Peer Pressure and Partnerships

Eugene Kandel

University of Rochester

Edward P. Lazear

University of Chicago and the Hoover Institution

Partnerships and profit sharing are often claimed to motivate workers by giving them a share of the pie. But in organizations of any significant size, the free-rider effects would seem to choke off any motivational forces. This analysis explores how peer pressure operates and how factors such as profit sharing, shame, guilt, norms, mutual monitoring, and empathy interact to create incentives in the firm. The argument that Japanese firms enjoy team spirit because compensation is linked to overall profitability is analyzed. An explanation for the prevalence of partnerships among individuals in similar occupations is provided.

Many firms that use profit-sharing plans claim that such plans have beneficial incentive effects. Partnerships, which share profits, not necessarily equally among partners, are thought by their owners to have some incentive features that are lacking in an employer/employee relationship. Indeed, the idea has even made its way down Madison Avenue into television advertising. Witness, for example, the recent ads for Avis Corporation that boast that the employees are owners and therefore will work harder to serve the customer. But the idea that joint ownership can do much for incentives when the number of workers is large seems wrong on the face of it. After all, each worker

We thank Eugene Fama, Peter Mueser, Kevin J. Murphy, and Sherwin Rosen for helpful comments. Financial support was provided by the National Science Foundation.

[*Journal of Political Economy*, 1992, vol. 100, no. 4]

bears the full cost of his or her own effort but reaps at most $1/N$ of the benefit in an N-worker firm. The prevalence of partnerships and profit sharing, even when risk allocation is not central, is difficult to explain in the standard principal-agent framework.

The introduction of a third party may make the team incentive problem more manageable. If every member of the team can be punished when output falls below some target level, then sufficient incentives may be provided. When central authorities cannot cheaply monitor the actions of their citizens, they may rely on mutual monitoring. Many Moslem societies can punish an entire family for the actions of one of its members. The logic is that the family is in the best position to discipline and control its members, so family punishment provides motivation to those who have the power to prevent crimes.[1]

We concentrate on schemes that use only internal motivation. Partnerships and, to a lesser extent, corporations that make worker compensation contingent on company profits are the central focus of this paper. Partnerships are different from hierarchical organizations in that the members of the team are all residual claimants: the members share in the fortunes and misfortunes of the firm and do not pass the risk to another party.

Much has been said about the role of team spirit in motivating workers. For example, it is alleged that Japanese firms have been successful because of the team atmosphere that prevails, perhaps because compensation is based in large part on firm output (see Freeman and Weitzman 1987). But the discussion on team motivation has, with few exceptions,[2] been loose and nonrigorous. In what follows, the discussion is formalized. Only in this way can issues be clarified so that the true role of mutual monitoring, team compensation, corporate culture, and norms can be assessed. In many respects, this paper is a progress report. There are some loose ends, but there are some definitive results as well. In theoretical research, one gets out what one puts in, as is apparent in what follows.

[1] This is the scheme described in Holmstrom (1982). That scheme may fail for a number of reasons: The third party may not want to bear all the risk, he may not have the information necessary to implement the scheme, or strategic or opportunistic behavior can create difficulties.

[2] See, e.g., Holmstrom (1982), Jones (1984), Kreps (1986), and most recently Varian (1990). See also Alchian and Demsetz (1972), Fama and Jensen (1983*a*, 1983*b*), and, more recently, Holmstrom and Milgrom (1990). Some recent examples in the sociology literature are Hechter (1987), Coleman (1988), Heckathorn (1988), Pfeffer (1988), and Petersen (1992); Farrell and Scotchmer (1988) provide a discussion of information sharing and sorting in partnerships. Radner (1986) explores the free-rider problem in static and repeated games, showing that moral hazard can be eliminated if there is no discounting and other conditions hold. Early work by Cheung (1969) discusses the free-rider problem that can occur when agents share profit.

The goal is to investigate the conditions under which peer pressure is operative rather than to show that partnership or profit sharing is the solution to all agency problems. The following questions are considered: (1) Does profit sharing foster peer pressure? (2) How are "norms" established and how do they affect motivation within the firm? (3) Are incentives always weakened as firm size increases? (4) Is the firm, department, or some other unit's size key in determining effort? (5) When do workers have incentives to engage in mutual monitoring? (6) Why do partnerships form among individuals in the same occupation?

The analysis deviates from standard incentive theory because it focuses on preferences. Most economic analysis concentrates on behavioral variations that result from changes in prices for a given set of preferences; the discussion of preferences is generally in the domain of other social sciences. We trespass in hopes that the discussion can be made more precise.

Free-Rider Effects and Peer Pressure

Let us begin with the most basic situation. Suppose that output from a group of identical workers is some function of each worker's effort, e_i, given by $f(\mathbf{e})$, where $\mathbf{e}$ is an N-dimensional vector of workers' effort levels and N is the number of workers. To provide a reason for partnerships, assume that $f(\mathbf{e})$ is nonseparable in e_i. Separability permits self-employment, which eliminates incentive problems. Define a partnership as a work situation in which each worker's compensation is determined as $f(\mathbf{e})/N$. For now, ignore considerations of other possible compensation schemes. It is painful to put forth effort, and the pain that a worker feels is given by $C(e_i)$, where $C' > 0$ and $C'' > 0$.

The free-rider problem is easily seen in the following algebra. The worker wants to maximize

$$\max_{e_i} \frac{f(\mathbf{e})}{N} - C(e_i) \tag{1}$$

with first-order conditions

$$\frac{f_i(\mathbf{e})}{N} - C'(e_i) = 0. \tag{2}$$

Efficiency requires that total surplus be maximized or that

$$\max_{e1,e2,\ldots,eN} f(\mathbf{e}) - \sum_{i=1}^{N} C(e_i) \tag{3}$$

with first-order conditions

$$f_i(\mathbf{e}) - C'(e_i) = 0 \quad \forall i. \tag{4}$$

Since $C'' > 0$, $\mathbf{e}^*$, defined as the solution to (4), exceeds $\mathbf{e}'$, defined as the solution to (2) for $N > 1$. The chosen level of effort in a partnership falls short of the efficient level.

If effort were observable, first-best would be achieved by paying $a + b\mathbf{e}$, where $b = f_i(\mathbf{e}^*)$. But observability of effort is the heart of the problem. Thus we rule out payment on the basis of effort and ask how peer pressure might operate.

To motivate the analysis, we introduce a "peer pressure" function:

$$\text{peer pressure} = P(e_i; e_j, \ldots, e_N, a_i, a_j, \ldots, a_N). \tag{5}$$

The pressure that worker i feels depends generally on his own effort, e_i; on the effort of his peers, $e_j, \ldots, e_N$; and on other actions that he and his peers may take, $a_i, \ldots, a_N$. The actions a_i have no direct effect on firm output. Since these actions may require effort, the cost to i of taking action a_i is shown by redefining cost as $C(e_i, a_i)$.[3]

Under this formulation, the general maximization problem for partner i is

$$\max_{e_i, a_i} \frac{f(\mathbf{e})}{N} - C(e_i, a_i) - P(e_i; e_j, \ldots, e_N, a_i, \ldots, a_N). \tag{6}$$

In many respects, the pressure function is the same as the cost of effort, but there are differences. One is that the nature of P is social; that is, it depends on others' effort and actions. Another difference, crucial below, is that $P(\ )$ may be subject to manipulation by the group, whereas $C(e)$ is not. The function $C(e)$ is the part of the utility of effort that is exogenous and $P(\ )$ is the part that is cultural and endogenous. The peer pressure function is an attempt to formalize the discussion of tastes. By making explicit assumptions about $P(\ )$, we clarify the exact nature of the tastes required to explain a particular behavior.

To illustrate the basic mechanism, suppose that an extreme Cournot-Nash assumption holds so that each worker takes others' effort and actions as given. Now consider a pure partnership of fixed size N, where each worker receives $f(\mathbf{e})/N$. Assume further that a's have no effect on P. Under these conditions, the worker's problem is

$$\max_{e_i, a_i} \frac{f(\mathbf{e})}{N} - C(e_i, a_i) - P(e_i, \ldots) \tag{7}$$

[3] A related structure is contained in Holländer (1990). He examines contribution to a public good and motivates contributions by utility that individuals receive through peer approval.

with first-order condition

$$\frac{\partial f/\partial e_i}{N} - C_1 - \frac{\partial P}{\partial e_i} = 0 \tag{8}$$

since a_i is set to zero.

Peer pressure here means that $\partial P/\partial e_i < 0$. Since $\partial P/\partial e_i < 0$, the level of effort that solves (8) exceeds the level that solves (2). The proof follows.

Denote $\hat{\mathbf{e}}$ as the solution to (8) and $\mathbf{e}'$ as the solution to (2). Then

$$\frac{f_i(\hat{\mathbf{e}})}{N} - C_1(\hat{e}_1, \ldots) - \frac{\partial P}{\partial \hat{e}_i} = \frac{f_i(\mathbf{e}')}{N} - C_1(e_1', \ldots).$$

To show that $\hat{e}_i > e_i'$, assume the opposite. Then since $C'' > 0$,

$$\frac{f_i(\hat{\mathbf{e}})}{N} - \frac{\partial P}{\partial \hat{e}_i} < \frac{f_i(\mathbf{e}')}{N}.$$

Also, since $\partial P/\partial e < 0$, this means that $f_i(\hat{\mathbf{e}}) < f(\mathbf{e}')$, which violates concavity of $f(\mathbf{e})$.[4] Q.E.D.

With peer pressure, equilibrium effort is higher than it would be without peer pressure. While this is the essence of our argument, we have done little more than to assume it. The $P(\ )$ function can be interpreted as implying that workers get utility from effort. As such, it is not surprising that more effort is the outcome.

Less obvious is that workers in a firm with peer pressure may be worse off than those in one without it. While pressure guarantees higher effort, it does not guarantee higher utility because the pressure itself is a cost borne by all members of the firm. It may produce higher effort levels, but workers may feel badly about working in an environment that has rampant peer pressure. To make clear statements about the two states, it is necessary to compare utility functions, one with and one without $P(\ )$. Such comparisons present deep philosophical problems. Of course, different equilibria for the same $P(\ )$ can be compared.

Creating Peer Pressure

How is peer pressure generated, and what is the role of profit sharing? These questions are addressed through attempts to tie specific actions taken by organizations to the peer pressure function defined in the previous section.

Any form of peer pressure function must rely on two components to be effective as a motivational device. First, member i's effort must affect the well-being of the rest of the team for them to have incentive

[4] Symmetry of the problem for all agents guarantees $e_i = e_j$.

to exert pressure on him. Second, in addition to the desire to exert pressure, the team members must have the ability to affect the choices of i. The first component requires some form of profit sharing, because if workers are paid straight salaries, the choice of a worker's effort has an effect on shareholders but not on his peers. Peers have no incentive to exert pressure because they do not care what action he chooses.

Profit sharing is necessary but not sufficient to create incentives beyond those present in (2). If co-workers do not have the means to exert pressure, then by default the peer pressure function cannot provide incentives. We assume that both components can be created and manipulated by the firm to some extent. This section analyzes the possible ways to accomplish this task.

It is useful to classify pressure as either internal or external. Internal pressure exists when an individual gets disutility from hurting others, even if others cannot identify the offender. External pressure is created when the disutility depends specifically on identification by others.

Sociologists sometimes distinguish guilt from shame. Guilt is internal pressure, whereas shame is external pressure. In the context of the firm, the important issue is observability. A worker feels shame when others can observe his actions. Without observability, only guilt can be an effective form of pressure. Shame requires that $a_j > 0$. If others do not take the time to watch, then a worker feels no shame. Formally, let a_j be defined to be monitoring of worker i by worker j. Shame requires external observation so that

$$\frac{\partial P(e_i; e_j, \ldots, e_N, a_i, a_j, \ldots, a_N)}{\partial e_i} < 0$$

only if some $a_j > 0$. Guilt is internal, implying that $\partial P/\partial e_i < 0$ even if $a_j, \ldots, a_N = 0$.

Guilt may require a greater amount of past investment than shame. Past investment may be necessary to ensure that an individual loses utility when he shirks, even in the absence of observability by others. Physical punishment by peers is an alternative to making past investments. In this respect, it is similar to shame, which requires that others be aware of effort reduction. Since guilt functions even in the absence of observability, it is a valuable force in production environments in which individuals work on their own but total output depends on the team.

The military provides an example of one such situation.[5] A fighter

[5] Sociologists have been aware of the importance of peer pressure and reference groups for a long time. An early analysis of the implications for pressure in the military

pilot may be alone on a mission in which bravery or cowardice is difficult to observe by others. Still, the safety of his squadron may depend on his success. Guilt, in the form of loyalty to his comrades, provides incentives that operate even in the absence of observability. Thus the military spends much time and money creating loyalty and team spirit. The up-front investment has a large payoff because shame, which may be cheaper to create, cannot be used when actions are unobservable.

If peer pressure and guilt can be manipulated, why doesn't the firm instill in workers a sense of guilt toward cheating shareholders? Empathy may be the answer. A worker may empathize more with co-workers than with shareholders or managers.[6] If the group with which the individual empathizes or the group that is able to do peer monitoring is not the same as the group within which profits are shared, incentives will not be well served. A worker who cares only about the opinions of the nearest 10 workers will not behave efficiently when profits are shared among the larger group of 100,000. If nothing else, the group of 10 should free-ride on the other 99,990 workers.

Define N^* as the number of profit sharers about whom the individual cares. Let $P(e_i, \ldots, 0) = 0$ so that if there are no relevant peers, there is no relevant pressure. The maximization problem is then

$$\max_{e_i} \frac{f(\mathbf{e})}{N} - C(e_1, \ldots) - P(e_i, \ldots, N^*),$$

where N remains the number sharing the profit. If there is no profit sharing among workers, then N consists of shareholders only. If there is no empathy with shareholders, then N^* is zero, which means $P = 0$. Peer pressure would not be an effective motivator. Maximum motivation for any given number of profit sharers is achieved by allowing only individuals about whom workers care to be profit sharers. Then the free-riding that occurs as a result of profit sharing is offset maximally by P.[7]

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is contained in Parsons (1954, esp. pp. 362–65). In the military, the goal is to convince a soldier of two things: first, that his actions affect his colleagues (profit sharing) and, second, that he should care about them. Guilt encompasses both.

[6] Burt (1987) shows that "happiness" increases with the size of a person's discussion network but decreases with the number of strangers in the group. Holländer (1990) also discusses the importance of the reference group for motivation.

[7] The observed patterns of indoctrination expenditure, profit sharing, turnover, and productivity differ between Japan and the United States. One possible explanation, frequently voiced, is that Japanese management style and organizational structure are very different from the American ones. The other attributes more weight to the cultural differences. Varian (1990) argues that Japanese society traditionally has had very strong clan links. Some have argued that the Japanese educational system is geared

Partnerships are often formed among friends or family members. Despite the free-rider problems inherent in the partnership structure, partners often put in long hours and exert substantial effort. One explanation is that when partners are friends or relatives, empathy is strong, so shirking results in significant guilt or shame. It is frequently suggested that trust is greater within small ethnic or religious groups than between groups. If individuals feel guiltier about cheating "their own kind" than about cheating others, we would expect to see partnerships among individuals from the same cultures.[8]

Similarly, it is possible that little of substance occurs in quality circles used by Japanese firms or their American copies. The motivation behind "team" meetings may be no different from that behind an intercompany softball league, company picnics, or even a company song. Once $P(\ )$ is endogenous, it is worthwhile to invest some resources in altering $P(\ )$ to provide better incentives for the employees. Since profit sharing is complementary with team spirit, partnerships should be more likely than wage and salary firms to invest in spirit-building activities.

Not only may the firm instill guilt by affecting work attributes, but it may also operate on the individual's alternatives. This can work in two ways. First, the firm may bring the worker's family into the organization, for example, by having a child care center on the premises or by having organizations to which spouses belong. When a worker shirks, he imposes costs not only on his co-workers but also on his family. Second, as in Iannaccone (1992), the firm may ruin a worker's alternatives so that he substitutes his time away from leisure and toward work. Academia selects people whose hobbies are their primary disciplines.

The environment in which initial investments in loyalty are most important is characterized by two features. Already mentioned is the inability (even by peers) to observe the worker's effort. But also required is complementarity in production. An empirical investigation of this point would require information on three components: a measure of complementarity in production, a measure of costs of observ-

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toward conformity and building team loyalty. Under these assumptions, it is less costly to instill the company team spirit in a Japanese firm than in an American one, which operates in a much more individualistic society (see Holländer 1990). The cultural differences vs. different management hypothesis can be tested using a cross-sectional comparison of the variables by ownership (management style) vs. by country of operation.

[8] Kreps (1986) makes the argument that "corporate culture" may move the situation toward a superior equilibrium. An alternative explanation is that information about others' skills is better within the group. Even without motivation effects, better information means less adverse selection and better sorting, which provides another reason to pair with "one's own kind."

ability, and a measure of expenditures on "indoctrination." While not easy to come by, as more firm-specific data become available, proxies may present themselves.

Norms

Sociologists often think of peer pressure as arising when individuals deviate from a well-established group norm. One possible specification is that individuals are penalized for working less than the group norm. Suppose

$$P(\cdot) = P(\bar{e} - e_i), \tag{9}$$

where $\bar{e} \equiv 1/(N-1)\,\Sigma_{i \neq j} e_j$.

Start with a firm of identical individuals. Each player maximizes

$$\frac{f(\mathbf{e})}{N} - C(e_i) - P(\bar{e} - e_i) \tag{10}$$

with first-order condition

$$\frac{f_i(\mathbf{e})}{N} - C'(e_i) + P' = 0. \tag{11}$$

(Since a_i has no effect on output or P, it is set to zero at the optimum.) With this formulation of peer pressure, there is a unique and symmetric equilibrium as long as cost and production functions have the standard properties. For example, if P is linear in $\bar{e} - e_i$, P' is just a constant and (11) has a clear and unique solution.[9]

It is also possible (although not likely) that peer pressure results in the efficient equilibrium, where efficient is defined as the level of effort, e^*, that a social planner would choose. To see this, let $P = (\bar{e} - e_i)\gamma$, with $\gamma > 0$. The interpretation is that $\bar{e}$ is the norm and γ is a measure of the penalty associated with falling below it. Then the worker's first-order condition is

$$\frac{f_i(\mathbf{e})}{N} - C'(e_i) + \gamma = 0. \tag{12}$$

To achieve efficiency, it is necessary that the solution to (12) be identical to the solution to (4). Thus

$$\frac{f_i(\mathbf{e}^*)}{N} - C'(e^*) + \gamma = f_i(\mathbf{e}^*) - C'(e^*) = 0$$

[9] If $P(\,)$ is convex and $P'(0) < 0$, then uniqueness is guaranteed.

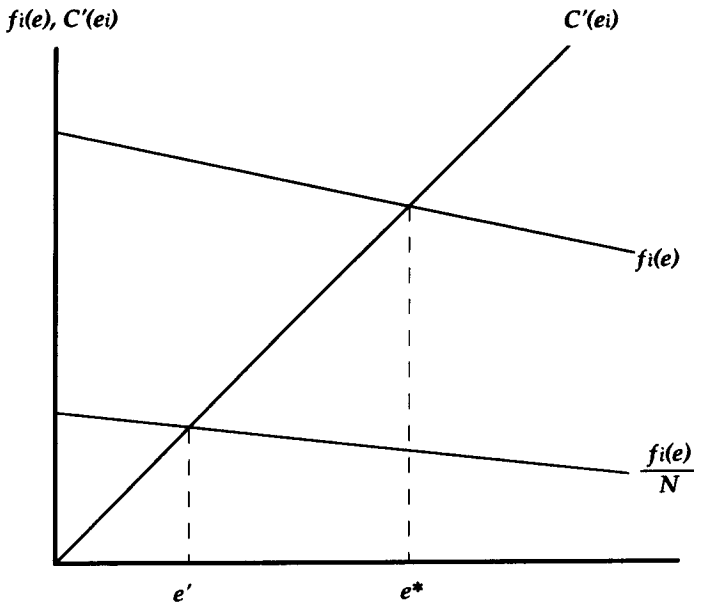

FIG. 1

or

$$\frac{f_i(\mathbf{e}^*)}{N} + \gamma = f_i(\mathbf{e}^*), \tag{13}$$

which generally has a solution (see fig. 1). Earlier, it was suggested that P could be manipulated. To the extent that manipulation is possible, setting γ to solve (13) maximizes joint surplus.[10]

An implication is that the effort norm should be higher when deviations are more heavily punished. Finding actual measures of punishment may be very difficult to obtain in practice.

In some work environments, workers may be chastised by their peers for exceeding the norm.[11] Mechanically, this merely requires $\gamma < 0$ in (12). While this is feasible, it is unlikely to be true in a partnership. Here, individuals like their partners to put forth more effort because it implies higher income. "Rate busters" are ostracized in hierarchical firms, not partnerships. There, working too hard tips off

[10] It is possible that P is such that a firm might even provide workers with "pride." If P is negative at the equilibrium value of $\mathbf{e}$, then workers get something for nothing. It implies that the worker derives utility simply from being at work. Holländer's (1990) parameterization of individualism and group belonging is similar to γ.

[11] This is close to Jones's (1984, pp. 40–52) idea of conformism.

the supervisor that the quota is too low.[12] Ratchet effects are required for this story to work.

More reasonable in a partnership may be that deviations from the norm, in either direction, are punished. Reduced effort means lower income for each of the other partners, but effort above their own levels may shame them. If $P(\ )$ were quadratic in effort, so that $P(e_i) = (\bar{e} - e_i)^2$, then deviations from $\bar{e}$ in either direction bring the same disutility. In equilibrium, $e_i = \bar{e}$, so the level of effort chosen equals the level that would be chosen in the absence of peer pressure; that is, (8) becomes identical to (2).

Mutual Monitoring

The popular press frequently attributes Japanese productivity to mutual monitoring by workers. The *kanban* system or just-in-time inventory approach is mentioned as a facilitator of team monitoring. In this section, we analyze that claim rigorously.

Suppose that, in addition to exerting effort, workers can monitor each other, at a cost. Workers who are caught shirking can be penalized by their partners. The penalty for now is best thought of as a nonpecuniary one, such as mental or physical harassment. Of course, if monitoring implies that effort is observable with error, why should a partnership be used at all? A better scheme would reward workers for their own effort, irrespective of firm output. If workers are not efficient risk bearers, then there is a cost to making pay completely responsive to variations in measured effort. Peer pressure provides another instrument and thereby makes the compensation strategy richer.[13]

The actions, a, defined above can now be thought of as peer monitoring. Let the expected penalty associated with being caught shirking now be $P(e_i; a_j, \ldots, a_n, N)$. More specifically, since all workers are ex ante identical, the choice of monitoring level by k will be identical to that by j, so that we write $P(\ )$ as $P(e_i, (N-1)a_j)$. Additionally, with symmetry of f, i's maximization problem is

$$\max \frac{f(\mathbf{e})}{N} - C(e_i, a_i) - P(e_i, (N-1)a_j) \tag{14}$$

[12] Jones (1984, pp. 28–37) considers two-sided pressure by bringing in asymmetries in the compensation function. Low-effort workers depress the size of the pie but have little effect on the schedule. High-effort workers significantly affect the standard according to which the wage is set.

[13] Arnott and Stiglitz (1991) analyze some of the risk-bearing features of a partnership.

with first-order conditions

$$\frac{f_i(\mathbf{e})}{N} - C_1 - P_1 = 0 \tag{15a}$$

and

$$\frac{N-1}{N} f_i \frac{\partial e_j}{\partial a_i} - C_2 = 0. \tag{15b}$$

Each worker's choice of monitoring level a must satisfy (15b), in which other workers respond to i's choice of a. The worker puts forth monitoring effort because he believes that other workers will increase their effort as a response. To derive j's response to i's choice of a_i, differentiate (15a) with respect to a_j since the problem is symmetric over all workers:

$$\left.\frac{\partial e_j}{\partial a_j}\right|_{(15a)} = \frac{-P_{12}}{(f_{ii}/N) - C_{11} - P_{11}}. \tag{16}$$

The denominator is unambiguously negative. The sign of the expression is therefore opposite the sign of P_{12}. In the context of P being the expected punishment, P_{12} is related to accuracy of detection. As monitoring increases, presumably the reading on whether a worker is shirking or not becomes more accurate. It is now clear why it is necessary that $P_{12} < 0$. If additional monitoring is to increase the level of effort, there must be a gain to increasing effort when monitoring increases. The P_2 term does not enter. Increasing the penalty without altering effort's effectiveness in forestalling it will have no effect on effort. It is the interaction between monitoring and effort in altering the probability or effect of being caught that causes effort to increase when other workers monitor more.

The free-rider effect appears in (15a) in the term $1/N$. As N increases, the direct incentive to put forth effort falls. Effort may increase, however, because other workers' monitoring, a_j, may increase in N. Whether effort is actually increasing or decreasing in N depends on the shapes of the production function and the peer pressure function.

Group Size and Mutual Monitoring

Consider the large Japanese firm. It may consist of 100,000 employees, most of whom work at different plants. The N that is relevant in (16) is the size of the entire firm, since profits are shared among all workers of the corporation and are not tied to individual (or even small group) performance. But in such a large firm, P_{12} is likely to

be very close to zero. Monitoring by a worker in Osaka of a worker in Tokyo is likely to have little effect on the accuracy of the Tokyo worker's effort reading. As such, the Tokyo worker's effort should be affected primarily by the free-rider effect, not by the monitoring effect.[14]

Put differently, any given worker can observe maybe 100 of his peers. But the fruits of the monitoring and peer pressure that he doles out are shared with 99,999 other workers. This implies that there is little incentive to engage in mutual monitoring, even with profit sharing. The monitoring story has some appeal in smaller groups, but as the firm gets very large, the ability of workers to monitor or even inform on each other is somewhat reduced. If mutual monitoring is a force in Japanese firms, it is not a result of profit sharing.

Committing to Punish

Is the threat to punish peers credible? If $P(\ )$ is self-imposed guilt, then credibility is not an issue. But if $P(\ )$ reflects a sanction imposed after a team has observed shirking, then would peers carry through on the threat? Sufficient to ensure punishment is that revenge, but not random penalties, provides positive utility.

A system of "norms" might provide another mechanism. Suppose that the norm is that shirkers must be punished. An individual who permits a shirker to go unpunished must be punished himself by an increased amount, and so forth. If each believes that punishment will be doled out, it will be. But multiple equilibria may exist because the amount of punishment that individuals undertake depends on their beliefs about others' actions. Additionally, the norm may unravel. If there is an end to the chain so that someone believes that he will not be punished for not disciplining another who let another go without punishment, then there is no reason for anyone to discipline anyone. But the firm can be thought of as a circle. As long as a worker is told only that he is to punish the neighbor on his right or suffer punishment from the one on his left, he will carry out the punishment.

Homogeneous Workers

Partnerships tend to occur among individuals of similar type and quality. There are partnerships of lawyers, accountants, and physi-

[14] The interaction between peer pressure and group size is considered by Allen (1982).

cians, but it is rare to find a partnership between a physician and an accountant.

The grouping of partners by occupation is a direct implication of the mutual monitoring analysis. The effectiveness of peer pressure is directly related to $|P_{12}|$ in (16). If $P_{12} = 0$, peer monitoring has no effect on worker effort. But P_{12} is accuracy, so $|P_{12}|$ is likely to be larger when the monitor knows the job of the individual who is being observed. Sometimes partnerships use specialization. One partner sells and the other manages. But even in those cases, the partners were frequently drawn from the same field so that each can evaluate the other's work. Partnerships should be less prevalent in firms in which workers specialize in nonoverlapping tasks.

It is also possible to explain the grouping of individuals by appealing to technology. For example, it may be advantageous for a tax lawyer to work with a labor lawyer because cases may involve both disciplines. But working together does not imply sharing the profit. The tax lawyer could own the firm and hire the labor lawyer. The fact that they form a profit-sharing partnership probably says more about peer pressure and incentives than it does about technology.

Infiltration

Suppose that the world consisted of two types of workers: the social, for whom $P_1 < 0$, and the independent, for whom $P = 0$ for all e_i, a_j, and N.[15] If one's type is known only by the individual himself, does a separating equilibrium exist in which each type of worker prefers firms of his own kind? If P depends only on e_i and N, then the answer is no. The independents would never prefer to join a firm with their own kind. Rather, they would benefit by infiltrating a partnership of social individuals, where output is higher.

To see this, assume that a separating equilibrium exists. Denote $\mathbf{e}^{**}$, N^{**} as the effort–firm size pair that exists in the firm that attracts social types and $\mathbf{e}''$, N'' as the pair that exists in the firm that attracts independents. Then separating equilibrium implies that the social do not want to join the independents' firm, so

$$\frac{f(\mathbf{e}^{**})}{N^{**}} - C(e^{**}) - P(\mathbf{e}^{**}, N^{**}) > \frac{f(\mathbf{e}'')}{N''} - C(e'') - P(\mathbf{e}'', N'').$$

There are two possibilities: If $P(\mathbf{e}^{**}, N^{**}) > P(\mathbf{e}'', N'')$, then

$$\frac{f(\mathbf{e}^{**})}{N^{**}} - C(e^{**}) > \frac{f(\mathbf{e}'')}{N''} - C(e''),$$

[15] Alternatively, independents could be defined as those in whom it is more difficult to instill guilt, loyalty, or other social characteristics.

which implies that independents would prefer the social firm to their own even if they worked at $\mathbf{e}^{**}$, so there would be no separating equilibrium. If independents chose their own optimal level of effort in the social firms, they would do even better. (An independent's utility is $[f(\cdot)/N] - C(\cdot)$.)

Alternatively, $P(\mathbf{e}^{**}, N^{**}) < P(\mathbf{e}'', N'')$. Now, since $P_1 < 0$ and $P_2 > 0$, either $\mathbf{e}'' < \mathbf{e}^{**}$ or $N'' > N^{**}$ or both. This means that

$$\frac{f(\mathbf{e}'')}{N''} - C(e'') < \frac{f(\mathbf{e}^{**})}{N^{**}} - C(e^{**}),$$

since $[f(\mathbf{e})/N] - C(e)$ is increasing in $\mathbf{e}$ for $\mathbf{e}$ less than the optimum. But that implies that $\mathbf{e}''$, N'' is not optimum for the independents' firm. Thus no separating equilibrium exists.

Does Effort Fall as Firm Size Rises?

The standard argument, as illustrated by (2), is that effort falls as firm size increases because of free-riding. Is it possible that peer pressure can reverse the standard intuition? The answer is a qualified yes.

The first-order condition for $N = N_0$ is the solution to

$$\frac{f_i}{N_0} - C' - P_1^0(e_i, \ldots; a_j) = 0,$$

where P^0 denotes P for $N = N^0$. Let $N_1 > N_0$. Then the first-order condition is the solution to

$$\frac{f_i}{N_1} - C' - P_1^1(e_i, \ldots; a_j) = 0.$$

Effort can increase in N only if the P_1 function becomes much larger for each e_i as N increases. This requires that as N increases, the effect of effort on peer pressure must be greater.

It is possible that this might hold, at least up to some point. If more workers can observe an individual, then sanctions (implicit or explicit) imposed by the group may be greater. For example, in a firm of 10, a worker must deal with nine discontented peers. In a firm of two, he has only one to contend with. After some point, however, adding workers may serve only to make the relationships more impersonal or sanctions more difficult to enforce.

Of course, even if effort rises with N, it is not necessary that utility rise with N. As always, there is an optimal level of effort: a compensation scheme that induces higher effort does not imply higher utility.[16]

[16] An example is the rat race result in Akerlof (1976), also described in Lazear and Rosen (1981).

The conclusion is that an appropriate, and not unreasonable, form of peer pressure can mean that effort is greater in large firms than in small ones. It is well known that wages and firm size are positively correlated (see Brown and Medoff 1989). But this probably reflects worker sorting and rent sharing more than differential effort.

Conclusion

The notion that peer pressure can be an effective motivator is not new. This analysis has attempted to clarify the conditions under which peer pressure operates in an industrial environment. Some of the more significant points follow.

1. Peer pressure and partnerships (or some other form of profit sharing) go hand in hand. Incentives are generated when an individual empathizes with those whose income he affects. Thus peer pressure is expected to be a more effective force in firms in which profits are shared among those in similar circumstances.
2. In the absence of peer pressure, larger partnerships have greater free-rider problems and less effort. But peer pressure can reverse this conclusion under reasonable assumptions.
3. The sociologists' distinction between shame and guilt as effective motivators hinges on observability. Shame requires observability whereas guilt does not. The logic implies that indoctrination designed to instill guilt is more important when workers' actions are unobservable.
4. Norms develop in firms to establish an expected level of effort. A norm is an equilibrium phenomenon that results because deviations from the norm bring disutility.
5. Mutual monitoring is a specific application of peer pressure. Mutual monitoring can affect effort but is likely to be effective only when profits are shared by a very small group.
6. Partnerships tend to be formed among individuals who perform similar tasks because mutual monitoring is more effective.
7. Incentives are improved when the group relevant for profit sharing is the peer group, where peer group means the individuals about whom a worker cares or by whom a worker is monitored.

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