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Incentives, Retention or Sorting?

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ABSTRACT

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Variable pay, defined as pay that is tied to some measure of a firm's output, has become more important for executives of the typical American firm. Variable pay is usually touted as a way to provide incentives to managers whose interests may not be perfectly aligned with those of owners. The incentive justification for variable pay has well-known theoretical problems and also appears to be inconsistent with much of the data. Alternative explanations are considered. One that has not received much attention, but is consistent with many of the facts, is selection. Managers and industry specialists may have information about a firm's prospects that is unavailable to outside investors. In order to induce managers to be truthful about prospects, owners may require managers to "put their money where their mouths are," forcing them to extract some of their compensation in the form of variable pay. The selection or sorting explanation is consistent with the low elasticities of pay to output that are commonly observed, with the fact that the elasticity is higher in small and new firms, with the fact that variable pay is more prevalent in industries with very technical production technologies, and with the fact that stock and stock options are a larger proportion of total compensation for higher level employees. The explanation fits small firms and start-ups better than larger, well-established firms.

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The typical rationale given for tying compensation to the profitability of the firm is that output-based variable pay aligns managerial incentives with those of owners. While appealing, this explanation is not easily reconciled with theory or facts. Free-rider effects in a multi-agent firm make incentives associated with output-based pay very weak, perhaps to the point of being trivial. At the empirical level, even CEOs, whose compensation is most likely to depend on company performance, own a very small part of the firm. Other facts also seem to be at variance with, or at least not directly supportive of, the incentive argument. For example, information technology firms are more likely to offer stock options than other kinds of firms. The probability of offering variable pay through options to managers varies with firm size, as does the pay-performance elasticity. High-level executives are more likely to receive variable pay than lower-level employees. The simple incentive explanation that is cast in the framework of a single-agent firm does not go far toward explaining these observations.

Additionally, stock options have become an increasingly important part of compensation over the past few years.[1] Some [2] view the growth as totally unwarranted, reflecting among other things, pressure that CEOs can place on their boards to award them high salaries. Other authors argue that an even larger part of compensation should take the form of stock options. Their view is that the relation of pay to output is not strong enough. Incentives are important, given what

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[1]See Murphy (1999).

[2]See, for example, O'Reilly, Main and Crystal (1988) .

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executives can do to affect firm profits, and CEOs, it is claimed, are not sufficiently affected by firm

profitability. Jensen and Murphy (1990) find very low sensitivity of CEO pay to firm value. They

worry that this induces CEOs to spend shareholder money on unwarranted CEO perks, like corporate

jets.[3] The claims on this side of the debate are bolstered by recent evidence that variable pay can

have dramatic effects on productivity.[4] Although true, there is little hope that making the elasticity

of compensation to firm profitability higher can have the appropriate effect on incentives. The free-

rider effects are still too great to induce a risk-neutral CEO to behave efficiently.[5]

The question is more general: What is the appropriate relation of worker pay to output? The

answer depends on what one believes is accomplished by linking pay to performance. The strongest

version of concern over the low sensitivity of pay to performance comes from analyzing incentives

in a risk-neutral environment. The observation is that the coefficient of output, properly measured,

on CEO pay is much less than one. To align incentives, it is argued, CEOs should be full residual

claimants. This argument is a straw man. In fact, a number of authors have defended the fact that

the coefficient on output, properly defined, in a CEO compensation equation is not one. Most have

been on the basis of risk aversion.[6] Another, in some ways more obvious, constraint is that of

personal bankruptcy on the part of the CEO or the agent who is made residual claimant. Given the

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[3]Hall and Leibman (1998) re-examine the issue more critically, but still find coefficients in the output-wage equation that are well below one.

[4]See, for example, Lazear (2000b), Freeman and Kleiner (1998), Paarsch and Shearer (1997).

[5]Baker and Hall (1998) divide production activities undertaken by CEOs into two polar cases. This is discussed below.

[6]See, for example, Haubrich (1994).

size of the swings in profit, it would be impossible for most CEOs to be full residual claimants. If

profits fell by $1 billion, as they might in a large corporation, the CEO would be unable to pay that

amount to the firm. The situation is made more complicated when it is recognized that there are

many workers that a firm wants motivated. It is difficult, if not impossible, to make all workers

residual claimants.[7]

In what follows, another approach is taken. Rather than focusing on the incentive role of

variable pay, the importance of sorting (or selection) and information will be stressed. The idea is

that insiders have more information about the profitability of an enterprise than outsiders. Outsiders,

who might be inclined to invest in an enterprise, would like some assurance that the firm is likely

to make a positive profit. By taking compensation in a contingent form, insiders put their money

where their mouths are. A worker who will take a lower wage, coupled with pay that varies with

the profitability of the firm, is betting that the firm's profits will be sufficiently high to make up for

any deviation in the fixed pay from the market wage. This information is reassuring to outside

investors.   The implications of sorting and information are quite different from incentives. The

sorting story seems to mesh better with a number of facts than at least the most extreme version of

the incentive story. Most important, it implies a coefficient on output that is much closer to zero

than it is to one. It also suggests that to the extent variable pay is used, it is more likely to be used

in new firms and those where information is most likely to be private, than in older, better-

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[7]A Groves (1973) scheme could make each a residual claimant by offering to pay every
worker $1 for every $1 of profit. The worker pays a fixed amount for the privilege so that, on
net, he receives his reservation wage. The problem is that capital owners prefer lower profits
under such schemes and bankrolling the uncertain payoff is more than just a practical difficulty.
Carmichael (1983) has argued that tournament compensation, where all workers but one receive
fixed prizes depending on rank, create optimal incentives for the entire firm.

understood firms. It is possible to argue that sorting is an appropriate story only for small, new or rapidly changing firms where the information aspect is important. If so, the ability to explain the low coefficient of profit on pay by information arguments is limited. On the other hand, the fact that the relation is stronger in small or new firms fits the story. Finally, this explanation is consistent with having a number of workers receive variable compensation, because the coefficient on the output-pay variation for any one worker is expected to be very small.

In addition to incentives and sorting, another explanation of providing variable pay, particularly non-vested stock options, is the desire to retain workers. The various theories have very different empirical implications that can be tested. There already exists considerable evidence on some of these points. That evidence will be examined to ascertain the importance of the different explanations. The main conclusion is that many facts are more consistent with sorting than with incentives. Specifically:

1. Sorting does not require that the manager "own" the firm. An elasticity very close to zero sorts projects perfectly.

2. Selling the manager the firm is the wrong solution to the sorting problem because the price at which the sale takes place induces inefficiency.

3. Worker retention is not a justification for awarding non-vested stock options.

SOME VIEWS OF VARIABLE PAY

Risk Aversion

It can be argued that there should be no variable pay at all. Variable pay transfers risk from

capital to labor, defined to include management. This is bad for two reasons. First, workers have their human capital tied up in the firm, whereas non-labor owners of capital do not. From the point of view of diversification, a transfer of more idiosyncratic risk to labor is a step in the wrong direction. Second, a firm's own workers do not offer funds at the lowest cost. Consider, for example, a cash-constrained start-up that asks its clerical workers to take below-market wages in return for stock options. A cheaper source of capital would appear to be available. Low-wage workers should charge a higher price for funds than should, say, venture capitalists or debt-based investors. If a worker would accept, say, 5000 options in lieu of 20% of the market wage, then a venture capitalist who is in a better position to bear risk should provide that same amount of capital for less than the 5000 options. The firm should simply borrow from the venture capitalist and pay the worker the market wage. Yet it is common at start-ups to see even the lowest-level workers receiving below-market wages, which are offset by stock options.[8] This is inconsistent with what risk allocation theories would predict.[9] Put differently, given the risk aversion of workers and their limited resources, it is unlikely that they are the cheapest source of funds, even for cash-hungry start-ups.

Incentive

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[8]According to John Morgridge, former CEO and Chairman of Cisco Systems, the San Jose, California-based firm that produces internet servers. He is well-known for distributing stock options to every employee.

[9]Davis and Willen (1998) argue that workers may want to hold shares in their own industries because when wages in their industries fall, profits in their industries rise, so that buying the industry might provide insurance. Even if true at the industry level, there is evidence that suggests that firm profitability and worker wages are positively correlated. (E.g., see Lazear [1999]).

The standard incentive model is well-known. When there is one risk-neutral agent whose effort is variable, the agent should be made full residual claimant. A compensation scheme that takes the form

(1) $\text{Compensation} = a + b\,\pi$

where π is profit, will induce first-best behavior if $b = 1$.[10] This induces the agent to set the marginal cost of effort equal to the marginal return. The constant term, a, is then adjusted to distribute the rents. With perfectly elastic labor supply, a is set such that

$$a + b\,\pi^* = W,$$

where W is the worker reservation wage and π^* is the level of profits when effort is set to the optimal level.

The main problem with this result is that it flies in the face of the facts. Except for franchisees and a few 100% commission agents, very few individuals have this sort of relationship with a firm or other provider of capital. The reasons have already been mentioned. First, when there are multiple agents whose effort cannot be monitored and compensated directly, there are practical difficulties in making all agents residual claimants. Risk aversion and the ability to declare bankruptcy also push away from this kind of system. Incentives no doubt play some role in

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[10]This is shown in many places. See, for example, Lazear (1995) pp. 14-15.

determining the compensation. But the fact that the coefficient in the pay-earnings equation is far less than one suggests that other factors are present.

Retention

Another explanation that is sometimes offered by business persons is that granting non-vested options assists in employee retention. A number of firms offer options to employees, but the worker must stay with the firm for some time before the options vest. Any departure before that date results in a loss of the options.

Although the non-vested aspect of options does retain workers, there are two problems with this argument. First, nothing requires that non-vested pay take the form of equity. Second, retention is not always efficient.

To the extent that the typical worker is more risk-averse than the outside suppliers of capital, non-vested pay should take the form of bonds rather than equity. At the time that the promise is made, the firm could simply put a bond (like a t-bill) in an escrow account. If the worker were to stay for the required period, he would receive the bond. If he left early, it would revert to the firm. Such an arrangement would have all the binding power of non-vested options, but would not transfer risk to employees who are not efficient risk bearers.

Furthermore, binding a worker to the firm is not usually efficient.[11] If a worker's outside opportunities exceed his value at the current firm, then distorting pay to enhance retention is inefficient. Both worker and firm could be made better off by negotiating a separation.

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[11]One exception is firm-specificity to the relationship, either because of human capital or informational considerations. Additionally, it may be privately (although not socially) optimal to bind workers to the firm in order to prevent a monopoly from becoming an oligopoly.

The conclusion is that the retention argument fails to explain the granting of options, non-vested or otherwise.

Retention with Variable Output

A slight variation of the retention argument is that productivity is either unknown or time-varying. For example, there may be good states of the world, where retention of workers is optimal, and bad states where separation is optimal. Ex ante, the realization is unknown so the firm wants to set up a contract that has the flexibility to pay them more and thereby retain workers during the good state, but pay them less and encourage them to leave during the bad state. Stock options perform this function.

A simple version of this allows the manager's value to be some constant fraction of the firm's market capitalization. Let there be two states. In one, the manager's value exceeds W, his alternative use of time. In the other, it falls short of W. Efficiency requires that managers stay with the firm in the good state and leave in the bad state. If a manager is simply paid one penny less than W, he will leave in the bad state because his options will be out of the money. If the firm is in the good state, the exercise price can be set such that the options are in the money and have positive value. If the options are structured such that they do not vest until after the work that period is performed, then the manager will work that period, receive his options at the end of the period, and earn more than W, which is both efficient and individually rational.

A slightly more complicated version of this explanation is offered by Oyer (2000). Rather than focusing on the efficient contract, he assumes that retention is the goal. He argues that because movements in the alternative use of time and the value at the firm are likely to be correlated, it is necessary to offer compensation that varies with the market conditions in order to retain managers.

Non-vested stock options perform this function because they vary in the appropriate direction, making the option value increase during good times and decrease during bad times. Oyer and Schaefer (2002) provide evidence that is consistent with this view.

Sorting: Skin in the Game

A story that has received much less attention than the incentive story, but seems consistent with many of the facts, is that of sorting or selection. Sorting can occur across workers or it can be across projects. Both are relevant, but the initial discussion is cast in terms of project sorting. The clearest way to frame the discussion is through an example of a capitalist who is considering extending an enterprise to a new direction. Consider, for example, a clothing manufacturer who sells pajamas, but is thinking about moving into the lingerie line.[12] The manufacturer has no expertise in lingerie, nor does the company know the prospects in the lingerie market. There are, however, a number of individuals with managerial expertise in lingerie who are potential developers or partners in this line. One such manager contacts the owner of the pajama firm. The manager claims that Gladys, Inc. can enter the lingerie business profitably, with the manager's assistance. This may be correct, but the statement may be wrong for two reasons: The manager's assessment of the lingerie market may be wrong. Alternatively, the manager may know the truth, but may gain personally by drawing Gladys, Inc. into the venture even when it is unprofitable. We focus on the second reason first and return to the first reason later.

To begin, consider the fact that π, now thought of as the profit on the lingerie line, is a random variable, the realization of which is important information to Gladys, Inc. the capitalist.

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[12]This example is based on the experience of a student in the Stanford-National University of Singapore executive program.

Specifically, a capitalist with complete knowledge would only choose to invest in positive profit

projects. If capitalists were able to screen out all negative profit projects, then expected profits

would be

$$(2) \quad E(\pi|\pi \geq 0) \;\equiv\; \int_0^\infty \pi f(\pi) d\pi$$

$$\equiv \int_0^\infty \pi \, dF$$

where π has density $f(\pi)$ with distribution function $F(\pi)$. This is obvious, but is easily derived from

the condition

$$\max_{\pi *} \int_{\pi *}^\infty \pi \, dF$$

which has first-order condition

   $-\pi^* f(\pi^*)=0$.

The solution is $\pi^*=0$. To maximize profits, the firm should reject only and all negative profit

projects. The expected profits in (2) are the maximum attainable profits under perfect information.

Now, a manager who knows π and has alternative opportunities W accepts a job offer at

compensation $a + b\pi$ whenever

(3) $a + b\pi \geq W$.

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One can implement the optimal solution by using the compensation scheme of setting $a = W$, and setting b positive, but arbitrarily close to zero. Using (3) and substituting $a = W$, the manager only chooses to accept the job when

$$b\pi \geq 0,$$

or, since $b>0$, he accepts when and only when $\pi \geq 0$. A value of $b = 0$ would not work, however, because then the manager would accept the job even when profits were negative.[13]

There are a few points to note. First, and most important, managers receive their reservation wage and the capitalists capture all rent above W. Of course, any $b > 0$ would result in efficiency as well, but larger values of b would distribute a larger share to the manager than necessary if there is a perfectly elastic supply of managerial talent at wage W. Still, the implied relation between profit and wages of the manager is much closer to zero than it is to one. The purest incentive story suggests a coefficient on b of one, whereas the sorting explanation implies a coefficient on b that approaches zero.

In some sense, this mechanism is too easy. As long as a manager knows that he cannot receive anything above the reservation wage, he should be willing simply to tell the owner whether the project is worthwhile. The information is valuable to the owner, but the manager extracts no rents because of the competitive nature of the managerial market. Thus, b arbitrarily close to zero solves the problem. Indeed, it could be argued that $a = W$ and $b = 0$ works as well because the manager has no incentive to lie under these circumstances. Unobserved heterogeneity among managers breaks the indifference and nails down more precisely the exact level of b, which must be

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[13]Note that economic profit nets out the opportunity cost of managerial time, which equals W.

positive. This is shown below, but intuitively, with $b = 0$ some managers whose alternative wage

is less than W might lie to the capitalist stating that the project is profitable when it is not, in order

to get a higher wage than the alternative.

Second, efficiency prevails. Capitalists obtain perfect information; the manager accepts the

job for every positive profit project and rejects the job for every negative profit project. Note further

that setting $a < W$ and $b > 0$ does not attain efficiency. It is inefficient to use a lower base pay

coupled with a higher output-based component. For any $\gamma > 0$ such that $a = W - \gamma$, there is a range

of positive profit projects that are rejected by the manager. Specifically, in those situations where

$a + b\pi < W$,

the manager rejects the job. This implies the manager rejects when

$W - \gamma + b\pi < W$

or when

$\pi \quad < \quad \gamma / b \quad .$

The larger is gamma, the more positive profit projects that are rejected. Conversely, were a greater

than W, the manager would accept the job in some cases where profits were negative.

Third, and related, selling the manager the firm is neither efficient nor optimal from either

agent's point of view. Selling the manager the firm would imply a negative value of a, and would,

by default, necessarily imply $b = 1$. The manager would be made full residual claimant. This could

be accomplished by using debt financing rather than equity financing.[14] But this solution is neither

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[14]Capital owners would issue a bond that had a fixed payoff. All amounts of profit that
exceeded the owed amount would revert to the equity holder, namely the manager. Of course,
this debt would be quite risky because if profits turned out sufficiently negative, the manager
could not repay the loan. Worse, managers would have incentives to borrow even if profits were

efficient nor profit-maximizing for the capitalist. For the capitalist to make money on the sale, a

must be negative, i.e., the manager must pay the capitalist a fee to acquire the firm. To see that this

is inefficient, note that this is merely a special case of $\gamma > 0$ with $b = 1$, because when a < 0, the

manager rejects projects for which $\pi < -a$. As shown above, this results in positive profit projects

being rejected by the manager. Even though a project yields positive profit, it may not yield enough

to make the manager willing to take on the activity, given that he must pay something to obtain the

firm in the first place. If the manager already owned the firm, then he would take on all positive

profit projects. But the manager is making the decision to buy the firm after he has already obtained

information on the realization of profits. Put differently, if the owner knew the actual value of π,

a deal could be struck for every $\pi > 0$. But when the owner charges a fixed price for the firm in the

absence of knowledge, some positive profit projects will be rejected.

Furthermore, selling the manager the firm does not maximize capitalist profit. If the sorting

view holds, then the problem for the capitalist is an ex ante one because the capitalist does not know

the true value of the firm. The manager's decision, on the other hand, is made ex post of the

realization. To see what this implies formally, consider the capitalist who wants to sell the firm.

The choice is merely over a, because once the firm is sold, $b = 1$. Now, the manager buys the firm

whenever

$$a + \pi > 0$$

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negative as long as they could consume some of the loan before having to repay. Collateral of
some sort or more direct monitoring is usually required under these circumstances.

or whenever[15]

$$\pi > -a \,.$$

The more negative is *a*, the less often the firm is bought by the manager. But the more negative the *a*, the more the owner receives for the firm. This is the classic stochastic monopoly problem where the capitalist receives -*a* and the manager "receives" *a*, which will be negative. To see this, note that the capitalist wants to choose *a* so as to maximize

$$(-a) \quad \text{prob} \, (\, a + \pi > 0)$$

or

$$(-a) \, [\, 1 - F(-a) \,]$$

The first order condition is

$$- [\, 1 - F(-a)] - a \, f(-a) = 0$$

or

(4) $a = -[\, 1 - F(-a) \,] / f(-a) \,.$

This is the standard condition that says set the price equal to the inverse hazard ratio of profits.[16]

It yields a value of a that is negative. The manager must pay a positive amount to the capitalist.

Selling the firm to the manager at the optimal a in (4) always results in lower profits to the

capitalist than setting $a = W$ and b close to zero. The solution of $a = W$, b close to zero yields full

efficiency and distributes all the rent to the capitalist. It is impossible to do better. When $a < 0$, the

condition that the firm operates whenever $\pi > 0$ is violated. Profits must exceed $-a$, a positive

number, in order to induce the manager to buy the firm. Since positive profit opportunities are

foregone (i.e., those when $0 < \pi < -a$), expected profit is strictly lower when the firm is sold to the

manager than when it is retained by the capitalist who pays $a = W$ and b close to zero. Selling the

firm to the manager solves the moral hazard problem, but it does not solve the adverse selection

problem.

The result is another example of a price discriminator extracting all the rents and a

monopolist extracting only a part of them. By setting $a = W$ and b close to zero, the capitalist price

discriminates. The capitalist implicitly charges a lower price for the firm when π is low than when

it is high. The firm is worth more and the capitalist receives more when $a = W$ and b is close to

zero. With $a < 0$ and $b = 1$, no price discrimination occurs. The price that the capitalist receives for

the firm from the manager is always $-a$, and this occurs only when $\pi > -a$. Thus, the capitalist does

better by using the $a = W$, b close to zero compensation scheme than she does by selling the firm

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[16]This is the same result as that obtained in Hall and Lazear (1984) in the context of
calling out a wage that induces a worker to accept a job when his reservation wage is unknown.

to the manager, even if such a sale were feasible.[17]

With competitive bidders, an auction could be held that would extract all rents. Instead of fixing price in advance at -a, the firm would simply allow the informed managers to bid against one another to buy the firm. Competition among managers would drive the price paid up to π and the capitalist could extract all rent this way. This would be fully efficient because no positive bids would be received when profits were negative. This solution gives identical rents and allocations as the solution of $a = W$ and b arbitrarily close to zero. The difficulty here, of course, is the same as mentioned earlier. In order to extract full rent, the manager must be in a position to buy the entire firm outright at the present value of its future profit stream. In most situations, this is infeasible and is part of the reason why managers are managers and not owners. Managers neither have the capital nor can they borrow enough to buy the firm outright. Borrowing introduces severe moral hazard problems. A lender would only be willing to finance the firm if the collateral, in this case, the firm itself, were sufficient to protect the loan. But to make this determination, the capitalist who lends the money must have the same information as the informed manager. Were this the case, an informed manager would be unnecessary, which negates the entire premise. Instead, the solution of setting $a = W$ and b slightly positive accomplished everything that selling the firm outright does,

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[17]The solution that assigns all the rent to the capitalist generalizes to any solution of the rent split. Simply think of W as the equilibrium amount that the manager captures, given bargaining strength. This is an ex ante amount because the capitalist, who is ignorant of π, does not base negotiation strategy on π. Then all results hold. In the lingerie example, the capitalist captures all rents because there are substitute managers who also know the lingerie business.

   If the market for such knowledge were sufficiently large, then a "certifying" business might be viable. Rather than having the manager actually take the job with the manufacturer, the potential manager could simply provide a diagnostic service and charge a fee for giving unbiased assessments of profit opportunities.

but it does not require a loan nor does it put managers in a position where they benefit from lying about the value of the firm to obtain loan funds that they can consume before a default. The solution is fully efficient and the owner extracts all of the rent.

Put more intuitively, the sorting story boils down to this: Before a capitalist is willing to put resources into an enterprise, he wants to be confident that the investment will yield a significant payout. Worker behavior, and especially the behavior of those most knowledgeable, provides the capitalist with clues. In order to get informed managers to put their money where their mouths are, the capitalist makes pay contingent on profit. If those with the most knowledge are unwilling to take a job under a contingent pay arrangement, then the capitalist is less inclined to invest. It is sensible for a capitalist to be more willing to commit to an organization where all the knowledgeable people accept contingent pay than to an organization where those people demand a guaranteed wage. The capitalist is reassured when managers have "skin in the game."

All Managers are Not Created Equal

There are two dimensions of managerial differences that are relevant for sorting. First, the manager may not know true profits with certainty. Second, managers are a heterogeneous lot and the firm may want to induce only the most able managers to apply.

Furthermore, once managers are different, the model that ensured a perfectly elastic supply of managers at wage W is no longer valid. Different solutions and equilibria to the problem must be explored. The first-best contract that was feasible and sustainable with a perfectly elastic supply of homogeneous managers will not be feasible under more general conditions.

How does uncertainty about managers change the solution? First of all, even risk-neutral capitalists prefer to be dealing with agents who have more precise information. The reason is that

a perfectly informed manager accepts the job only when profits are positive and always rejects it

when profits are negative. An imperfectly informed manager makes mistakes, sometimes taking the

job when profits are negative and sometimes rejecting the job when profits are positive. These false

positive and false negative mistakes reduce the overall level of expected profits for the capitalist.

To see this more formally, consider two managers. One knows π with certainty (as assumed up to

this point). The other only estimates π with $\hat{\pi}$

$$\hat{\pi} = \pi + v ,$$

where v is random measurement error.

Given compensation scheme $a + b\pi$, the risk-neutral imperfectly informed manager accepts

the job whenever

$$a + b\hat{\pi} > W$$

or when

$$\hat{\pi} > (W - a) / b .$$

Thus, the imperfectly informed manager would accept the job when

(5) $v > -\pi + (W - a) / b$.

The rule in (5) implies that even with negative profits, an imperfectly informed manager who drew

a high enough value of v would accept a job that a perfectly informed manager would reject.

Conversely, if v is sufficiently low, then an imperfectly informed manager rejects positive

profit projects. Again, if $a = W$ and b is small but positive, the perfectly informed manager always

does the right thing, which results in maximum profits for the capitalist. The imperfectly informed

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manager does not. Since the capitalist receives $(1-b)\pi$ of every investment made, the existence of either false negative or false positive errors results in lower profits than those in (2), which are obtained when a perfectly informed manager is paid W, plus a very small positive fraction of profit. Since (2) yields the maximum profit, any acceptance of projects other than those where $\pi > 0$ results in lower profits than those in (2). Because (5) implies that false positive and/or false negative errors are made, the project acceptance rule deviates from that in (2) and results in lower overall profit. Thus, the capitalist's expected profits are lower with an imperfectly informed manager than with a perfectly informed one.[18]

The second point, that managers are heterogeneous, requires some discussion. There are two dimensions along which managers differ. Managers have different ability to affect profit and also have different alternative uses of time. One might suspect that the two would be correlated. This has implications for the size of b. Once worker heterogeneity is taken into account, it is no longer the case that the firm can simply ask knowledgeable managers to reveal voluntarily whether a project is profitable. Sorting of managers requires a value of b that exceeds zero by a specific amount.

This is precisely the problem that the capitalist was worried about in setting up a lingerie division. The capitalist wanted the manager to run the division because the manager could turn a profit for the company, not because the manager's alternatives were poor. The capitalist had no expertise in the lingerie business and had to rely on the manager or someone similar, but wanted

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[18]For risk-averse managers, using a higher value of b and lower value of a is more of a burden to an imperfectly informed manager than to an otherwise identical perfectly informed manager. Because v is a random variable, the larger the b, the larger the amount of random variation in income.

to ensure the right manager for the job so that the project would be profitable under this guidance.

Were the capitalist able to auction off the lingerie division, then all would be solved. But this simply begs the question about why the capitalist owns the clothing firm in the first place. Presumably, there is some comparative advantage in organizing a firm of this type. The fact that the manager knows lingerie does not imply efficiency along all dimensions, and the inability to raise sufficient capital provides just one reason why the manager might not be the owner.

Short of selling the firm to the manager, what can the owner do? The owner can set up a compensation scheme that attempts to induce sorting along two dimensions. The owner wants to weed out the bad managers and also induce managers to take the job only when it is profitable to do so. Because managers have different alternative uses of time, the solution no longer simple. For example, suppose there were two types, Quicks and Slows. The quick managers produce profit level π_Q for the firm, whereas the slow managers produce profit level π_S for the firm, with $\pi_Q > \pi_S$. Furthermore, the quick managers are also likely to have better alternatives than are the slow managers, even if only in self-employment. Let the Quicks have alternative wages W_Q and the Slows have alternative wages W_S.

There exists no linear compensation scheme that accomplishes sorting, efficiency and pays the manager only the manager's reservation wage.[19] To see this, note that to attract the Quicks, it is necessary that

$a + b\pi_Q \geq W_Q$.

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[19]It may be possible to improve on performance by offering a menu of compensation schemes. See Myerson (1983).

To keep the less able manager from taking the job, it is necessary that

$$a + b\pi_S < W_S$$

Finally, to ensure that efficiency prevails, it is necessary that the able manager accept the job if and only if π_Q is non-negative. Thus, when $\pi_Q = 0$, the able manager should be just indifferent between accepting and declining the job, and should strictly prefer it when profits are positive. Suppose we choose $a = W_Q$ and b close to zero, as before. This scheme induces efficiency for the able individual, but since $W_Q > W_S$, the less able manager also takes the job, even when profits are considerably negative. For this individual, there is no longer a "tie." The Slow is not indifferent between telling the truth about the profitability of the firm and working elsewhere. Even were profits negative, as long as $\pi_S > (W_S - W_Q)/b$, which is a negative number, the Slow would be better off accepting the job and lying about the profitability of the venture.[20] Again, this was the owner's concern. The owner worried that the manager would say that the venture was profitable, even if it was not, just to take advantage of the high fixed salary.

Unfortunately, other compensation schemes that keep Slows out also result in inefficiency for Quicks. To obtain efficiency for Slows, the firm would set $a = W_S$ and b close to zero. But then Quicks would not accept the job for a range of positive profit opportunities. In order for the Quicks to accept, it would be necessary that $W_S + b\pi_Q > W_Q$ or that $\pi_Q > (W_Q - W_S)/b$. This leaves out a range of profitable projects because $W_Q - W_S$ is positive.

One solution is to obtain information on the worker's alternatives. If the owner knew that the manager's alternatives were higher than a, he would feel much more comfortable launching the

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[20]The Slow accepts when $a + b\pi_S > W_S$. Setting $a = W_Q$ means that the Slow accepts when $\pi_S > (W_S - W_Q)/b$.

project. When $W > a$, the manager can do better than his alternatives only when $\pi > 0$. The manager's willingness to give up some fixed salary to take the job would signal that the manager believes the firm would earn positive profit. Knowledge that the manager was giving up something to take the position at the firm could completely alter the owner's view of the project.

If the firm were unable to obtain information on the value of the manager's alternatives, then it must choose a and b, knowing only distributions and not realizations. This problem is somewhat more complicated than the previous specification, but it can be solved. If the firm can commit to a compensation function, then it selects a and b ex ante to maximize profit.

Formally, let managers have talents, k_i, distributed with density $g(k_i)$ such that profit at the firm equals

(5) $\pi_i = \pi + k_i$

where π continues to be known to the manager. As before, the owner only knows the ex ante density $f(\pi)$. Finally, allow managers to have alternative uses of time given by W_i. To make things simple, let

$W_i = W + \lambda k_i$

where λ is a parameter that is less than one. The most able managers also have better alternatives, but they have a comparative advantage at running the firm in question.

Now, manager i will only accept the job when

$a + b(\pi + k_i) > W + \lambda k_i$

or when

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(6) $\pi > \dfrac{W + \lambda k_i - a}{b} - k_i$

Thus, the firm's expected profits are

(8) $profit = \displaystyle\int_{-\infty}^{\infty} \int_{\frac{W+\lambda k - a}{b} - k}^{\infty} ((-a + (1-b)(\pi + k))) f(\pi) g(k) d\pi dk$

The solution can be found by differentiating (8) with respect to a and b and setting the resulting expressions equal to zero. The first order conditions are messy,[21] but it is clear from the f.o.c. MM4 that either $a < 0$ or $b < 1$, or both. If this were not so, the firm would never make a positive profit.[22] The exact nature of the solution depends on the underlying distributions of k and π. Also clear is that since there is no longer a unique alternative wage, there is no way, ex ante, to

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[21]They are

$$\frac{\partial}{\partial a} = \int_{-\infty}^{\infty} \int_{\frac{w+\lambda k - a}{b} - k}^{\infty} - f(\pi)\,g(k)\,d\pi\,dk + \frac{1}{b}\int_{-\infty}^{\infty}[-a + (1-b)(\frac{w+\lambda k - a}{b})f(\frac{w+\lambda k - a}{b} - k)]g(k)dk = 0$$

and

$$\frac{\partial}{\partial b} = \int_{-\infty}^{\infty} \int_{\frac{w+\lambda k - a}{b} - k}^{\infty} - (\pi + k)f(\pi)\,g(k)\,d\pi dk + \int_{-\infty}^{\infty}(\frac{w+\lambda k - a}{b^2})[-a + (1-b)(\frac{w+\lambda k - a}{b})f(\frac{w+\lambda k - a}{b} - k)]g(k)dk = 0$$

[22]The first term inside the integral of MM4 is negative so the second term must be positive, implying $a < 0$ or $b < 1$ (or both).

set *a* equal to the alternative wage for every potential manager.[23]

Although no general characterization is provided, an example makes clear why the optimal *b* exceeds zero. If f() is uniform between -20 and 20, with g() uniform between 0 and 10, then, when W = 1 and λ=.05, the solution is to set *a* = 1.12 and *b* = 0.06. With these values, the managers' alternatives vary between 1 and 1.5, so setting *a* = 1.12 pays managers a fixed component that is less than the average wage that managers earn outside. However, the positive coefficient on *b* makes the job attractive for some, especially those who have high values of k. Complete efficiency is not obtained. For example, a worker with a value of k = 0 and therefore an alternative wage of one would accept the manager's job even when profits were slightly negative. As long as *b*π is not less than -0.12, so that profit is greater than -2, the worker is still better off being manager at this enterprise than taking the alternative position. The firm would prefer that the manager decline. Conversely, some efficient opportunities are foregone. Consider, for example, an individual with k = 10 so that the alternative wage would equal 1.5. Since base pay is 1.12, it is necessary that the difference, in this case, 0.38, is made up by the variable component. Were *b*(π+10) < 0.38, so that profit is lower than 6.40, then the manager would pass up the opportunity, even when management profit, π + 10, is greater than zero.

Furthermore, higher levels of *b* punish low productivity managers relative to high productivity ones. For example, a fixed wage set at one coupled with a *b* = 0 would attract the lowest ability type and keep out the highest ability type. That same fixed wage of one with a *b* > 0 would keep all out low productivity types who would produce negative profits and would attract

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[23]This result r is similar to Prop. 2 in Gibbons (1987), but Gibbons result is based on moral hazard considerations, whereas the result here relates to adverse selection.

all high productivity types such that $b(\pi+k_i) > w+\lambda k_i$. There exist high enough levels of b (perhaps greater than one) that attract only the highest ability workers.

Summarizing this section, a higher value of b coupled with a lower value of a is relatively more advantageous to the more able managers. The firm can encourage more able managers to take the job and discourage less able ones from doing so by using a value of b that exceeds zero. This also implies a fixed wage component, a, that is less than the alternative wage of the most able type of worker. The cost of using a low value of a and a high value of b is that some profitable projects are passed up by more able workers.

EVIDENCE

The size of b

There is substantial evidence on the relation of compensation to output, especially for CEOs. Most of the evidence finds that b, the coefficient of some measure of output on compensation, is very small, even for CEOs. For example, Murphy (1999) finds that b is between 0.001 and 0.007 during the 1990s in the sample of firms that he examines. The coefficients vary with year and industry.[24] This means that a $1000 change in shareholder value implies about a $1 to $7 change in the compensation of the CEO. These numbers depend on how compensation is calculated. Hall and Liebman (1998) find larger effects than the earlier studies by taking into account changes in compensation that result from changes in the market value of the firm. Still, the results support a low value of b. It is quite clear that CEOs are not close to being full residual claimants.

Most of this evidence comes from large and established firms. The information argument,

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[24]See his figure 8.

although not irrelevant in these cases, is less compelling than it is for small and newer firms. But

there is evidence, discussed below, that suggests disproportionate use of variable pay for new firms,

especially where information is held by insiders and experts.

The sorting view is not inconsistent with the fact that b is small. It also seems to fit well with

some other facts. For example, Yermack (1995), finds that the form of stock options is inconsistent

with the view that they are provided for incentive reasons, despite the fact that most firms call them

incentive plans. For example, the vast majority of options are issued with the exercise price set at

the current market price. This does not provide the kind of leverage that would increase incentives

necessary to offset the free-rider effects of having diluted ownership.[25] There may be other reasons

for setting the strike price equal to the current price, but it is difficult to argue that providing optimal

incentives is one of them.

Sorting is not inconsistent with setting a strike price equal to the market price. Again, since

the b implied by sorting may be very small, no leverage is required to provide the right sorting

mechanism. Furthermore, tying value to stock price is exactly what sorting implies. Since investors

are concerned about the value of the firm, the sorting story is relevant even if the recipient of

variable pay is not the one that generates high value in the firm. It is only necessary that he knows

about value generation and is willing to bet on it.

Sorting does not explain all observed patterns. Although much more unusual than grants of

stock or stock options to executives, some firms give stock even to lower-level employees. The fact

that grants of stock and options to lower-level employees are rare, especially compared to those for

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[25]See Lazear (1998, pages 317-25, 340-42).

managers, is consistent with the sorting explanation. The existence of such awards at all is not. But given the size of grants to low-level employees, these awards are the exception rather than the rule.

Other examples of variable pay

Stock and stock options reflect one form of variable pay, but more direct pay variation is also observed. In Lazear (1986), I argued that American workers might have pay that is actually more variable than that of Japanese workers because raises implicitly depend on company profits in the US. This elasticity of pay to profit in the United States might be higher than the elasticity of pay to profit in the more explicit wage contracts observed in Japan. In a recent paper,[26] I found that firm growth and worker wage growth were positively related. This suggests that there may be some implicit variation even in the pay of workers who have fixed wages that are explicitly independent of variations in profit.

Also relevant is the volatility of stock price. Where information is more important, stock prices are more volatile because there are larger deviations between ex ante and ex post valuations. The sorting explanation suggests that stock options and variable pay should be more common when stock price is more volatile. No clear prediction on volatility comes from an effort motive for stock grants.

Do incentives work?

There are a number of studies that show that variable pay can indeed have large effects on productivity and possibly on profit as well. In addition to the micro-studies mentioned earlier (Lazear (2000b), Paarsch and Sheerer (1997) and Fernie and Metcalf (1996)), there are survey-based

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[26]See Lazear (1999).

analyses that find positive effects. Prendergast (1999) surveys the work on incentives in firms and concludes, based in part on studies already discussed, that incentives matter, but that the selection or sorting explanation has received too little attention given its apparent empirical importance. Additionally, Prendergast suggests that most incentives are produced through promotion in a tournament context, rather than through variable pay. Estrin, Perotin, Robinson and Wilson (1997) find that higher productivity is associated with the existence of profit sharing across a large number of firms in OECD countries. Finally, Blinder (1990) summarizes the findings of a conference on pay and performance by stating that profit sharing appears to raise productivity, but that ESOPs do not. The most direct evidence on ESOPs is presented in the Blinder volume by Conte and Svenjar (1990), who conclude that ESOPs do not reduce productivity, as some who worry about dilution effects predict, but that there is little evidence of increased productivity. Weitzman and Kruze (1990) cite the industrial relations literature and summarize it as implying that productivity rises when some form of gain-sharing or profit-sharing is instituted.

The fact that these papers find incentive effects suggests that variable pay can generate incentives. This is consistent with the incentive view of variable pay. To the extent that the studies on profit-sharing are taken to imply causation, the findings are noteworthy because standard models suggest that profit-sharing should not have much of an effect on worker behavior, again because of free-rider problems.[27] However, the results, while supportive of incentive stories, do not provide evidence that discriminates between incentives and sorting. Although the results may indicate incentive effects, it is also possible that the data reflect sorting. Profit-sharing firms attract the most

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[27]See Kandel and Lazear (1992).

able workers and only able workers are hired because all incumbents care about firm profitability. Thus, a correlation between performance and profit-sharing could be present even if sorting, rather than incentives, were the mechanism.[28]

Incentives are obviously important in some cases where sorting and information are irrelevant. Two examples leap to mind. First, taxicab drivers generally lease their cabs from cab companies and are complete residual claimants. For them $b = 1$. With cabs, incentive problems are key. Were drivers paid a fixed hourly wage, they would prefer to park the cab rather than to seek out customers. Making drivers full residual claimants solves this problem. (It also eliminates the desire of the driver to offer a ride with the meter off at a fixed fee. Both passenger and driver could be made better off by this deal, but it would result in reduction of revenue for the company.) Also clear is that those who invest in the cabs do not have poorer knowledge of the taxi business than individual drivers. Setting $b = 1$ serves no informational role here, but it does provide the right incentives for the drivers.[29]

The same logic applies to franchise salespersons. Mary Kay Cosmetics, Amway, and peanut sellers at ballparks fit here. They all have $b = 1$. The salesperson buys the product and resells it, keeping the difference as payment for services. The information argument makes little sense in this context, whereas the incentive justification seems sound. Of course, these cases, along with the taxicab example, involve situations where implicit purchase or rental of all of the capital is feasible.

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[28]Lazear (2000b) uses panel data, which allow total productivity effects to be partitioned into those that result from pure incentives and those due to other factors, including sorting. In that study, half of the total effect of switching to variable pay reflected incentives.

[29]It does tend to sort out the better drivers. Those who are least able to use the cab effectively will not find it profitable to lease the cab at the equilibrium price.

If there are incentive effects, then the optimal b will be between zero and one. Perfect incentives are provided when $b = 1$, but this causes a distortion in sorting, making entrepreneurs forego too many positive profit opportunities. (If $b = 1$, $a < 0$ which means that managers do not take the job unless profits are sufficiently high to cover the negative base.) As a result, the combination of incentives with sorting results in a hybrid structure, with $0 < b < 1$.

The conclusion, then, is that the typical case has b far less than one. Few managers are full residual claimants. Although there are many reasons why this is so, it implies that incentive stories, at least in their purest form, do not explain all of the data. Sorting may be a better explanation in some cases. Furthermore, in those situations where information is unimportant and incentives clearly matter, $b = 1$ is observed.

Hierarchical Considerations

As mentioned earlier, high-level managers are more likely to have information about prospects (both their own and the firm's) than are lower-level production workers. This would imply that straight fixed wage contracts should be more prevalent among low-level workers than among higher-level ones if information arguments imply a b that is positive, but small. Indeed, the evidence is clear on this point. The American Compensation Association Salary Survey from 1998-9 reports that about 94% of firms offered their offices and executives stock options, whereas only 19% of firms offered options to their non-exempt, hourly, non-union workers.

Is this finding also consistent with the provision of incentives? Aggarwal and Samwick (1999) suggest that it is. If workers are risk-averse, and if market value is a better signal of CEO output than it is of output of lower-level executives and production workers, then CEO

compensation would be more closely tied to market value than that of other workers.

Evidence by Kaplan and Stromberg (2002) supports the sorting explanation. In particular, they find that as uncertainty about the founder and venture rises, venture capitalists require that the founder's cash flow be more sensitive to firm performance. This takes the form of more explicit performance compensation, later vesting, and fewer liquidations.

Firm Size and Firm Age

Gathering information would seem to be more important in new industries than in older ones. Although there is little hard evidence on this point, the general impression is that the typical manger in a start-up firm in Silicon Valley receives a large part of his compensation in the form of variable pay (often stock options). These new firms fit the story modeled above. It is less clear why it would be more important from an incentive point of view to provide variable pay in new firms than in old.[30]

Evidence by Kaplan and Stromberg (2002) is again instructive. They find that the founder's equity stake declines as the venture capital - founder relationship progresses. Although there are other obvious reasons why this might be so, it seems consistent with asymmetric information being more important in young firms where founders are likely to know more than investors. As time progresses, the asymmetry is erased and possibly reversed.

There is also evidence on the relation of variable pay to firm size. The absolute number of dollars at risk to managers is lower for top executives in small firms than in large ones, but the

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[30]Aggarwal and Samwick's (1999) explanation may fit here also. To the extent that new firms are small, firm value is likely to be a better signal of managerial output in small firms than in larger ones.

elasticity of compensation is higher in small ones than in large firms.[31] Size and age are surely

correlated because almost all new firms are small. Is elasticity or absolute dollars at risk relevant

for incentive consideration? Baker and Hall (1998) argue that to motivate activities, the effects of

which are independent of firm size, absolute dollars should be the target variable. To induce

managers to take actions that have more value in larger firms, the elasticity is relevant. By using

data on the actual distribution of *b* across firms, they infer that the mix of desired activities is

somewhere in the middle of the two extremes. Their results, while interesting, do not provide

independent evidence on incentives because they assume an optimal incentive structure to estimate

the underlying parameters.

One implication of the information-sorting story is that variable pay should be used when

information is more important or more difficult for investors to obtain. New industries are one

example, but another is provided by high-tech industries, where those with a comparative advantage

operating in a capital market are not likely to have a comparative advantage in the technical activity

itself. There is some evidence on this point. Anderson, Banker and Ravindran (2000) find that there

is greater use of stock options in information technology firms. Not only is this a new industry, but

it is one where the level of technical expertise is high and skills are specialized so that investors are

likely to be at a large informational disadvantage relative to industry specialists. Managers who are

specialists are required to have skin in the game in high tech firms. The result seems inconsistent

with insurance explanations, because one would expect capital, not low wage labor, to bear the risk

in new, highly uncertain industries.

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[31]See Murphy (1999), figure 9, and Baker and Hall (1998).

Periods of Uncertainty

If the information-sorting argument is correct, then variable pay might be more prevalent during periods of uncertainty when outsiders are looking to insiders for information. Thus, when an industry is undergoing major change or when a firm is in a transition period, stock options and other variable pay might be observed. A prediction is that mergers, divestitures, bankruptcies and other events that signal a period of rapid change for a firm will be associated with variable pay. This is in contrast to the implications of risk aversion, which would suggest workers should want more insurance in volatile times. Prendergast (2000) argues that there is little evidence of more demand for wage insurance in riskier environments. If anything, the evidence goes in the opposite direction. One anecdote comes to mind. In the early 80s, when Chrysler was on the verge of bankruptcy, Lee Iacocca, a knowledgeable auto industry insider, was brought in as CEO for $1 a year plus variable pay that depended on Chrysler's performance. Iacocca's willingness to take this bet was touted in the press as reflecting his confidence in Chrysler and its ability, under his leadership, to turn around. Indeed, one clear rationale in publicizing the nature of his contract was to advertise Iacocca's confidence in Chrysler to investors and consumers.

CONCLUSION

Variable pay has become an important part of compensation. Most economists have tried to explain the use of variable pay in the context of incentive models. Although incentives may be a justification for a number of the variable pay contracts that are observed, incentives do not fit well with a number of other facts. An alternative story that relies on information and sorting seems to be consistent with some facts that are at odds with the incentive justification. Although sorting

cannot explain all the facts, the focus on incentives almost to the exclusion of sorting and selection has misled researchers and created apparent empirical anomalies where none may exist. Perhaps more attention should be paid to selection and sorting when attempting to explain the data on variable pay.

References

Aggarwal, Rajesh K. and Andrew A. Samwick. September 1999. "Performance Incentives Within Firms: The Effect of Managerial Responsibility," *NBER Working Paper No. w7334.*

American Compensation Association. 1998. *Report on the 1998-1999 Total Salary Increase Budget Survey.* Scottsdale, Arizona: WorldatWork.

Anderson, Mark C., Rajiv D. Banker and Sury Ravindran. 2000. "Executive Compensation in the Information Technology Industry." *Management Science* 46: 530-547 .

Baker, George and Brian Hall. December 1998. "CEO Incentives and Firm Size." *NBER Working Paper No. w6868.*

Blinder, Alan, ed. 1990. "Introduction." In *Paying for Productivity: A Look at the Evidence.* Washington, DC: The Brookings Institution, pp. 1-14.

Carmichael, H. Lorne. January 1983. "The Agent-Agents Problem: Payment by Relative Output." *Journal of Labor Economics* 1: 50-65.

Conte, Michael A. and Jan Svenjar. 1990. "The Performance Effects of Employee Ownership Plans." In *Paying for Productivity: A Look at the Evidence.* Alan Blinder, ed. Washington, DC: The Brookings Institution, pp.143-72.

Davis, Steven J. and Paul Willen. 1998. "Using Financial Assets to Hedge Labor Income Risks: Estimating the Benefits." University of Chicago.

Estrin, Saul, Virginie Pérotin, Andrew Robinson and Nick Wilson. December 1997. "Profit-Sharing in OECD Countries: A Review and Some Evidence." *Business Strategy Review* 8: 27-32.

Fernie, Sue and David Metcalf. 1996. "It's Not What You Pay It's the Way That You Pay It and That's What Gets Results: Jockeys' Pay and Performance," *Centre for Economic Performance Discussion Paper #295,* London School of Economics.

Freeman, Richard and Morris Kleiner. October 1998. "The Last American Shoe Manufacturers: Changing the Method of Pay to Survive Foreign Competition." *NBER Working Paper No. 6750.*

Gibbons, Robert. October 1987. "Piece-Rate Incentive Schemes." *Journal of Labor Economics* 5: 413-29.

Groves, Theodore. May 1973. "Incentives in Teams." *Econometrica* 41: 617-31.

Hall, Brian J. and Jeffrey B. Leibman. August 1998 ."Are CEOs Really Paid Like Bureaucrats?" *Quarterly Journal of Economics* 113: 653-691.

Hall, Robert E., and Edward Lazear. April 1984. "The Excess Sensitivity of Layoffs and Quits to Demand." *Journal of Labor Economics* 2: 233-57.

Haubrich, J. April 1994. "Risk Aversion, Performance Pay, and the Principal-Agent Problem." *Journal of Political Economy* 102: 258-76.

Jensen, Michael C., and Kevin J. Murphy. April 1990. "Performance Pay and Top Management Incentives." *Journal of Political Economy* 98: 225-64.

Kandel, Eugene and Edward P. Lazear. August 1992. "Peer Pressure and Partnerships." *Journal of Political Economy* 100: 801-17.

Kaplan, Steven N. and Per Strömberg. February 2002. "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts," unpublished manuscript, University of Chicago.

Lazear, Edward P. July 1986. "Salaries and Piece Rates." *Journal of Business* 59: 405-31.

Lazear, Edward P. 1995. *Personnel Economics*. Cambridge: MIT Press.

Lazear, Edward P. December 2000b. "Performance Pay and Productivity." *The American Economic Review*, 90: 1346-61.

Lazear, Edward P. 1998. *Personnel Economics for Managers*. New York: John Wiley & Sons, Inc.

Lazear, Edward P. April 1999. "Personnel Economics: Past Lessons and Future Directions." *Journal of Labor Economics*, 17: 199-236.

Lazear, Edward P. November 2000a. "The Future of Personnel Economics." *The Economic Journal*, 110: F611-639.

Murphy, Kevin J. 1999. "Executive Compensation." In *Handbook of Labor Economics*, Vol. 3B. Orley Ashenfelter and David Card eds. Amsterdam: Elsevier.

Myerson, Roger. November 1983. "Mechanism Design by an Informed Principal." *Econometrica* 51: 1767-97.

O'Reilly, Charles; Brian Main and Graef Crystal. June 1988. "CEO Compensation as Tournament and Social Comparison: A Tale of Two Theories." *Administrative Science Quarterly* 33: 257-74.

Oyer, Paul. April 2001. "Why Do Firms Use Incentives That Have No Incentive Effects?" Research Paper No. 1686. Research Paper Series: Graduate School of Business, Stanford University.

Oyer, Paul and Scott Schaefer. January 2002. "Why do Some Firms Give Stock Options to All Employees: An Empirical Examination of Alternative Theories." Unpublished manuscript, Stanford University and Kellogg School of Management.

Paarsch, Harry J. and Bruce S. Shearer. 1997. "Fixed Wages, Piece Rates, and Intertemporal Productivity: A Study of Tree Planters in British Columbia." *Cahiers de recherche # 9702*, Universite Laval.

Prendergast, Canice. March 1999. "The Provision of Incentives in Firms." *Journal of Economic Literature* 37: 22-515.

Prendergast, Canice. May 2000. "What Trade-off of Risk and Incentives?" *American Economic Review* 90: 421-425.

Weitzman, Martin L. and Douglas L. Kruse. 1990. "Profit Sharing and Productivity." In *Paying for Productivity: A Look at the Evidence*. Alan Blinder, editor. Washington, DC: The Brookings Institution, pp.96-139.

Yermack, David. October 1995. "Do Corporations Award CEO Stock Options Effectively?" *Journal of Financial Economics* 52: 449-76.

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