Optimal Incentive Contracts When Workers Envy Their Boss

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Abstract

A worker's utility may increase in his own income, but envy can make his utility decline with his employer's income. Such behavior may call for high-powered incentives, so that increased effort by the worker little increases the income of his employer. This paper employs a principal-agent model to study optimal incentive contracts for envious workers under various assumptions about the object and generality of envy. Envy amplifies the effect of incentives on effort and, therefore, increases optimal incentive pay. Moreover, envy can make profit-sharing optimal, even when the worker's effort is fully contractible. We discuss several applications of our theoretical work. For example, envy can explain why lower-level workers are awarded stock options, why incentive pay is usually lower in non-profit organizations, and why it is higher in larger establishments. Envy may also make governmental production of a good more efficient than private production.

Keywords: Principal-agent, Envy, Moral hazard, Compensation, Incentives, Contracts, Profit-sharing, Stock options, Public vs. private production.
JEL-codes: J31, J33, M52.

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1 Introduction

We usually think that a person values a job for the income that he can earn. But other motives may also enter, including pride in a job well done and the quest for status. And people are supposed to prefer to exert little effort because they value leisure or because the work is unpleasant. But here again other factors may enter.

This paper considers the obverse of status—envy. We shall consider a worker who envies his employer's or boss's wealth, and who recognizes that increased effort may enrich his employer or boss. Such feelings explain the rage of workers at American Airlines in 2003 who learned of bonuses for senior executives at the same time that workers were asked to accept wage cuts.

One might think that envy is irrelevant to effort, since the worker will be paid just enough to yield his reservation utility, with envy merely increasing his pay. But that need not hold. For after an envious person accepts a job, he may be unwilling to exert effort even if the reward for his effort exceeds the cost of effort. If a worker is paid the value of his marginal product, then an increase in his effort enriches only himself. But if the worker is paid less, then his increased effort would increase the firm's profits, and so possibly increase the wealth of the boss or of the owner. That in turn means that the more high-powered the incentives offered a worker, the less the worker's incentive to limit effort because of envy.

A worker may be paid less than his marginal product for several reasons. One is that high marginal compensation can cause a moral hazard problem (a person paid handsomely to fight fires may commit arson). Another reason may be that if a producer incurs fixed costs, and the worker cannot pay a large lump-sum to the employer, then a wage equal to marginal product would generate losses to the producer. Lastly, as in the standard principal-agent model that we adopt in this paper, a risk-averse worker may prefer his compensation to vary little with his output.

We study profit-maximizing incentive contracts for envious workers under various assumptions about the object and the generality of envy. The worker may envy the employer's profits. This envy of profits may also be seen as describing a spiteful worker rather than an envious one. Alternatively, envy may depend on relative income. Furthermore, we distinguish between specific envy and general envy. Specific envy arises when the worker personally contributes to his employer's wealth (this represents a 'warm glow,' or, perhaps

more appropriately, a 'cold shiver'). Alternatively, the worker may envy the employer regardless of whether or not he works for him; we call this general envy.

We shall see that envy amplifies the effect of incentive pay on effort, so that optimal incentive pay is higher when workers are envious. Furthermore, even when effort is fully contractible, the optimal contract may call for incentive pay. Although such profit-sharing increases the risk borne by the worker, it may reduce the expected utility loss from envy, making the job more attractive to the worker, and hence reduce wage cost.

Our theoretical work contributes to a better understanding of several stylized facts. First, envy may explain why lower-level workers are awarded stock options even though any one individual worker's effort hardly affects the stock price. Second, we argue that envy can cause for-profit firms to provide stronger monetary incentives to workers than do non-profit firms. And envy can explain why wages increase with the size of the employer. Lastly, envy can make public production of a good more efficient than private production.

2   Literature

Varian (1974) defines an envy-free allocation as one in which no agent prefers any other agent's consumption-leisure bundle to his own. Hence, when executives spend much time at work (for instance because they are in a 'rat race'), workers will envy them less for a given difference in consumption bundles. Here, however, we shall take a simpler approach: a worker's utility declines with the (relative) wealth of his employer or boss. Our qualitative results continue to hold, however, even if the worker takes into account the boss's effort, as long as the worker envies his boss, and the boss's effort is exogenous.

Our discussion of envy relates to concern about relative status, as well studied by Frank (1984, 1985). He shows that a worker may prefer a job at firm A which pays less than a job at firm B, if the pay offered at A compares well to the pay given other workers at A. Workers' concerns about their relative standing in the firm may therefore imply that a highly productive worker at a firm with many low-productivity workers may be paid less than his marginal product. Likewise, a worker with low productivity must be paid a compensating wage differential for enduring a low-status position amongst his co-workers. A similar effect shows up in our analysis: when envy is

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specific, the worker must be paid a higher wage to compensate for the utility loss of envy. Unlike our paper, Frank does not look at how concern about relative status affects the type of pay package a firm should offer, or at how the pay package affects a worker's effort. Fershtman, Hvide, and Weiss (2003) do examine incentive pay, considering workers who care about their relative standing among co-workers. Status concerns increase effort and may result in a 'rat race' among workers.[1] When workers are homogeneous in their status concerns, optimal incentive pay decreases in the weight attached to status so as to mitigate wasteful competition. With cultural diversity among workers, firms match workers with different status concerns, and give status-minded workers more high-powered incentives than workers who do not care about status.

Other papers assume that people are averse to inequity or inequality (Fehr and Schmidt (1999), Bolton and Ockenfels (2000)). That is, instead of agents valuing a high-status position, they feel compassion for lower ranked agents, and feel envy towards higher ranked agents.[2] Several recent papers explore optimal incentive contracts when workers feel envy and compassion towards co-workers, see Biel (2002), Demougin and Fluet (2003), Grund and Sliwka (2003), Itoh (2003), and Neilson and Stowe (2003).

For our purpose, it does not matter whether people value high status (as in Frank (1985)) or suffer from it (as in Fehr and Schmidt (1999) and related work). In contrast to these papers, we ignore envy towards co-workers and, instead, focus on envy of the boss. As workers rarely earn more than their boss (professional sports may be an exception), we ignore this possibility in our analysis and, consequently, need not consider how agents feel when they are relatively better off.[3]

A few papers examine optimal contracts when workers envy their employer. Fehr and Schmidt (2000) and Fehr, Klein, and Schmidt (2001) study the employer's choice of contractual incompleteness in a model where both the worker and the employer may have fairness concerns. The presence of

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[1]A similar effect shows up when people have 'keeping up with the Joneses' preferences, see Dupor and Liu (2003).

[2]Rabin (1993) studies games in which an agent's feelings depend on the (expected) intentions of the other agents, resulting in reciprocal behavior in equilibrium. Other papers with endogenous sentiments include Akerlof (1982) and Rotemberg (1994).

[3]We also abstract from workers' promotions to a managing position. When a worker's chance of promotion increases in his effort, envy may increase effort, see Grund and Sliwka (2003).

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fair-minded employers may render a highly incomplete bonus contracts optimal as fair-minded employers pay the bonus when the worker works hard. Selfish employers mimic the contract offered by fair employers, but do not pay the bonus. Interestingly, in such a setting fair-minded workers are more reluctant to provide effort than selfish workers, as they face an additional utility loss (increased inequality) when the employer appears to be of the selfish type and does not pay the bonus.

More closely related to our analysis is Englmaier and Wambach (2002). They study optimal incentive contracts for workers who dislike inequality, whereas employers are assumed to be selfish. The authors concentrate on determining whether the incentive contract is linear in output, finding conditions under which it is. Since we assume two possible outcomes (output is either High or Low), that is not our focus. Instead, we shall focus on the implications of envy for the power of the incentive scheme, for total wage compensation, and for worker's effort.

We differ from their work and other work (e.g. Itoh (2003)) in three ways. First, we focus on workers who are never richer than their bosses. We show that because envy amplifies the effect of incentives on effort, optimal incentive pay is higher when envy is present.

Second, we explicitly consider whether a person envies a boss only when he works under him, or whether he envies the boss's wealth even if someone else works under that boss. These two different types of envy have different implications for a worker's participation constraint, and therefore different implications for the wage contract a firm will offer.

Third, we apply the idea to new issues, including why lower-level workers are awarded stock options, and why government generally offers lower-powered incentives than do for-profit firms.

Experimental evidence for envious feelings is provided by Camerer (2003): subjects whose brains were imaged while presented with an unfair offer showed greater activity in the bilateral anterior insula of the brain, revealing that such an offer created negative emotions. Even monkeys appear to react with anger when some other monkey gets too high a reward (Brosnan and de Waal (2003)). Experimental studies by economists also suggest that fairness considerations are important determinants of human behavior. Fehr and Schmidt (2003) provide an extensive survey of this literature. Greenberg (1990) finds empirical evidence that employee theft increases when workers consider their pay to be inequitable. Lastly, there is considerable survey evidence that workers care about how their wage compares to the firm's profits,

and that managers fear quits and reduced effort when workers are given an 'unfair' wage (Agell and Lundborg (1995), Bewley (1999)).

3 Assumptions

We consider the following principal-agent model. A risk-neutral employer hires a risk-averse worker. The employer aims to maximize profits, Π. Profits equal the worker's output minus the wage paid (the price of output is normalized to one). The worker chooses effort e. The worker's effort yields output H with probability $\phi(e)$ and yields output L with probability $[1 - \phi(e)]$, with $\phi'(e) > 0$ and $\phi''(e) \leq 0$. The cost of effort to the worker is $c(e)$, with $c'(e) > 0$ and $c''(e) > 0$. We examine optimal contract design when effort is contractible and when it is not. Output is always contractible; the worker is paid w_i when output is i. Thus, w_L is the base salary and $w_H - w_L$ is the bonus or incentive pay.

The worker's income, cost of effort, and envy are separable in the utility function:

$$U = u(w) - c(e) - \gamma v(x), \tag{1}$$

with $u'(w) > 0$ and $u''(w) \leq 0$. The function $v(x)$ represents envious feelings, with γ the weight on envy in the worker's utility function, $v'(x) > 0$, and $v''(x) \geq 0$.

The simplest assumption about the object of envy is that the worker's utility declines with his employer's profits ($x = \Pi$). This envy of profits may also be seen as describing a spiteful worker rather than an envious one.[4]

Alternatively, in Section 5 we model envy as increasing with the difference in income between the employer and the worker ($x = \Pi - w$).

3.1 Specific envy

We analyze the consequences of two different assumptions about how envy affects the worker's participation constraint. One assumption is that a worker envies an employer only if the worker personally contributes to his employer's

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[4]Note, however, that if $v(\cdot)$ is linear, $x = \Pi$ is behaviorally equivalent to $x = \Pi - U$ and to $x = \Pi - u(w) - c(e)$. That is, when $v(\cdot)$ is linear, assuming that the worker's utility decreases in profits is equivalent to assuming that the worker's envy increases in the difference between the employer's profits and the worker's utility. When $v(\cdot)$ is convex, and $x = \Pi - U$, the model can not be solved analytically.

wealth. This is the 'cold shiver' assumption; it resembles the 'warm glow' assumption used in some analyses of the private provision of a public good, where a person cares not only about aggregate provision, but also about his own contribution.[5] For succinctness, we shall call this specific envy. Under this assumption, a person who is self-employed or unemployed suffers no envy. Let the worker's income be $\overline{w}$, and let his effort be $\overline{e}$ when choosing the outside option. Let E be the expectation operator. Then the envy-free utility when choosing the outside option is

$$\overline{U} = Eu\left(\overline{w}\right) - c\left(\overline{e}\right).$$

The participation constraint is

$$Eu\left(w\right) - c\left(e\right) - \gamma v\left(x\right) \geq \overline{U}.$$

We shall see that such specific envy always makes behavior differ from what it would be in the absence of envy.

3.2 General envy

The alternate assumption is that a worker envies the employer in question regardless of whether or not he works for him.[6] We call this general envy. Let a worker's envy when outside the firm be $v\left(x_e\right)$. The participation constraint is then

$$Eu\left(w\right) - c\left(e\right) - \gamma v\left(x\right) \geq \overline{U} - \gamma v\left(x_e\right).$$

When workers are homogeneous, each worker realizes that, in equilibrium, the employer's profits do not depend on which person is hired. Hence, when envy depends on profits ($x = \Pi$), the value of $v(x)$ equals the value of $v(x_e)$. This makes the participation constraint $Eu\left(w\right) - c\left(e\right) \geq \overline{U}$, which is independent of envy. When, however, envy increases with the difference in income ($x = \Pi - w$), and the wage at the firm can differ from income ($\overline{w}$) under the outside option, the expected disutility from envy may differ inside and outside the

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[5]Important papers on the 'warm glow' in provision of a public good include Arrow 1972; Andreoni 1989, 1990; Cornes and Sandler 1984, 1994; Kingma 1989; McClelland 1989; Roberts 1987; Sandler and Posnett 1991; and Steinberg 1986, 1987.

[6]It is straightforward to extend the utility function to allow for envious feelings towards more than one employer. This does not affect our results when envy increases only with profits, whereas it strengthens our results when envy increases with relative income.

for-profit firm. General envy then directly affects the decision to take the job.

For future reference, we write the worker's participation constraint as:

$$Eu\left(w\right) - c\left(e\right) - \gamma v\left(x\right) \geq \overline{U} - (1 - \beta)\gamma v\left(x_e\right), \qquad (2)$$

where $\beta = 0$ for general envy (that is, when envy arises even when another worker takes the job) and $\beta = 1$ for specific envy. We study the polar cases of specific envy and general envy, by letting β equal 1 or 0; a more general analysis would let it take intermediate values. Thus, a computer programmer working for Sun or for Oracle may envy the wealth of Bill Gates; but perhaps someone at Microsoft envies him even more. The balance between specific and general envy may also depend on where a person lives. A worker in New York City may notice so many wealthy employers that he little envies any one employer unless he works for him. But a worker in a small city can be highly aware of a boss's wealth even when not working for him. So specific envy may be more common in large cities and large countries, and general envy more common in smaller cities and smaller countries.

In the following we shall consider the solutions that arise under different assumptions: a worker's envy can be specific or general; his envy may depend either on the employer's profits or else on the difference between the employer's profits and the worker's income; the pay can be contingent on both effort and output (effort is contractible) or else (because effort is not contractible) only on output. This gives eight different possibilities to consider.

4 Envy increases with employer's profits

4.1 Contractible effort

We start by allowing pay to increase with both the worker's effort and his output. When effort is thus contractible, the principal-agent problem is simple. In the standard model with risk-averse but non-envious workers, the profit-maximizing contract pays the worker a fixed wage (so that the firm bears all the risk) and demands an effort level such that the worker's marginal cost of effort equals the firm's marginal expected revenue from that effort. As we will see, when a worker envies his boss, the optimal contract may impose some of the risk on the worker.

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The employer's optimization problem is

$$\max_{e, w_H, w_L} \phi(e)(H - w_H) + [1 - \phi(e)](L - w_L) \text{ subject to } (2).$$

The first-order conditions are:

$$\phi'(e)[H - L - w_H + w_L] + \lambda\{\phi'(e)[u(w_H) - u(w_L)] - c'(e)\}$$
$$-\lambda\beta\gamma\phi'(e)[v(H - w_H) - v(L - w_L)] = 0 \qquad (3)$$

$$-\phi(e) + \lambda[\phi(e)u'(w_H) + \beta\gamma\phi(e)v'(H - w_H)] = 0 \qquad (4)$$

$$-[1 - \phi(e)] + \lambda\{[1 - \phi(e)]u'(w_L) + \beta\gamma[1 - \phi(e)]v'(L - w_L)\} = 0 \qquad (5)$$

$$\phi(e)u(w_H) + [1 - \phi(e)]u(w_L) - c(e)$$
$$-\beta\gamma\{\phi(e)v(H - w_H) + [1 - \phi(e)]v(L - w_L)\} = \overline{U}, \qquad (6)$$

where λ is the Lagrange multiplier.

In these equations, β and γ always appear as $\beta\gamma$. Therefore under general envy ($\beta = 0$) the weight of envy in utility (γ) is irrelevant, and so envy here has no effect. The neutrality arises because the contractibility of effort effectively makes the worker's only decision whether to participate. In equilibrium, the worker realizes that the employer's profits do not depend on who is hired. As he will envy the employer anyway, envy plays no role in the worker's participation decision. In contrast, with specific envy ($\beta = 1$), the worker can avoid feelings of envy by choosing the envy-free outside option. Then, as is clear from the participation constraint, (6), for a given level of effort, the worker must be compensated for the utility loss of envy, and so envy increases the worker's pay.[7]

Combining (4) and (5) characterizes the optimal pay schedule:

$$u'(w_L) - u'(w_H) = \beta\gamma[v'(H - w_H) - v'(L - w_L)]. \qquad (7)$$

Unsurprisingly, when workers are risk-averse and not envious ($\gamma = 0$), or when workers are risk-averse and suffer from general envy ($\beta = 0$), a fixed wage ($w_H = w_L$) is optimal. A fixed wage places all the risk on the employer, which is optimal because the employer is risk neutral. With specific envy,

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[7]Obviously with specific envy and high γ, the expected wage cost may exceed expected revenues, and so the employer may hire no worker. Throughout the paper, we assume an interior solution.

however, if the marginal utility loss from envy increases with profits ($v'' > 0$), a profit-maximizing firm will share profits (and thus risk) with the worker. The intuition lies with the observation that when the marginal disutility from envy increases with profits, the worker suffers much more when profits are high than when profits are low. With a fixed wage, profits are high when output is high and low when output is low. The employer can increase the worker's expected utility, and hence reduce the worker's expected total compensation, by paying more when output and profits are high, and paying less when output and profits are low. Such profit-sharing increases the employer's expected profits.[8] The cost of profit-sharing is the increased risk borne by the worker. The optimal contract trades off this cost and the benefit of a lower expected utility loss from envy. In the extreme case of a risk neutral worker, (7) implies that the optimal bonus equals the full marginal product of the worker ($w_H - w_L = H - L$).

Combining these results with the first-order condition for effort (3) shows that specific envy affects effort, whereas general envy does not. First note that specific envy makes it more costly to induce a worker to exert effort as long as expected profits rise in effort, see the last term in (3). This, however, has no implications for the optimal level of effort specified in the contract since it is always in the employer's interest to demand a higher level of effort as long as expected profits rise in effort. There are, however, two indirect effects of envy on optimal effort. First, an increase in specific envy causes the firm to compensate the worker with higher pay. When the worker's utility is concave in income, the increase in pay reduces the worker's marginal utility from income and hence increases the marginal wage cost of effort to the firm. Optimal effort is therefore less than in the absence of envy. Second, when envy makes profit-sharing optimal, the employer demands less effort, to reduce the risk borne by the worker. Note that, for a given incentive wage, risk is highest when $\phi(e) = 1/2$. Whether effort is higher or lower therefore depends on the equilibrium level of $\phi(e)$ in the absence of envy. When $\phi(e) < 1/2$, a reduction in effort reduces risk; the reverse holds when

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[8]Notice that when $v(\Pi)$ is linear, the expected utility loss from envy always increases with expected profits. Hence, the only way to reduce the worker's expected disutility from envy, and thereby relax his participation constraint, is to reduce expected profits; this clearly hurts the employer. The convexity of $v(\cdot)$ implies that some profit-sharing can reduce the expected utility loss from envy even though expected profits for the employer increase.

$\phi(e) > 1/2.$[9]

To summarize, when effort is contractible, only specific envy affects the design of the optimal contract. Specific envy induces the employer to compensate the worker for his envy, by increasing pay. Moreover, if utility is convex in envy, the optimal contract calls for profit-sharing. So, though incentives are unnecessary to induce effort, a pay schedule that resembles performance pay is optimal. Lastly, envy may affect the effort requirement in the contract, as a result of an income effect and of the employer's benefit from weakening the consequences of profit-sharing on the worker's risk.

4.2 Noncontractible effort

Suppose now that effort is not contractible. Workers make two decisions: whether to participate and, if so, how much effort to exert. We solve the model by backward induction.

When choosing effort, the worker's expected utility is:

$$U = \phi(e)u(w_H) + [1 - \phi(e)]u(w_L) - c(e)$$
$$-\gamma \left\{ \phi(e)v(H - w_H) - [1 - \phi(e)]v(L - w_L) \right\}. \qquad (8)$$

Note that, by the definition of general and specific envy, it does not matter whether envy is general or specific at the moment the worker chooses effort. The worker's first-order condition for optimal effort is:

$$\phi'(e)[u(w_H) - u(w_L)] - c'(e) - \gamma\phi'(e)[v(H - w_H) - v(L - w_L)] = 0. \qquad (9)$$

Clearly, when incentive pay is less than the worker's marginal product (that is, $w_H - w_L < H - L$), envy reduces the worker's effort. The reason is that the worker's effort increases his employer's profit, making the worker more envious. Though envy reduces the worker's effort given the power of the incentive schedule, envy amplifies the effects of incentives:

$$\frac{de}{dw_H} = \phi'(e)[u'(w_H) + \gamma v'(H - w_H)]s^{-1}$$
$$\frac{de}{dw_L} = -\phi'(e)[u'(w_L) + \gamma v'(L - w_L)]s^{-1},$$

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[9]This effect relies heavily on the assumed production technology. For instance, it would not appear if uncertainty in pay stems from additive noise in production or from additive noise in the performance measure. Therefore, we do not stress it.

where $-s$ is the second-order condition:

$$s = -\frac{\partial^2 U}{\partial e^2} = c''(e) - \phi''(e)\left\{u(w_H) - u(w_L) - \gamma\left[v(H - w_H) - v(L - w_L)\right]\right\} > 0.$$

Besides the usual effect, stronger incentives imply that the employer gains less from marginal effort. This gives envious workers an additional incentive to work harder when incentive pay increases.[10]

The employer maximizes profits subject to the worker's participation constraint, so that the employer's objective is to

$$\max_{w_H, w_L} \phi(e)(H - w_H) + [1 - \phi(e)](L - w_L) \text{ subject to (2)}.$$

The first-order conditions for a profit-maximizing contract are:

$$
\begin{aligned}
-\phi(e) + \frac{de}{dw_H}\phi'(e)[H - w_H - L + w_L] \\
+\lambda\left\{\phi(e)u'(w_H) + \beta\gamma\phi(e)v'(H - w_H)\right\} \\
+\lambda\left\{\frac{de}{dw_H}(1 - \beta)\gamma\phi'(e)[v(H - w_H) - v(L - w_L)]\right\} = 0
\end{aligned}
\tag{10}
$$

$$
\begin{aligned}
-[1 - \phi(e)] + \frac{de}{dw_L}\phi'(e)[H - w_H - L + w_L] \\
+\lambda\left\{[1 - \phi(e)]u'(w_L) + \beta\gamma[1 - \phi(e)]v'(L - w_L)\right\} \\
+\lambda\left\{\frac{de}{dw_L}(1 - \beta)\gamma\phi'(e)[v(H - w_H) - v(L - w_L)]\right\} = 0
\end{aligned}
\tag{11}
$$

$$
\begin{aligned}
\phi(e)u(w_H) + [1 - \phi(e)]u(w_L) - c(e) \\
-\beta\gamma\left\{\phi(e)v(H - w_H) + [1 - \phi(e)]v(L - w_L)\right\} = \overline{U},
\end{aligned}
\tag{12}
$$

where λ is the Lagrange multiplier and the terms in large brackets have been simplified using the first-order condition for effort (9).

When $v(\cdot)$ is linear, the optimization problem has a simple solution. Combining (10) and (11) and letting $v(\cdot)$ be linear shows that the optimal contract has

$$w_H - w_L = H - L - \frac{\phi(e)[1 - \phi(e)][u'(w_L) - u'(w_H)]s}{[\phi'(e)]^2[u'(w_H) + \gamma][u'(w_L) + \gamma]}. \tag{13}$$

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[10]In addition to this first-order effect, envy further magnifies the effect of incentive pay on effort if there are decreasing returns to effort, $\phi''(e) < 0$; see the second-order condition.

Clearly, when workers are risk neutral $[u'(w_L) = u'(w_H)]$, for all values of γ profit maximization requires full incentives (that is, $w_H - w_L = H - L$). When workers are risk averse $[u'(w_L) > u'(w_H)]$, the employer always sets partial incentives (that is, $w_H - w_L < H - L$). Optimal incentives decline with the degree of risk aversion and with the uncertainty about the equilibrium level of output, measured by $\phi(e)[1 - \phi(e)]$. Optimal incentives increase in the effect of effort on expected output $[\phi'(e)]$. Lastly, and most importantly, the marginal incentive an employer offers increases with the importance of envy (as captured by γ) to the worker. The reason is that incentives induce more effort when workers are envious. Hence, it is more costly to weaken incentives for risk-sharing reasons when workers are envious.[11] Note that when $v(\cdot)$ is linear, optimal incentive pay is independent of whether envy is specific or general. As in the previous section, the kind of envy does matter for total compensation. As is clear from the participation constraint (12), the worker earns more when envy is specific (when $\beta = 1$) than when envy is general (when $\beta = 0$).

When $v(\cdot)$ is convex and envy is specific ($\beta = 1$), optimal incentive pay is:

$$
\begin{aligned}
w_H - w_L = H - L \\
- \frac{\phi(e)[1 - \phi(e)]\{u'(w_L) - u'(w_H) - \gamma[v'(H - w_H) - v'(L - w_L)]\}s}{[\phi'(e)]^2[u'(w_H) + \gamma v'(H - w_H)][u'(w_L) + \gamma v'(L - w_L)]}. \quad (14)
\end{aligned}
$$

Note, as apparent from the last term in brackets in the numerator, the convexity of $v(\cdot)$ enhances the effect of envy on incentive pay. This is the effect that also appeared for contractible effort, as described in the previous section: if envy is specific ($\beta = 1$) profit-sharing reduces expected wage cost as the worker suffers relatively much from envy when profits are high than when profits are low.

When $v(\cdot)$ is convex and envy is general ($\beta = 0$), optimal incentive pay

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[11]Envy has two additional, indirect, effects on optimal incentive pay. First, if $\phi''(e) < 0$, the absolute value of the second-order condition (s) decreases in γ. Following (13), this further increases optimal incentive pay. The reason is that incentive pay more strongly affects effort when s is small. Second, there is an indirect effect through $\phi(e)$. By the first-order condition (9), envy directly reduces effort e. Hence, $\phi(e)$ falls, and, if $\phi''(e) < 0$, the vale of $\phi'(e)$ increases. Following (13), the increase in $\phi'(e)$ implies a further increase in optimal incentive pay. The decrease in $\phi(e)$ has an ambiguous effect, depending on whether $\phi(e) \gtrless 1/2$, that is, depending on whether risk increases or decreases in effort.

is:

$$w_H - w_L = H - L -$$

$$\frac{\phi(e)[1 - \phi(e)][u'(w_L) - u'(w_H)]s}{[\phi'(e)]^2[u'(w_H)u'(w_L) + \gamma[1 - \phi(e)]v'(H - w_H)u'(w_L) + \gamma\phi(e)v'(L - w_L)u'(w_H)]}$$
$$+ (\gamma[v(H - w_H) - v(L - w_L)])$$
$$\left(\frac{[1 - \phi(e)][u'(w_H) + \gamma v'(H - w_H)] + \phi(e)[u'(w_L) + \gamma v'(L - w_L)]}{u'(w_H)u'(w_L) + \gamma[1 - \phi(e)]v'(H - w_H)u'(w_L) + \gamma\phi(e)v'(L - w_L)u'(w_H)]}\right).$$

$$(15)$$

Note that here again the convexity of $v(\cdot)$ amplifies the effect of envy on optimal incentive pay. The intuition is clear from the first-order conditions (10) and (11). Recall that when $\beta = 0$, the worker envies the employer even when another worker takes the job. Therefore, envy does not directly affect the worker's decision to take the job. But once on the job, the worker's envy induces him to work less than he otherwise would; effort declines the most when incentive pay is low (see (9)). The reduced effort reduces the worker's utility for a given level of envy. Since, in equilibrium, envy *is* given (that is, independent of the worker's participation), the worker must be compensated for this by a higher base salary. In other words, when $\beta = 0$ and effort is non-contractible, the worker anticipates that when he is hired, his envy will induce him to exert little effort, and so envy indirectly affects the worker's willingness to participate. Higher incentive pay reduces the effect of envy on effort, and hence relaxes the worker's participation constraint. As before, when $v(\cdot)$ is convex, the employer can reduce the expected wage he will pay and thereby increase expected profits, by giving stronger incentives. The only difference from the result with specific envy is that under general envy the effect is indirect through the worker's choice of effort.

In short, when effort is not contractible, envy amplifies the effect of incentives on effort. Consequently, the employer offers stronger incentives. When utility is convex in envy, envy further increases optimal incentive pay so as to reduce the worker's expected disutility from envy and, hence, reduce wage compensation.

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5   Envy depends on relative income

Suppose now that the worker's envy increases with the difference in income between the employer and the worker. Again, we first consider contractible effort and then consider noncontractible effort.

5.1   Contractible effort

The first-order conditions for the profit-maximizing pay schedule are:

$$\phi'(e)\left[H - L - w_H + w_L\right] + \lambda\{\phi'(e)\left[u\left(w_H\right) - u\left(w_L\right)\right] - c'(e)\}$$
$$-\lambda\gamma\phi'(e)\{v(H - 2w_H) - v(L - 2w_L)\}$$
$$+\lambda\gamma\phi'(e)\{(1 - \beta)v(H - w_H - \overline{w}) - (1 - \beta)v(L - w_L - \overline{w})\} = 0 \qquad (16)$$

$$-\phi(e) + \lambda\phi(e)u'\left(w_H\right)$$
$$+\lambda\left[2\gamma\phi(e)v'(H - 2w_H) - (1 - \beta)\gamma\phi(e)v'(H - w_H - \overline{w})\right] = 0 \qquad (17)$$

$$-\left[1 - \phi(e)\right] + \lambda\left[1 - \phi(e)\right]u'\left(w_L\right)$$
$$+\lambda\left\{2\gamma\left[1 - \phi(e)\right]v'(L - 2w_L) - (1 - \beta)\gamma[1 - \phi(e)]v'(L - w_L - \overline{w})\right\} = 0 \qquad (18)$$

$$\phi(e)u(w_H) + \left[1 - \phi(e)\right]u(w_L) - c(e)$$
$$-\gamma\left\{\phi(e)v(H - 2w_H) + \left[1 - \phi(e)\right]v(L - 2w_L)\right\}$$
$$+\gamma(1 - \beta)\left\{\phi(e)v(H - w_H - \overline{w}) + \left[1 - \phi(e)\right]v(L - w_L - \overline{w})\right\} = \overline{U}. \qquad (19)$$

Note that these conditions closely resemble the conditions we described above when envy depends on profits. There are two differences. First, even under general envy ($\beta = 0$), envy directly reduces the worker's willingness to participate. The reason is that, when envy depends on the difference in income between the employer and the worker, wages can differ inside and outside the firm, and so envious feelings may differ. Second, under specific envy ($\beta = 1$), the effect of an increase in pay (either w_H or w_L) on the disutility from envy is twice as large. The reason is that, all else equal, an

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increase in w_i both reduces the employer's profits and increases the worker's income, thus reducing the difference in income by twice as much as the increase in compensation.

Combining (17) and (18) yields:

$$u'(w_L) - u'(w_H) = 2\gamma[v'(H - 2w_H) - v'(L - 2w_L)]. \qquad (20)$$

We see that here, where effort is contractible and envy depends on relative income rather than on profits, the optimal pay schedule no longer depends on β, or is the same under general and specific envy. Both when envy is specific and when it is general, profit maximization may require pay to increase with output. As in the previous section, when utility is convex in envy a trade-off appears between the risk borne by the worker and the expected disutility from envy, implying that some profit-sharing is optimal. Now, even when a worker outside the firm envies the boss ($\beta = 0$), profit-sharing is optimal. The reason is that the expected disutility from envy is no longer a constant when envy depends on the difference in income. Making pay increase with output reduces the expected disutility from envy more when the person works inside the firm than when he is outside it. Hence, working for the firm becomes more attractive compared to the outside option, allowing the firm to reduce the base salary.

A second important difference with the results in the previous section is that the expected disutility from envy is minimized when $w_H - w_L = (H - L)/2$. That is, the employer should pay *half* of the marginal product instead of the full marginal product.[12] The intuition is that when the worker is paid a lump-sum plus half his marginal product, the difference in income between the employer and the worker can be made invariant with output.[13] When $v(\cdot)$ is convex, and given the expected value of the income differential, the worker prefers a stable to an uncertain income differential. Since the compensation schedule has no incentive effects, and since the risk-neutral employer only cares about expected profits, not about the distribution of profits over states, the employer chooses the distribution of pay that maximizes the worker's utility, thus enabling the employer to reduce expected wage costs. Comparing

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[12]Some data support this prediction. Young and Burke (1998) show that in their sample of Illinois farms, almost all contracts have the same tenant share for all types of crops, and this share is one-half for 80% of the contracts.

[13]Note that given that the employer always ends up richer than the worker, a pay system with full incentives results in high income inequality when output is low, whereas the absence of incentive pay results in high income inequality when output is high.

(20) to (7), it follows that envy which varies with relative income may induce less profit-sharing than does envy which varies with profits. We should be careful, however, in comparing the two cases because the function $v(\cdot)$ need not be identical in the two cases. We are sure, however, that if envy depends on the difference in incomes, then when the importance of envy to the worker rises (when γ increases), or when the risk-aversion falls, the optimal level of $w_H - w_L$ converges to half of the marginal product. If instead envy depends on profits, optimal pay converges to the full marginal product.

5.2 Noncontractible effort

Consider next envy which varies with relative income, and pay which is tied to output rather than to effort. The worker chooses that level of effort which satisfies the first-order condition

$$\phi'(e)[u(w_H) - u(w_L)] - c'(e) - \gamma\phi'(e)[v(H - 2w_H) - v(L - 2w_L)] = 0.$$

Note that envy no longer unambiguously reduces effort. When $w_H - w_L < (H - L)/2$, envy reduces effort, as before. But when $w_H - w_L > (H - L)/2$, envy motivates effort, even though effort enriches the employer. The reason is that when incentive pay exceeds half the marginal product, effort reduces the expected difference in income between the employer and the worker, giving the worker an incentive to work harder. Envy amplifies the effects of incentives:

$$\begin{aligned}
\frac{de}{dw_H} &= \phi'(e)[u'(w_H) + 2\gamma v'(H - 2w_H)]s^{-1} \\
\frac{de}{dw_L} &= -\phi'(e)[u'(w_L) + 2\gamma v'(L - 2w_L)]s^{-1},
\end{aligned}$$

where $-s$ is the second-order condition:

$$s = -\frac{\partial^2 U}{\partial e^2} = c''(e) - \phi''(e)\left\{u(w_H) - u(w_L) - \gamma\left[v(H - 2w_H) - v(L - 2w_L)\right]\right\} > 0.$$

Stronger incentives imply that effort becomes more rewarding in terms of income, but also that the difference in income between the employer and the worker increases less (or decreases more) with effort. Hence, envious workers have an additional incentive to work harder when incentive pay increases.

The first-order conditions for a profit-maximizing pay schedule are:

$$-\phi(e) + \frac{de}{dw_H}\phi'(e)[H - w_H - L + w_L]$$
$$+\lambda\left\{\phi(e)u'(w_H) + 2\gamma\phi(e)v'(H - 2w_H) - (1 - \beta)\gamma\phi(e)v'(H - w_H - \overline{w})\right\}$$
$$+\lambda\left(\frac{de}{dw_H}(1 - \beta)\gamma\phi'(e)[v(H - w_H - \overline{w}) - v(L - w_L - \overline{w})]\right) = 0 \quad (21)$$

$$-[1 - \phi(e)] + \frac{de}{dw_L}\phi'(e)[H - w_H - L + w_L]$$
$$+\lambda\left\{[1 - \phi(e)]u'(w_L) + 2\gamma[1 - \phi(e)]v'(L - 2w_L) - (1 - \beta)\gamma[1 - \phi(e)]v'(L - w_L - \overline{w})\right\}$$
$$+\lambda\left(\frac{de}{dw_L}(1 - \beta)\gamma\phi'(e)[v(H - w_H - \overline{w}) - v(L - w_L - \overline{w})]\right) = 0 \quad (22)$$

$$\phi(e)u(w_H) + [1 - \phi(e)]u(w_L) - c(e)$$
$$-\gamma\left\{\phi(e)v(H - 2w_H) + [1 - \phi(e)]v(L - 2w_L)\right\}$$
$$+(1 - \beta)\gamma\left\{\phi(e)v(H - w_H - \overline{w}) + [1 - \phi(e)]v(L - w_L - \overline{w})\right\} = \overline{U}. \quad (23)$$

We first solve for the profit-maximizing pay schedule when $v(\cdot)$ is linear. Combining (22) and (23) yields

$$w_H - w_L = H - L - \frac{\phi(e)[1 - \phi(e)][u'(w_L) - u'(w_H)]s}{[\phi'(e)]^2[u'(w_H) + 2\gamma][u'(w_L) + 2\gamma]} \quad (24)$$

The result much resembles that of the previous section; compare (13). Optimal incentive pay is higher when workers are envious because incentives have a larger effect on effort.

When $v(\cdot)$ is convex, and envy is specific ($\beta = 1$), optimal incentive pay is

$$w_H - w_L = H - L$$
$$-\frac{\phi(e)[1 - \phi(e)][u'(w_L) - u'(w_H) - 2\gamma[v'(H - 2w_H) - v'(L - 2w_L)]]s}{[\phi'(e)]^2[u'(w_H) + 2\gamma v'(H - 2w_H)][u'(w_L) + 2\gamma v'(L - 2w_L)]} \quad (25)$$

As before, the convexity of $v(\cdot)$ makes some profit-sharing, which reduces the expected disutility from envy, optimal. This effect is captured by the last

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term in the numerator. Note that the effect of envy on optimal incentive pay becomes ambiguous. Though envy amplifies the effect of incentives on effort and, therefore, increases optimal incentive pay (see the terms in the denominator), profit-sharing may call for lower incentives. This occurs when, apart from profit-sharing reasons, optimal incentive pay is higher than half the marginal product. Then lowering incentive pay reduces uncertainty about the difference in income and thus, as $v(\cdot)$ is convex, reduces the expected disutility from envy. When, apart from profit-sharing reasons, optimal incentive pay is less than half of the marginal product (for instance, when the worker is sufficiently risk averse), envy unambiguously increases optimal incentive pay.

Lastly, consider the case where $v(\cdot)$ is convex and envy is general ($\beta = 0$). Define:

$$
\begin{aligned}
D = {}& u'(w_H)u'(w_L) + \gamma \left[2v'(H - 2w_H) - \phi(e)v'(H - w_H - \overline{w}) \right] \left[u'(w_L) + 2\gamma v'(L - 2w_L) \right] \\
& + \gamma \left\{ 2v'(L - 2w_L) - [1 - \phi(e)]\, v'(L - w_L - \overline{w}) \right\} \left[u'(w_H) + 2\gamma v'(H - 2w_H) \right] \\
& \qquad\qquad\qquad\qquad - 4\gamma^2 v'(H - 2w_H)v'(L - 2w_L)
\end{aligned}
$$

Optimal incentive pay is:

$$
w_H - w_L = H - L -
$$
$$
\frac{\left\{ \dfrac{\phi(e)[1 - \phi(e)]s}{[\phi'(e)]^2 D} \right\}}{\{ u'(w_L) - u'(w_H) - \gamma\left[2v'(H - 2w_H) - v'(H - w_H - \overline{w}) - 2v'(L - 2w_L) + v'(L - w_L - \overline{w}) \right] \}}
$$
$$
+ \gamma[v(H - w_H - \overline{w}) - v(L - w_L - \overline{w})]
$$
$$
\left\{ \frac{[1 - \phi(e)][u'(w_H) + 2\gamma v'(H - w_H)] + \phi(e)[u'(w_L) + 2\gamma v'(L - w_L)]}{D} \right\} \quad (26)
$$

To understand the differences between (25) and (26), consider the first-order conditions (21) and (22). These show two additional effects under general envy, described by the last two terms in brackets.

First, the pay schedule has a smaller effect on the participation constraint when envy is general, because the firm's pay schedule now also affects the worker's envy when another worker take the job. Comparing the numerators in the first fractions in (25) and (26) shows that this reduces optimal incentive pay. Incentive pay declines because, for a given level of effort, weaker

incentives imply higher profits. Since wages elsewhere are unaffected by the firm's wage offer, higher profits imply that a person working outside the firm suffers a higher expected disutility from envy. Thus, lower incentive pay makes participation more attractive compared to the outside option, allowing the firm to reduce the base salary.

Second, working in the opposite direction, is an indirect effect through effort, described by the last terms in brackets in the first-order conditions (21) and (22). The intuition is the following. Higher incentive pay increases effort. This increases the probability of high output. When the firm pays less than the full marginal product, profits will be higher when output is H than when output is L. As the wage elsewhere is fixed, this implies that the worker expects to suffer more from envy when he chooses the outside option. Hence, higher incentive pay makes the outside option less attractive, allowing the firm to reduce the base salary (see the last term in (26)). As the two additional effects have opposite signs, it is unclear whether incentive pay will be higher or lower when envy is specific compared to when it is general.

6 Applications

6.1 Stock options to lower-level workers

While awarding stock options can align the interests of CEOs and shareholders, it is harder to see why lower-level workers should be granted stock options, as each individual worker's effort hardly affects the stock price. Yet, many firms offer stock options to all workers (Hall and Murphy, 2003). Workers' envy of the manager's wealth may be an explanation. As we have seen, when utility is convex in envy, the profit-maximizing compensation schedule is not a flat wage, even when effort is fully contractible. Instead it pays a high wage when output (and hence profit) is high and a low wage when output (and hence profit) is low. The employer balances the cost of risk to the worker and the worker's expected disutility from envy. These effects can make a profit-maximizing firm award stock options to workers even if any one individual worker's effort hardly affects the stock price. When, for incentive reasons, the CEO is awarded stock options, workers should be also, so as to reduce the expected disutility from envy.

6.2 Wages are higher at larger establishments

Other things equal, in a large firm or a large plant, the income of the boss will be higher. We can think of multiple workers under each boss or owner. The higher income creates higher envy, and so induces higher wages and higher-powered incentives. Agell (2003) gives evidence on how incentives vary with the size of establishment. Using a representative survey of compensation managers he finds that small establishments rely less on pecuniary incentives and report less often that their employees care about relative pay.

A large literature finds that large employers pay higher wages than smaller ones, and that this wage premium remains even after controlling for observable characteristics of workers and of firms. The size effect is large; Brown, Hamilton and Medoff (1990) show that employees in US companies with more than 500 employees earn 35 percent more than those in companies with less than 500 employees. Brown and Medoff (1989), Groshen (1991), Oi and Idson (1999), and Troske (1999) report and summarize similar results for the United States. The increase of wages with employer size is also found in other countries. Arai (1999) reports results for Sweden. Albaek et al. (1998) present results for the Nordic countries, and provide references to studies for other non US-countries.

6.3 Profit vs. Non-profit organizations

In a private firm the firm's owner is the residual claimant on net profit. In contrast, in a governmental or non-profit organization the residual claimants are a large fraction of the public, with incomes far lower than those of owners of firms. It is therefore reasonable to suppose that envy plays a less important role for workers outside for-profit firms.[14]

The absence of envy means that a worker will be willing to work for a lower wage at a governmental job. It also means that a government worker faced with low-powered incentives will exert more effort than he would given the same incentives at a for-profit firm.

Empirical evidence indeed suggests that government workers face lower-powered incentives than do workers in the private sector. Burgess and Met-

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[14]For the same reason, corporate taxes and progressive taxation may reduce workers' envious feelings in for-profit firms, as the worker's marginal product contributes less to the firm's profits. Hence, corporate taxes and tax progressivity may increase lower-level workers' productivity.

calfe (1999) find that firms in the private sector make far more use of incentive wages than in the public sector. Kikeri and Nellis (2002) discuss several studies which find an increase in performance-based incentives for workers in privatised firms. Martin and Parker (1997) report similar evidence for several British firms. There is also evidence showing that governmental workers are paid less. In particular, several studies find that wages at firms increased after privatization in the United Kingdom (see Bishop and Kay (1988), Haskel and Szymanski (1993), and Parker and Martin (1996)). La Porta and Lopez-de-Silanes (1999) find the same for Mexico, and Brainerd (2002) for Russia.

Our explanation for low-powered incentives in government relies on the assumption that the residual claimants are members of the general public, rather than a wealthy owner. The literature offers some other explanations for low-powered incentives in government: the absence of market discipline (Niskanen (1971), Hanushek (1996)), and optimal design of governmental agencies to limit collusion and corruption (Crozier (1967), Tirole (1986), and Banerjee (1997)). Acemoglu, Kremer, and Mian (2003) explore the implications of such low-powered incentives for the types of goods or services that are better provided by government than by the private sector. Recent work models workers who value the output they produce. Francois (2000 and 2003) calls this Public Service Motivation, and shows why a worker concerned about an employer reducing the supply of an input as the worker increases his effort may prefer working for a non-profit organization and is given lower-powered incentives. Delfgaauw and Dur (2002) argue that weak incentives in the public sector may stem from exploitation of monopsonistic power over motivated workers, a power that firms in a competitive environment lack.

7   Concluding remarks

This paper examined the behavior of a worker who envies his employer, and characterized the employment contracts that may result. Our analysis clearly implies that the employer could enjoy higher profits the less envious are workers of the owner or manager. One way of doing this is to make the job of the manager appear unattractive to his subordinates. Requirements for credentials (such as an MBA degree) by managers, can make executive positions appear less attractive to some workers, and thus reduce their envy. The nasty and brutal campaigns that candidates for political office endure, and the continued scrutiny by the press, can make citizens little envy a governor

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or senator, and therefore more willing to work on his behalf. The difficulty of Officer Candidate School in the military can similarly make enlisted soldiers more willing to obey their officers. In short, many of the phenomena which appear to fit a signaling story which sorts different types of people into different positions, may instead or in addition be explained as mechanisms to reduce envy of superiors.

Our reasoning can be applied not only to production, but also to consumption. Suppose that a consumer envies the wealth of the sellers of goods. As Kahneman, Knetsch, and Thaler (1986), for example, document, consumers may refuse to buy from firms that are seen to profiteer from natural disasters. Similarly, Olmstead and Rhode (1985) tell the fascinating story of California oil companies in the 1920s. Standard Oil of California, the dominant firm and price-setter, refused to raise gasoline prices although the real price of light crude doubled. Similarly, during the 1979 gasoline crisis large oil companies such as Exxon and Mobil posted lower prices for gasoline and heating oil than did small companies (Erfle, Pound, and Kalt 1981; Erfle and McMillan 1990). In our terms, we can think of a consumer's utility as increasing with his consumer surplus, and decreasing with the seller's profits. If price equals marginal cost, the quantity a consumer buys has no effect on the firm's profits. But the more price exceeds marginal cost, the higher the profits to the seller on each additional unit sold. Envy will then reduce demand. Or stated differently, envy makes demand more elastic, inducing the seller to charge a lower price than he would in the absence of envy. And, in analogy with our analysis of production, an increase in the tax rate on profits will increase consumer demand.

8   Notation

$c(e)$ Cost of effort

e Effort

$\overline{e}$ Outside option effort

H Firm's revenue when production is high

L Firm's revenue when production is low

$u(w_i)$ Worker's utility from income

$v(x)$ Worker's disutility from envy

U Worker's utility

$\overline{U}$ Worker's envy-free outside option utility

w_i Wage when productivity is i

$\overline{w}$ Worker's outside option wage

Y Worker's income

$\phi(e)$ Probability that production is high

γ Weight on envy in the worker's utility function

Π Profits

References

[1] Acemoglu, Daron, Michael Kremer, and Atif Mian (2003) "Incentives in markets, firms and governments." National Bureau of Economic Research, Working Paper 9802.

[2] Agell, Jonas (2003) "Why are small firms different? Managers' views." Working paper, Department of Economics, Stockholm University.

[3] Agell, Jonas and Per Lundborg (1995) "Theories of pay and unemployment: Survey evidence from Swedish manufacturing firms." *Scandinavian Journal of Economics*, 97: 295-307.

[4] Akerlof, George A. (1982) "Labor Contracts as Partial Gift Exchange." *Quarterly Journal of Economics*, 97(4): 543-569.

[5] Albaek, K., M. Arai, R. Asplund, E. Barth, and E. Strojer Madsen (1998) "Measuring wage effects of plant size." *Labour Economics*, 5: 425-448.

[6] Arai, Mahmood (1999), "Wages, profits and capital intensity: Evidence from matched worker-firm data." Working Paper, Department of Economics, Stockholm University.

[7] Andreoni, James (1989) "Giving with impure altruism: Applications to charity and Ricardian equivalence." *Journal of Political Economy*, 97: 1447-1458.

[8] Andreoni, James (1990) "Impure altruism and donations to public goods: A theory of warm-glow giving." *Economic Journal*, 100: 464-477.

[9] Arrow, Kenneth J. (1972) "Gifts and exchanges." *Philosophy and Public Aairs*, 1: 343362.

[10] Banerjee, Abhijit (1997) "A theory of misgovernance." *Quarterly Journal of Economics*, 112(4): 1289-1332.

[11] Biel, Pedro Rey (2002) "Inequity Aversion and Team Incentives." Working Paper, ELSE, University College London.

[12] Bishop, Matthew and John Kay (1988) "Does privatization work? Lessons from the UK." Centre for Business Strategy, London Business School.

[13] Bolton, Gary E. and Axel Ockenfels (2000) "ERC: A Theory of Equity, Reciprocity, and Competition¿" *American Economic Review*, 90(1): 166-93.

[14] Brainerd, Elizabeth (2002) "Five years after: The impact of mass privatization on wages in Russia, 1993-1998." *Journal of Comparative Economics*, 30: 160-190.

[15] Brosnan, Sarah F. and Frans B. M. de Waal (2003). *Nature*, 425: 297-299.

[16] Brown, Charles, James Hamilton, and James Medoff (1990) *Employers: Large and Small.* Cambridge, MA: Harvard University Press.

[17] Brown, C. and J. Medoff (1989) "The employer size-wage effect," *Journal of Political Economy*, 97: 1027-1059.

[18] Burgess, Simon, and Paul Metcalfe (1999) "The Use of Incentive Schemes in the Public and Private Sectors: Evidence from British Establishments." CMPO Working Paper 99/015.

[19] Camerer, Colin F. (2003) "Strategizing in the brain." *Science*, 300: 1673-1675.

[20] Cornes, Richard and Todd Sandler (1984) "Easy riders, joint production, and public goods." *Economic Journal*, 94: 580-598.

[21] Cornes, Richard and Todd Sandler (1994) "The comparative static properties of the impure public good model." *Journal of Public Economics*, 54: 403-421.

[22] Crozier, Michel (1967) *Bureaucratic Phenomenon.* Chicago: University of Chicago Press.

[23] Delfgaauw, Josse and Robert Dur (2002) "From Public Monopsony to Competitive Market: More Efficiency But Higher Prices." Tinbergen Institute Discussion Paper 02/118-1.

[24] Demougin, Dominique and Claude Fluet (2003) "Group vs. individual performance pay when workers are envious." CIRPÉE Working Paper 03-18.

[25] Dupor, Bill and Wen-Fang Liu (2003) "Jealousy and equilibrium over-consumption." *American Economic Review*, 93: 423-428.

[26] Englmaier, Florian and Achim Wambach (2002) "Contracts and inequity aversion." CESifo, Working Paper 908.

[27] Erfle, Stephen, John Pound, and Joseph Kalt (1981) "The use of political pressure as a policy tool during the 1979 oil supply crisis." Discussion Paper #E-80-09, Kennedy School of Public Policy, Harvard University.

[28] Erfle, Stephen and Henry McMillan (1990) "Media, political pressures, and the firm–the case of petroleum pricing in the late 1970s." *Quarterly Journal of Economics*, 105: 115-134.

[29] Fehr, Ernst, Alexander Klein, and Klaus Schmidt (2001) "Fairness, incentives and contractual incompleteness." Centre for Economic Policy Research, Discussion Paper 2790.

[30] Fehr, Ernst and Klaus Schmidt (1999) "A theory of fairness, competition and co-operation." *Quarterly Journal of Economics*, 114: 817-868.

[31] Fehr, Ernst and Klaus M. Schmidt (2000) "Fairness, incentives, and contractual choices." *European Economic Review*, 44: 1057-1068.

[32] Fehr, Ernst and Klaus Schmidt (2003) "Theories of fairness and reciprocity — Evidence and Economic Applications." In M. Dewatripont et al., eds. *Adavnces in Economics and Econometrics*. Vol. 1, Cambridge: Cambridge University Press.

[33] Fershtman, Chaim, Hans K. Hvide, and Yoram Weiss (2003) "Cultural Diversity, Status Concerns and the Organization of Work." workers with status concerns will have more high-powered incentives, work more and earn more than workers who do not care about status.

[34] Francois, Patrick (2000) "Public service motivation as an argument for government provision." *Journal of Public Economics*, 78: 275-299.

[35] Francois, Patrick (2003) "Not-for-profit provision of public services." *The Economic Journal*, 113: C53-C61.

[36] Frank, Robert H. (1984), "Are Workers Paid their Marginal Products?" *American Economic Review*, 74: 549-571.

[37] Frank, Robert H. (1985) *Choosing the Right Pond: Human Behavior and the Quest for Status.* New York: Oxford University Press.

[38] Greenberg, Jerald (1990) "Employee theft as a reaction to underpayment inequity: The hidden cost of pay cuts." *Journal of Applied Psychology*, 75: 561-568.

[39] Groshen, Erica L. (1991) "Five reasons why wages vary among employers." *Industrial Relations*, 30: 350-381.

[40] Grund, Christian and Dirk Sliwka (2003) "Envy and compassion in tournaments." Mimeo, University of Bonn.

[41] Hall, Brian J. and Kevin Murphy (2003) "The trouble with stock options." *Journal of Economic Perspectives*, 17: 49-70.

[42] Hanushek, Eric A. (1996) "Outcomes, cost, and incentives in schools. In Eric A. Hanushek and Dale W. Jorgenson, eds. *Improving America's Schools: The Role of Incentives.* Washington, D.C.: National Academies Press.

[43] Haskel, Jonathan, and Stefan Szymanski (1993) "Privatization, liberalization, wages and employment: Theory and evidence for the UK." *Economica*, 60: 161-181.

[44] Itoh, Hideshi (2003) "Moral hazard and other-regarding preferences." Working paper, Graduate School of Commerce and Management, Hitotsubashi University.

[45] Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler (1986) "Fairness as a constraint on profit seeking: Entitlements in the market." *American Economic Review*, 76(4): 728-741.

[46] Kikeri, Sunita, and John Nellis (2002) "Privatisation in Competitive Sectors: The Record To Date." World Bank Policy Research Working Paper 2860.

[47] Kingma, Bruce Robert (1989) "An accurate measurement of the crowd-out effect, income effect, and price effect for charitable contributions." *Journal of Political Economy*, 97: 1197-1207.

[48] La Porta, Rafael and Florencio Lopez-de-Silanes (1999) "Benefits of privatization: Evidence from Mexico." *Quarterly Journal of Economics*, 114(4): 1193-1242.

[49] Martin, Stephen, and David Parker (1997) *The Impact of Privatisation: Ownership and Corporate Performance in the UK*. London: Routledge.

[50] McClelland, Robert (1989) "Voluntary donations and public expenditures in a federalist system, Comment and extension." *American Economic Review*, 79: 1291-1296.

[51] Neilson, William S. and Jill Stowe (2003) "Incentive pay for other-regarding workers." Mimeo, Duke University.

[52] Niskanen, William A. (1971) *Bureaucracy and Representative Government*. Chicago: Aldine/Atherton.

[53] Oi, W. Y. and T. L. Idson (1999) "Firm size and wages." In O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, volume 3A. Elsevier: Amsterdam.

[54] Olmstead, Alan L. and Paul Rhode (1985) "Rationing without government: The west coast gas famine of 1920." *American Economic Review*, 75(5): 1044-56.

[55] Parker, David and Stephan Martin (1996) "The impact of UK privatization on employment, profits and the distribution of business income." *Public Money and Management*, 16(1): 31-37.

[56] Rabin, Matthew (1993) "Incorporating fairness into game theory and economics." *American Economic Review*, 77: 1281-1302.

[57] Roberts, Russel D. (1987) "Financing public goods." *Journal of Political Economy*, 95: 420-437.

[58] Rotemberg, Julio J. (1994) "Human Relations in the Workplace." *Journal of Political Economy*, 102(4): 684-717.

[59] Sandler, Todd and John Posnett (1991) "The private provision of public goods: A perspective on neutrality." *Public Finance Quarterly*, 19: 22-42.

[60] Steinberg, Richard (1986) "Charitable giving as a mixed public/private good: Implications for tax policy." *Public Finance Quarterly*, 14: 415-431.

[61] Steinberg, Richard (1987) "Voluntary donations and public expenditures in a federalist system." *American Economic Review*, 77: 24-36.

[62] Tirole, Jean (1986) "Hierarchies and bureaucracies: On the role of collusion in organizations." *Journal of Law, Economics, and Organization*, 2: 181-214.

[63] Troske, K. R. (1999) "Evidence on the employer size-wage premium from worker establishment matched data." *Review of Economics and Statistics*, 81: 15-26.

[64] Varian, Hal R. (1974) "Equity, envy, and efficiency." *Journal of Economic Theory*, 9(1): 63-91.

[65] Young, P. and M. Burke (1998) "Competition and custom in economic contracts: A Case study of Illinois agriculture." mimeo.