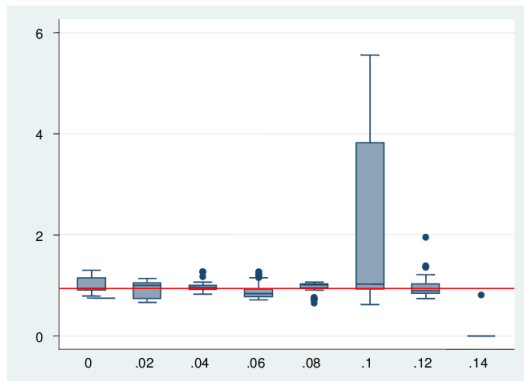




Figure: Ratio of profits for **one** firm deviating to zero performance pay, competitive case



## 6. Behind profits

Figure: Prices, over performance pay and competition

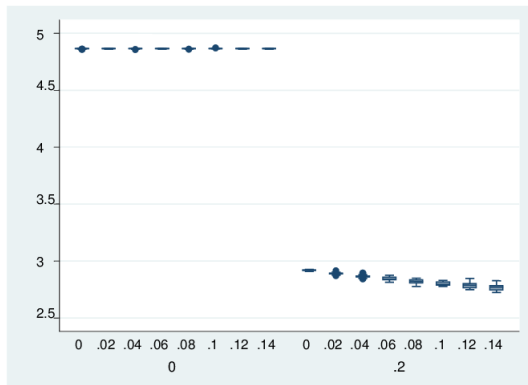


Figure: Ratio of real output for **one** firm deviating, over performance pay and competition

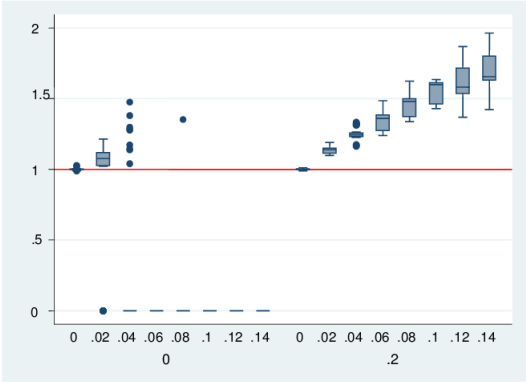
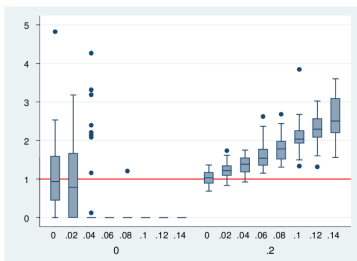


Figure: Ratio of efforts for **one** firm deviating, over performance pay and competition

*Effort of low ability workers*



*Effort of high ability workers*

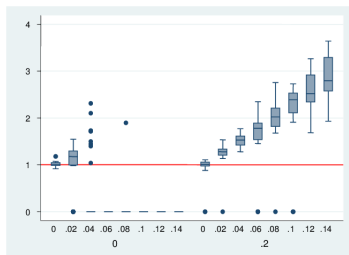
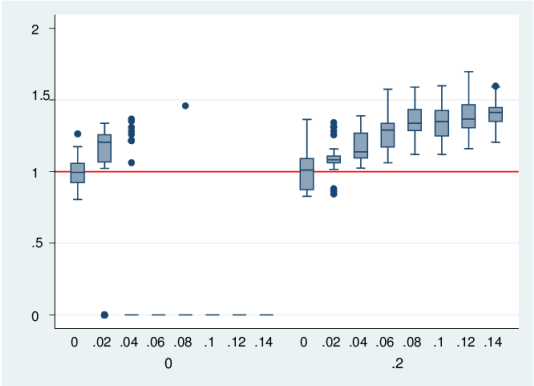


Figure: Ratio of wage costs for one firm deviating, over performance pay and competition



## 7. Summarizing simulation results

1. Competition in the product market creates incentive for a single firm to switch to performance pay as it will on average earn higher profits than the firms which do not switch.
2. The incentive remains as more firms switch to performance pay.
3. However, as all firms switch average profits to be earned in the market decline.
4. There is no incentive for a single firm to switch back to zero performance pay.

-- > Dilemma

## 8. To do

- ▶ Robustness tests
- ▶ Analyze role of share of high ability workers
- ▶ Extend model to firms hiring CEO from competing firm