ECON0106: **Microeconomics**

16. An Introduction to Contracts*

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1. Overview

In this lecture, we will study the basics of contract theory, which is the study of how agents can write contracts to mitigate the effects of asymmetric information and other frictions in economic interactions. We will start by studying the simplest possible contract, a wage contract, and then move on to more complex contracts, which can be used to mitigate issues when actions taken are not contractible (moral hazard). Finally, we will examine how career concerns may on their own provide incentives to induce workers to exert effort in a dynamic setting.

2. Incentive Contracts

The simplest environment in contract theory is as follows. Suppose that a manager hires a worker to perform a task, and that the worker's effort level affects the outcome of the task. The manager can offer the worker a contract, which specifies a wage w, in order to induce a given level of effort.

2.1. Setup

Suppose that the worker's effort level a affects the outcome of the task, y, according to $y = a+\epsilon$, where ϵ is a normally distributed random shock, with mean zero and variance σ^2. The manager offers a wage contract w to the worker.

Exerting effort is costly for the worker, with effort level a entailing a monetary-equivalent cost of $g(a)$, where g is a $\mathscr{C}^2$ function satisfying $g(0) = g'(0) = 0$ and $g', g'' > 0$ for $a > 0$. The worker has CARA preferences, and thus their expected utility is given by $\mathbb{E}[U_W(w - g(a))]$, where $U_W(x) = -\exp(-\rho_W x)$, with $\rho_W \geq 0$.

The worker can accept or reject the offer, and if they accept, they then choose how much effort a to exert. If they reject, they obtain utility $U(0)$. We'll have the worker accept the offer if and only if $\mathbb{E}[U(w - g(a))] \geq U(0)$.

*Last updated: 23 September 2025.

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The manager then makes a profit of $\pi = y - w$, which depends on the effort level a, and the random shock ϵ. The manager has also CARA preferences, and thus their expected utility is given by $\mathbb{E}[U_M(\pi)]$, where $U_M(x) = -\exp(-\rho_M x)$, with $\rho_M \geq 0$.

2.2. Observable Effort

If the manager can observe and contract on the worker's effort level, then they can offer a contract that specifies a wage $w(a, y)$ for each level of effort a and output. The manager's problem is then given by

$$\max_{w(\cdot,\cdot),a^*} \mathbb{E}[U_M(y(a^*) - w(a^*, y))]$$

$$\text{s.t.} \quad a^* \in \arg\max_{a \geq 0} \mathbb{E}[U_W(w(a, y) - g(a))] \quad \text{and} \quad \mathbb{E}[U_W(w(a^*, y) - g(a^*))] \geq U(0).$$

It is straightforward to show that, at an optimum level of effort, the optimal contract has to satisfy $w(a^*, y) = g(a^*)$ for any y, as this is the cheapest contract that induces the worker to exert the desired level of effort. Then, the desired level of effort is given by

$$a^* = \arg\max_{a \geq 0} \mathbb{E}[U_M(y(a) - g(a))] = (g')^{-1}(1).$$

For $a \neq a^*$, the manager then sets arbitrarily low wage $w(a)$.[1]

This leads to an efficient outcome, as the worker is incentivised to exert effort in a way that maximises the surplus.

2.3. Unobservable Effort

Now suppose that the manager cannot contract on the worker's effort level, either because the latter is unobservable, because of legal constraints, or due to some other reason. Then, the manager can only offer a contract that specifies a wage $w(y)$ for each level of output y.

The manager's problem is then given by

$$\max_{w(\cdot),a^*} \mathbb{E}[U_M(y(a^*) - w(y))]$$

$$\text{s.t.} \quad a^* \in \arg\max_{a \geq 0} \mathbb{E}[U_W(w(y(a)) - g(a))] \quad \text{and} \quad \mathbb{E}[U_W(w(y(a^*)) - g(a^*))] \geq U(0).$$

For simplicity, we'll restrict the analysis to linear contracts, $w(y) = c + by$, and assume that $g(a) = a^2/(2\theta)$.

Note that, given accepting a contract $w(y)$, the worker's problem, by sequential rationality, chooses the level of effort that maximises their expected utility, which is given by

$$\arg\max_{a \geq 0} \mathbb{E}[U_W(w(y) - g(a))] = \arg\max_{a \geq 0} ba - a^2/(2\theta) = b\theta.$$

[1] We are breaking ties in favor of the worker accepting the offer as in a proper game-theoretic treatment, in an SPNE, the worker would accept the offer if and only if $\mathbb{E}[U(w(a, y) - g(a))] \geq U(0)$ – note this problem represents, for all purposes, a take-it-or-leave-it offer situation, as in a simpler ultimatum game.

The above condition is often called *incentive compatibility*. Further, also by sequential rationality, they will only accept the contract if $\mathbb{E}[U_W(w(y)-g(a^*))] \geq U(0) \iff c+b^2\theta/2-\rho_W b^2\sigma^2/2 \geq 0$, which implies that $c \geq b^2(\rho_W\sigma^2-\theta)/2$. This is often called *participation constraint*.

So the manager's problem is then given by

$$\begin{aligned}
&\operatorname*{arg\,max}_{c,b} \mathbb{E}[U_M(y(b\theta)-c-by(b\theta))] \quad \text{s.t.} \quad c \geq b^2(\rho_W\sigma^2-\theta)/2 \\
=&\operatorname*{arg\,max}_{b} \mathbb{E}[U_M((1-b)y(b\theta)-b^2(\rho_W\sigma^2-\theta)/2)] \\
=&\operatorname*{arg\,max}_{b} (1-b)b\theta - b^2(\rho_W\sigma^2-\theta)/2-\rho_M(1-b)^2\sigma^2/2,
\end{aligned}$$

with first-order condition $(1-2b)\theta - b(\rho_W\sigma^2-\theta)+\rho_M(1-b)\sigma^2 = 0$, which implies that the optimal contract (b^*, c^*) satisfies

$$\begin{aligned}
b^* &= \frac{\theta+\rho_M\sigma^2}{\theta+(\rho_W+\rho_M)\sigma^2}, \\
c^* &= b^{*2}(\rho_W\sigma^2-\theta)/2
\end{aligned}$$

and the exerted level of effort is given by $a^* = b^*\theta$. Comparing this with the socially efficient level of effort, $(g')^{-1}(1) = \theta$, we see that the optimal contract induces the worker to exert less effort than the efficient level of effort, as the manager cannot contract on the worker's effort level.

The worker appropriates a share b^* of the output, which is increasing in the worker's marginal productivity, θ and in the manager's risk aversion, and decreasing in the worker's risk aversion, ρ_W, and exogenous risk volatility σ^2. This is because the more risk averse an agent is, the more they prefer to insulate their income from the exogenous risk.

2.4. Multiple Tasks

Now suppose that the worker is hired to perform multiple tasks. In particular, output is now n-dimentional, $y \in \mathbb{R}^n$, and given by $y = ka+\epsilon$, where effort $a \geq 0$ is m-dimensional, k is a $n \times m$ matrix of productivity coefficients, and ϵ is a normally distributed random shock, with mean zero and variance-covariance matrix Σ^2. Output is then valued as $p'y$, where p is an n-dimensional vector of market values.

Effort cost is now given by $g(a) = a'Qa/2$, where Q is a $m \times m$, symmetric and positive-definite matrix.

The manager can offer a contract that specifies a wage $w(y)$ for each level of output y; in order to make things simple, we'll again restrict to linear wage structures, $w(y) = c + b'y$, where b is an n-dimensional vector.

Given a contract, sequential rationality, implies $a^* = \operatorname{arg\,max}_{a\geq 0} \mathbb{E}[U_W(w(y)-g(a))] = Q^{-1}k'b$.

Again, by sequential rationality

$$\begin{aligned}&\mathbb{E}[U_W(w(y)-g(a^*))] \geq U(0)\\ \iff & c+b'kQ^{-1}k'b-b'kQ^{-1}QQ^{-1}k'b/2-(\rho_W/2)b'\Sigma b = c+b'kQ^{-1}k'b/2-(\rho_W/2)b'\Sigma b \geq 0,\end{aligned}$$

which implies that, at an optimal linear contract, $c = b'(\rho_W\Sigma - kQ^{-1}k')b/2$.

Finally, the optimal linear contract solves

$$\begin{aligned}&\arg\max_b \mathbb{E}[U_M(p'y(a(b))-c(b)-b'y(a(b)))]\\ &= \arg\max_b (p'-b')kQ^{-1}k'b - b'(\rho_W\Sigma - kQ^{-1}k')b/2 - \rho_M(p'-b')\Sigma(p-b)/2\end{aligned}$$

with first-order condition

$$\begin{aligned}&(p'-b')kQ^{-1}k'b - b'(\rho_W\Sigma - kQ^{-1}k')b/2 - \rho_M(p'-b')\Sigma(p-b)/2 = 0\\ \iff & b' = p'(kQ^{-1}k' + \rho_M\Sigma)(kQ^{-1}k' + (\rho_M+\rho_W)\Sigma)^{-1}.\end{aligned}$$

Exercise 1. *Suppose that effort is unidimensional, $m = 1$, and that the manager is risk-neutral. For simplicity, let output be valued at 1, i.e. p is a vector of ones, and k be a constant vector.*

(a) Assume Σ is a diagonal matrix. Solve for the optimal linear contract. Interpret.

(b) Assume, for $i = 1,\dots,n$, $y_i = a + \epsilon_i$ and $\epsilon_{i+1} = \epsilon_i + \xi_{i+1}$, where $\xi_{i+1} \overset{iid}{\sim} \mathcal{N}(0,\sigma_\xi^2)$. Solve for the optimal linear contract. Interpret.

Exercise 2. *Now let us extend to many workers. Suppose that there are n workers, indexed by $i = 1,\dots,n$, and that each worker i is hired to perform a task, with effort level $a_i \in \mathbb{R}_+$ affecting the outcome of the task, y_i, according to $y_i = a_i + \xi + \epsilon_i$, where ϵ_i is a worker-idiosyncratic, normally distributed random shock, with mean zero and variance σ^2, and ξ is a normally distributed random shock, common to all workers, with mean zero and variance σ_ξ^2. Profit is still given by $p'y$. Differently from before, the manager can offer a contract to each agent that specifies a wage $w_i(y) = c_i + b_i'y$ for each level of output y. Note that this means that the manager can offer different contracts to different workers, and that the contract to one worker may depend on the output of other workers. Consider the case where $g_i(a_i) = a_i^2/(2\theta_i)$, where $\theta_i > 0$ is worker i's ability, and $\rho_i > 0$ is their absolute risk-aversion coefficient. Assume throughout that the manager is risk-neutral.*

(a) Suppose that the manager can observe the effort level of each worker. Solve for the optimal linear contracts. Interpret.

(b) Suppose that the manager cannot observe the effort level of each worker. Solve for the optimal linear contracts. Interpret.

(c) Is it always the case that the manager will want to hire all workers? Why?

3. Career Concerns

It is often the case that managers have uncertain ability, for instance when starting out their career, with no track record or with limited experience. In this context, the market and the manager learn about the managers' ability through realisations of output, given the effort exerted. However, the managers' effort is not only costly, it is also often unobservable to firms. Despite this suggesting that managers would never put in any effort, in a dynamic setting like managing one's own career, career concerns may create incentives for managers to exert effort so as to signal high ability. This raises several questions. Can the manager be incentivised to exert effort? What are the dynamics of wages and effort levels? Is it possible for the market to learn a manager's ability through observing output alone? This lecture will explore these questions in a simple dynamic model of career concerns, based on the seminal paper by Holmström (1999).

3.1. Setup

Suppose that, in every period $t = 0, 1, \ldots$, a manager is hired in a competitive market to work for firm F. The firm hires the manager each period, and pays them a wage w_t at the beginning of each period. The manager's output or productivity in period t, y_t, depends additively (i) on the manager's effort that period, $a_t \geq 0$, (ii) the manager's ability, $\eta \in \mathbb{R}$, a persistent type, and (iii) random shocks to the macroeconomic environment, $\epsilon_t \sim \mathcal{N}(0, \sigma_\epsilon^2)$. That is, $y_t = a_t + \eta + \epsilon_t$.

Flow Payoffs: In every period t, the firm earns a profit of $\pi_t = y_t - w_t$, which depends on the effort level a_t, the unknown ability η, and the random shock ϵ_t. Again we assume that exerting effort is costly for the manager, with effort level a_t entailing a monetary-equivalent cost of $g(a_t)$, where g is a $\mathscr{C}^2$ function satisfying $g(0) = g'(0) = 0$ and $g', g'' > 0$ for $a > 0$. The monetary equivalent of the manager's flow payoff in period t is then $u_t = w_t - g(a_t)$.

Information: All parties, firm and manager, observe y_t at the end of the period. Ability on the other hand is a persistent attribute of the work that is unknown to both the manager and the firm. Specifically, both players share a common prior that ability is drawn from a normal distribution with mean m_0 and variance σ_0^2. Finally, the effort levels chosen by the manager are never observed by the firm.

The firm's information sets are then given by $I_{F,t} := I_{F,t-1} \cup \{w_{t-1}, y_{t-1}\}$ for $t \geq 1$, where $I_{F,0} = \emptyset$. In contrast, the manager's information sets are given by $I_{W,t} := I_{W,t-1} \cup \{w_t, y_{t-1}, a_{t-1}\}$ for $t \geq 1$, where $I_{W,0} = \{w_0\}$.

Strategies: A pure strategy of the firm consists of a wage offer w_t in each period t, which may depend on the firm's information set. A pure strategy of the manager is then a level of effort exerted in each period, a_t, which may depend on the manager's information set.

Game Payoffs: Both players discount monetary payments at a common discount factor $\delta \in (0,1)$. The firm is risk-neutral, and their continuation payoff in period t is $\Pi_t := \mathbb{E}[\sum_{s=0}^{\infty} \delta^{t+s} \pi_{t+s} \mid I_{F,t}]$, which depends on both the firm's and the manager's strategies. The manager, instead, has CARA preferences over the (normalised) present value of their income stream, with an Arrow-Pratt absolute risk-aversion parameter $\rho > 0$. The manager's continuation payoff in period t is then $U_t := \mathbb{E}\left[-\exp\left(-\sum_{s=0}^{\infty}(1-\delta)\delta^{t+s} u_{t+s}\right) \mid I_{W,t+s}\right]$, which naturally also depends on both the firm's and the manager's strategies.

3.2. Equilibrium

We are going to focus on pure-strategy subgame perfect Nash equilibria (SPNE) of this game. For that, we will make three assumptions:

1. **Deterministic Effort:** The manager's effort level a_t is deterministic, and does not depend on the history of output realisations or of wage offers.
2. **Perfect Competition:** The labor market is perfectly competitive, so that the firm makes zero profits in expectation, given the manager's level of effort anticipated by the firm, $\hat{a}_t$. That is, firm's wage offer in each period is equal to the expected output in that period, $w_t = \mathbb{E}[y_t \mid I_{F,t}, a_t = \hat{a}_t] = \eta + \hat{a}_t$.
3. **Correct Anticipation:** The firm correctly anticipates the manager's effort level in each period, $a_t = \hat{a}_t$.

3.3. Bayesian Learning

Let $x_t := y_t - \hat{a}_t = a_t - \hat{a}_t + \eta + \epsilon_t$ be the signal for ability, given the anticipated level of effort. Under the assumption of correct anticipation, the signal for ability is then $x_t = \mathbb{E}[\eta \mid I_{F,t}] + \epsilon_t$. Denoting by $\tau_\epsilon = \sigma_\epsilon^{-2}$ the precision of the noise, the signal for ability is then $x_t \mid \eta \sim \mathcal{N}(\eta, \tau_\epsilon)$ (where we reparametrise the normal distribution using precision instead of variance). If the firm's prior over ability in period $t-1$ is $\eta \mid I_{F,t-1} \sim \mathcal{N}(m_{t-1}, \tau_{t-1})$, where m_{t-1} and τ_{t-1} are the mean and precision of the prior, respectively, then the posterior is $\tau_t = \tau_{t-1} + \tau_\epsilon$ and $m_t = \frac{\tau_{t-1} m_{t-1} + \tau_\epsilon x_{t-1}}{\tau_t} = \frac{\tau_0 m_0 + t \tau_\epsilon \bar{x}_{t-1}}{\tau_t}$, with $\bar{x}_{t-1} = \sum_{s=0}^{t-1} x_s / t$.

3.4. Solving for an Equilibrium

Under the assumption of perfect competition, the firm's wage offer in each period is equal to the expected output in that period, $w_t = \mathbb{E}[y_t \mid I_{F,t}, a_t = \hat{a}_t] = m_t + \hat{a}_t$. We rely on the one-shot deviation principle to solve for an SPNE. That is, we want to prevent profitable one-shot deviations by the manager.

Suppose that at period t the manager chooses $a_t \neq \hat{a}_t$, but $a_{t+s} = \hat{a}_{t+s}$, $\forall s \geq 1$. Then, $x_{t+s} =$

$\eta + \epsilon_{t+s}$, but $x_t = a_t - \hat{a}_t + \eta + \epsilon_t$. Therefore, $\sum_{h=0}^{s-1} x_{t+h} = a_t - \hat{a}_t + \eta + \epsilon_t + \sum_{h=1}^{s-1} x_{t+h}$. The effect of the deviation at t on the posterior mean of ability at $t+h$ is then given by

$$\begin{aligned} m_{t+s} &= \frac{\tau_t m_t + \tau_\epsilon \left(\sum_{h=0}^{s-1} x_{t+h}\right)}{\tau_{t+s}} \\ &= a_t \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} + \frac{\tau_t m_t + \tau_\epsilon \left(-\hat{a}_t + \eta + \epsilon_t + \sum_{h=1}^{s-1} x_{t+h}\right)}{\tau_{t+s}}. \end{aligned}$$

Hence, its impact on wage at $t+h$ is given by

$$\begin{aligned} w_{t+s} &= \hat{a}_{t+s} + m_{t+s} \\ &= a_t \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} + \hat{a}_{t+s} + \frac{\tau_t m_t + \tau_\epsilon \left(-\hat{a}_t + \eta + \epsilon_t + \sum_{h=1}^{s-1} x_{t+h}\right)}{\tau_{t+s}} \\ \implies \quad \mathbb{E}[w_{t+s} \mid I_{W,t}] &= a_t \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} + \hat{a}_{t+s} + \frac{\tau_t m_t + \tau_\epsilon \left(-\hat{a}_t + m_t + \sum_{h=1}^{s-1} x_{t+h}\right)}{\tau_{t+s}}. \end{aligned}$$

Denoting expectation and variance taken with respect to the manager's information at time t by E_t^W and V_t^W, respectively, the continuation payoff of the manager at t is then given by

$$\begin{aligned} U_t(a_t) &= E_t^W \left[-\exp\left(-\rho \left((1-\delta) \sum_{s=0}^{\infty} \delta^s (w_{t+s} - g(a_{t+s})) \right) \right) \right] \\ &= \left[-\exp\left(-\rho(1-\delta) \left(\sum_{s=0}^{\infty} \delta^s \left(E_t^W [w_{t+s} - g(a_{t+s})] \right) - \frac{\rho(1-\delta)}{2} V_t^W \left(\sum_{s=0}^{\infty} \delta^s (w_{t+s} - g(a_{t+s})) \right) \right) \right) \right] \\ &= \left[-\exp\left(-\rho(1-\delta) \left(\sum_{s=0}^{\infty} \delta^s \left(E_t^W [w_{t+s} - g(a_{t+s})] \right) - \frac{\rho(1-\delta)}{2} V_t^W \left(\delta^t \sum_{s=0}^{\infty} \delta^s (w_{t+s} - g(a_{t+s})) \right) \right) \right) \right]. \end{aligned}$$

Then, the manager's most profitable deviation at t is given by

$$\arg\max_{a_t} U_t(a_t) = \arg\max_{a_t} \sum_{s=0}^{\infty} \delta^s \left(E_t^W [w_{t+s} - g(a_{t+s})] \right) - \frac{\rho(1-\delta)}{2} V_t^W \left(\delta^t \sum_{s=0}^{\infty} \delta^s (w_{t+s} - g(a_{t+s})) \right)$$

Note that (i) the variance and covariance of future wages are independent of a_t, (ii) the level of effort is deterministic, and (iii) the effort level at t has no impact on the wage offer at t, which implies that the manager's most profitable deviation is given by,

$$\begin{aligned} \arg\max_{a_t} U_t(a_t) &= \arg\max_{a_t} \left(\sum_{s=1}^{\infty} \delta^s E_t^W [w_{t+s}] \right) - g(a_t) - \frac{\rho(1-\delta)}{2} V_t^W (w_t - g(a_t)) \\ &= \arg\max_{a_t} \left(\sum_{s=1}^{\infty} \delta^s E_t^W \left[a_t \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} + \hat{a}_{t+s} + \frac{\tau_t m_t + \tau_\epsilon \left(-\hat{a}_t + m_t + \sum_{h=1}^{s-1} x_{t+h}\right)}{\tau_{t+s}} \right] \right) - g(a_t) \\ &= \arg\max_{a_t} \left(\sum_{s=1}^{\infty} \delta^s a_t \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} \right) - g(a_t) \end{aligned}$$

which results in the following first-order condition,

$$a_t^{CC} = (g')^{-1} \left(\sum_{s=1}^{\infty} \delta^s \frac{\tau_\epsilon}{\tau_t + s\tau_\epsilon} \right).$$

By assumption, $g'' > 0$, which implies that $(g')^{-1}$ is strictly increasing and a_t^{CC}. By the assumption of correct anticipation, $\hat{a}_t = a_t = a_t^{CC}$, which implies that the wage offer in each period is given by $w_t^{CC} = \mathbb{E}[y_t \mid I_{F,t}, a_t = a_t^{CC}] = m_t + a_t^{CC}$. Hence, the unique SPNE satisfying the aforementioned assumptions is given by $(a_t^{CC}, w_t^{CC})_{t \geq 0}$.

3.5. Comparative Statics

Note that a_t^{CC} is (i) decreasing in time t, since τ_t is increasing in t; (ii) increasing in the discount factor δ, and (iii) decreasing in relative volatility of the random shock, $\sigma_\epsilon^2/\sigma_0^2$. This makes a lot of sense. First, the model predicts more effort when the manager is young and less experienced, and less effort when the manager is older (compare assistant profs and tenured faculty). Second, the more patient the manager is, the more they care about the future, and the more effort they will exert, as the effort they exert today will only affect future earnings. Third, the less volatile the environment, the more informative output is about the manager's ability, the more effort the manager will exert to signal high ability.

Note that the efficient level of effort solves

$$a_t^* = \arg\max_{a_t} E_t^W[y_t] - g(a_t) = g^{-1}(1).$$

If the manager is patient enough and the relative volatility of the random shock is sufficiently small, then career concerns lead the manager to exert more effort than optimal early on. But sufficiently later on in their career, the manager will always exert less effort than optimal.

Exercise 3. *Suppose that the manager is offered an incentive contract where the wage offer in each period is given by $w_t(y_t) = c_t + b_t y_t$. In addition to the above, assume that $g''' > 0$ for $a \geq 0$. Restrict focus to equilibria satisfying the following conditions: (i) the effort level and wage are deterministic functions of time, (ii) that in every period the firm makes zero profits in expectation, i.e. $E_t^W[y_t - w_t] = 0$, (iii) that the effort level is correctly anticipated in equilibrium, and (iv) that the wage in each period t is chosen to maximise the manager's flow payoff at t. Characterise the (pure strategy) SPNE levels of effort and wage offers. What are the dynamics of equilibrium effort levels and wage offers? How do they compare to the ones obtained above? How do they compare to the efficient levels of effort and wage offers?*

4. Study and Further Reading

4.1. Further Reading

- The originals: Holmström (1979), Grossman and Hart (1983), Holmström and Milgrom (1991), Holmström (1999), Hölmstrom and i Costa (1986).
- Extensions to more general environments: Dewatripont et al. (1999a); Dewatripont et al. (1999b).
- A closer look at the interaction between experimentation and career concerns: Bonatti and

Hörner (2017), Halac and Kremer (2020).

- Evidence from the field: Gibbons and Murphy (1992), Chevalier and Ellison (1999); and from the lab: Fehr et al. (2007), Koch et al. (2009).

References

Bonatti, Alessandro, and Johannes Hörner. 2017. "Career concerns with exponential learning." *Theoretical Economics* 12 (1): 425–475. 10.3982/TE2167.

Chevalier, Judith, and Glenn Ellison. 1999. "Career Concerns of Mutual Fund Managers." *The Quarterly Journal of Economics* 114 (2): 389–432. 10.1162/003355399556034.

Dewatripont, Mathias, Ian Jewitt, and Jean Tirole. 1999a. "The Economics of Career Concerns, Part I: Comparing Information Structures." *The Review of Economic Studies* 66 (1): 183–198. 10.1111/1467-937X.00085.

Dewatripont, Mathias, Ian Jewitt, and Jean Tirole. 1999b. "The Economics of Career Concerns, Part II: Application to Missions and Accountability of Government Agencies." *The Review of Economic Studies* 66 (1): 199–217. 10.1111/1467-937X.00085.

Fehr, Ernst, Alexander Klein, and Klaus M. Schmidt. 2007. "Fairness and Contract Design." *Econometrica* 75 (1): 121–154. 10.1111/j.1468-0262.2007.00734.x.

Gibbons, Robert, and Kevin J. Murphy. 1992. "Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence." *Journal of Political Economy* 100 (3): 468–505. 10.1086/261826.

Grossman, Sanford J., and Oliver D. Hart. 1983. "An analysis of the principal-agent problem." *Econometrica* 51 (1): 7–45. 10.2307/1912246.

Halac, Marina, and Ilan Kremer. 2020. "Experimenting with Career Concerns." *American Economic Journal: Microeconomics* 12 (1): 260–288. 10.1257/mic.20170411.

Holmström, Bengt. 1999. "Managerial Incentive Problems: A Dynamic Perspective." *The Review of Economic Studies* 66 (1): 169–182. 10.1111/1467-937X.00083.

Hölmstrom, Bengt, and Joan Ricart i Costa. 1986. "Managerial Incentives and Capital Management." *The Quarterly Journal of Economics* 101 (4): 835–860. 10.2307/1884180.

Holmström, Bengt. 1979. "Moral hazard and observability." *Bell Journal of Economics* 10 (1): 74–91. 10.2307/3003320.

Holmström, Bengt, and Paul Milgrom. 1991. "Multi-task principal-agent analyses: Incentive contracts, asset ownership, and job design." *Journal of Law, Economics, and Organization* 7 24–52. 10.1093/jleo/7.special_issue.24.

Koch, Alexander K., Albrecht Morgenstern, and Philippe Raab. 2009. "Career concerns incentives: An experimental test." *Journal of Economic Behavior & Organization* 72 (1): 571–588. 10.1016/j.jebo.2009.06.003.