

The Sociology of Groups and the Economics of Incentives: Theory and Evidence on Compensation Systems

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March 1, 2000

ABSTRACT

When working together, people engage in non-contractual and informal interactions that constitute the sociology of the group. We use behavioral models and a unique survey of medical groups to analyze how group sociology influences physician incentive pay and behavior. We conclude that informal interactions among group members influence pay practices and behaviors, but the relationship is complex. No single aspect of group sociology is entirely consistent with all the patterns in the data. Factors emphasized in the economic theory of agency, notably risk

aversion, also shape pay policies but these factors cannot account for all the observed empirical relationships. (JEL D21, D22, J40, J41)

Economic models of compensation treat pay practices as a solution to an incentive problem. High levels of performance require high levels of effort and, beyond some minimal point, providing this effort is costly. Firms desiring high levels of performance from employees should therefore link economic rewards closely to an individual's productive contribution. Yet this tight linkage is hardly a universal characteristic of pay systems. Firms exhibit enormous variation in the degree to which compensation responds to individual performance. Explaining this diversity is one of the fundamental tasks for the economics of organizations (Baker, Jensen and Murphy, 1988; Baker, Gibbons and Murphy, 1994, and Gibbons, 1996).

This paper introduces the concept of “the sociology of groups” into a theoretical and empirical analysis of variation in pay systems. The term “group sociology” refers to the non-contractual and informal interactions that occur between members of work groups. These interactions can take the form of activities (mutual help, mutual monitoring) and psychological experiences (guilt, envy, shame, greed, peer pressure). It is widely believed among economists, sociologists, and human resource professionals that group sociology influences the design of incentive contracts, but theory and evidence regarding these influences has been scarce. We argue below that group sociology influences both the benefits and costs of incentives and therefore the kind of incentive arrangements that firms will use.

Although the economic issues we discuss are quite general, our analysis focuses on pay practices in a narrowly defined setting: medical groups. We concentrate on these organizations for three reasons. First, the medical groups we study tend to be small and to have a flat organizational structure. This simplicity, combined with the fact that the key revenue generating activities (e.g. patient office visits) are regularly recorded for billing purposes, makes it feasible to link compensation to the performance of individual physicians.

The second reason for our focus on medical groups is that our data allow us to observe (rather than infer) the incentive formula that prevails in the group. Our sample of medical groups, like professional groups in general, rely upon administrative rules that specify how partners share in the income generated by other partners in the firm (Farrell and Scotchmer, 1988; Gaynor and Pauly, 1990; Gilson and Mnookin, 1985; Kandel and Lazear, 1992; Landers, Rebitzer and Taylor, 1996). Information concerning these sharing rules allows us to directly examine a group's incentive system. Third, our data on medical groups contains information about the attitudes and behaviors of individual physicians in the group. The combination of a simple organizations, direct information about incentive structures and separately collected information about the attitudes and behaviors of the physicians who make up the group, make possible new and novel tests of economic and sociological incentive theories.

We analyze the sociology of medical groups in terms of three types of informal interactions among physicians: (1) the intra-group income comparisons that lead to income norms; (2) the intra group effort comparisons and mutual monitoring that result in effort norms; and (3) mutual help activities.

Income and effort norms play a prominent role in the study of group sociology, but the meaning of these terms is often unclear. In this paper we use "group norms" to refer to the consequences that interpersonal comparisons of income and effort have on the actions and psychological experiences of group members. The phenomena we have in mind, envy, shame, guilt and peer pressure are of self-evident importance in social and economic life, but have so far played only a peripheral role in modern microeconomic studies of compensation systems.¹ It is not hard, however, to see how interpersonal comparisons could influence incentive design. In the case of medical groups, if physicians resent having a low rank in the firm's income hierarchy, groups may prefer to avoid workplace tensions by adopting incentive pay schemes that do not create too much of a gap between high performers and others. Interpersonal comparisons of effort will also influence optimal pay practices. Those groups able to marshal sufficient peer pressure

and mutual monitoring to support stringent effort norms will also require less in the way of pay-for-performance.

The third type of group interaction we analyze are mutual help activities. Physicians in group settings must decide how much effort they will devote to seeing their own patients versus helping other members of the group. The “helping” activities we have in mind are informal and therefore hard to reward via incentive pay. Some of the helping activities can improve the general reputation of the group and in this way benefit all its members (e.g. making sure that receptionists are polite when they answer the phone), while other helping activities make it easier for other doctors in the group to generate their own revenues (e.g. offering advice to another physician struggling with a tricky case). Both types of informal helping activities will be discouraged by high powered incentives that reward physicians for seeing more patients. Put differently, incentive pay arrangements are costly because they may discourage valuable, mutual help activities. The behavioral logic of mutual help activities is formally the same as the familiar multi-task models of optimal incentive design (Holmstrom and Milgrom, 1991; and Baker, 1992). Our application of these models to informal group interactions is novel, however, as is our investigation of the empirical predictions of the multi-task model.

In what follows, we present a series of models designed to capture various dimensions of group sociology. We use these models to generate hypotheses that can be explored using our data. Our findings indicate that the sociology of groups matters for compensation systems—but that no single type of informal interaction is sufficient to explain the patterns in the data. We also find evidence that risk aversion matters, but risk aversion alone cannot explain observed variations in incentive pay. Indeed the empirical results are most consistent with a model in which risk aversion and a number of different informal interactions among group members simultaneously influence the incentive pay policies of organizations.

The paper proceeds as follows. The next part, Section 1, presents a theoretical analysis of incentive pay in groups. Empirical findings are reported in Section 2. The paper concludes by considering the implications of our results for the economic analysis of organizational design.

I. Theory

In this section we develop a series of models concerning optimal incentive design in medical groups. We begin by presenting the model setup. Each subsequent section develops an analysis of a different aspect of the incentive design problem: risk aversion, income norms, effort norms (and mutual monitoring), and, finally, mutual help activities.

A. Model Setup

We analyze a setting in which doctors form groups in order to share fixed costs. Some of these costs may be specific to a given specialty (e.g. special purpose equipment or nurses with particular skills) while others are generic to any medical practice. In every case, however, the group shares a common administrative structure that collects revenues from patients and insurance companies.² This common accounting system makes it easy and convenient for physicians to link revenues to the activities of individual physicians. In what follows we consider the design of optimal compensation arrangements within groups.

Consider a partnership of n doctors. Each individual doctor generates revenue, R , according to

$$(1.) \quad R(e_i) = e_i + \mathbf{e}_i,$$

where e_i is the effort exerted by partner i . We capture the random aspect of revenue by \mathbf{e}_i , a mean zero random variable having variance \mathbf{s}_e^2 . For simplicity we assume that all individuals in the partnership are identical and the error term is distributed independently across individuals.³

The group allows each partner to keep a fraction, \mathbf{a} , of her revenues and puts $(1-\mathbf{a})$ into a common pool that is divided equally among the remaining partners. Taking the number of partners in the group to be exogenously determined at n , we can write the expected income of individual i as

$$(2.) \quad E(Y_i) = \mathbf{a}e_i + (1-\mathbf{a}) \frac{\sum_{j \neq i} e_j}{n-1} \quad 1/n \leq \mathbf{a} \leq 1.$$

We assume that individual doctors derive utility from income and that there is a private cost of effort, $ce_i^2/2$, where c is a positive parameter. Preferences for physician i are represented by ⁴

$$(3.) \quad U_i = E(Y_i) - \frac{ce_i^2}{2} - E[\text{Cost of Incentives}].$$

The expected cost of incentives term, $E[\text{Costs of Incentives}]$, is central to our analysis. If the marginal cost of incentives were negligible, the group's incentive problems would always be solved by setting $\mathbf{a}=1$.

We assume that each individual physician supplies optimal effort given monetary incentives (α), the cost of effort, and the cost of incentives systems. The first-order condition determining effort supply is:

$$(4.) \quad \frac{dU_i}{de_i} = \mathbf{a} - ce_i - \frac{dE[\text{Cost of Incentives}]}{de_i} = 0 \text{ or } e_i = \frac{\mathbf{a}}{c} - \frac{dE[\text{Cost of Incentives}]}{c de_i}$$

This first-order condition, in turn, yields an effort supply function, $e(\mathbf{a})$, in which physician effort is an increasing function of α .

The group's incentive design problem is to choose the value of α that maximizes the utility of a representative member, subject to the individual effort supply function, $e(\mathbf{a})$:

$$(5.) \quad \text{Max}_{\mathbf{a}} U = Y(e) - C(e) - E[\text{Cost of Incentives}] \quad \text{s.t. } e = e(\mathbf{a})$$

Most economic explanations for variation in incentive pay revolve around the expected costs created by high-powered incentives. In the next sections we analyze the incentive costs due to risk aversion and to informal group interactions. In some instances the marginal cost of incentives increases with group size, while in others the marginal cost of incentives falls with respect to group size. These features will play an important role in our empirical investigation of the determinants of incentive pay practices.

B. Incentive Costs Due To Risk Aversion

Much of the economic literature on incentive design emphasizes the importance of risk aversion. We therefore begin our analysis of incentives and group sociology by studying the effect that risk aversion has on compensation in medical groups.⁵

Risk aversion on the part of individual physicians makes high powered incentives costly. In this section, we demonstrate that the marginal costs of incentives due to risk aversion are greater in large groups than small groups. This result, in turn, leads to the prediction that if all variation in incentive pay were due to risk aversion, large groups would offer less incentive pay than small groups.

Mean-variance utility functions offer a convenient framework for analyzing incentive costs due to risk aversion. We write individual utility as

$$(6.) \quad U_i = E(Y_i) - \frac{ce_i^2}{2} - r\mathbf{s}_Y^2$$

where \mathbf{s}_Y^2 is the variance of income and r is 1/2 the coefficient of absolute risk aversion. Thus mean-variance utility provides the simple expression $E(\text{Costs of Incentives}) = r\mathbf{s}_Y^2$. The cost of incentives is the variance in income created by the incentives. Hence, to derive the marginal costs of incentive pay, we must analyze the relationship between the incentive parameter, \mathbf{a} , and \mathbf{s}_Y^2 . For partner i , the variance of income is $\mathbf{s}_{Y_i}^2 = E(Y_i - E(Y_i))^2$. Since the error terms are

independent and the partners put forth identical levels of effort in response to \mathbf{a} , the variance of income reduces to:

$$(7.) \quad \mathbf{s}_{Y_i}^2 = E \left\{ \mathbf{a}e_i + (1-\mathbf{a}) \frac{\sum_{j \neq i} e_j}{n-1} \right\}^2 = \mathbf{s}_e^2 \Lambda \quad \text{with } \Lambda \equiv \left[\mathbf{a}^2 + \frac{(1-\mathbf{a})^2}{n-1} \right].$$

The preceding discussion establishes that when doctors share income ($\mathbf{a} < 1$), the variance of income is influenced by the intensity of incentives, \mathbf{a} , and the size of the group, n . Taking the derivative of $\mathbf{s}_{Y_i}^2$ with respect to \mathbf{a} we can derive the expected marginal cost of incentives due to risk aversion:

$$(8.) \quad r \frac{ds_{yi}^2}{da} = r s_e^2 \Lambda_a \geq 0 \quad \text{with } \Lambda_a \equiv 2 \left(a - \frac{1-a}{n-1} \right).$$

Two features of this equation are worth noting. First, the marginal cost of incentives is non-negative because groups will never set $a < 1/n$.⁶ Second, so long as $a < 1$, the marginal cost of incentives is influenced by the size of the group as well as its pay policies. More specifically, the marginal cost of incentives is greater in large groups than small groups. This last result has a straightforward intuition. For any given level of $\alpha < 1$, large groups offer more effective income insurance than small groups. It follows that increases in α cause physicians in large groups to forego more income insurance than in otherwise identical groups having fewer physicians.

Since the marginal costs of incentive pay increase with group size, it is easy to show that $\frac{da}{dn} < 0$, i.e. that income insurance motives will cause larger groups to adopt less powerful incentives than small groups.⁷

Since effort levels do not influence incentive costs due to risk aversion, we can use equation (4) to write effort supply

$$(4b) \quad e = a/c.$$

Substituting this into equation (5), the group chooses α to maximize the utility of a representative group member:

$$(9.) \quad \max_a U = E(Y_i) - \frac{ce^2}{2} - r \Lambda s_e^2 \quad \text{s.t. } e=a/c \quad \text{or} \quad U = \frac{a}{c} - \frac{a^2}{2c} - r \Lambda s_e^2$$

It is clear from inspection of this problem that, ceteris paribus, groups with relatively risk averse physicians will choose low values of α . A less obvious result, but one that is important for our empirical work, is that exogenous changes in group size will also influence incentive pay.

The comparative statics of α with respect to n are determined by:

$$(10.) \quad \frac{da}{dn} = \frac{-\frac{\partial^2 U}{\partial a \partial n}}{\frac{\partial^2 U}{\partial a^2}} = \frac{r \Lambda_{an} s_e^2}{\frac{\partial^2 U}{\partial a^2}} < 0$$

where the denominator is negative from the second order condition and the numerator is positive from equation (8).

Thus, if risk aversion were the only factor causing α to be less than 1, we would expect to see higher powered incentives in small groups than in large groups and vice versa.

C. Group Income Norms and Incentive Pay

1. *The Social Psychology of Income Comparisons*

Models of group norms highlight the informal, interpersonal comparisons that take place in groups. In order to bring these comparisons into a microeconomic model, we need to specify how individuals assess (and react to) differences between themselves and others. Conventional economic theory does not offer much insight into the ways in which these comparisons are made. We rely, therefore, on three behavioral regularities that have emerged from experimental studies of economic behavior:⁸

Reference Dependence:

Utility is determined by absolute and relative income. For any given earnings level, an increase in the earnings of the reference group reduces an individual's utility.

Loss Aversion:

The marginal utility gain from doing "better" than the reference group (x dollars more income) is less than the marginal utility lost by doing "worse" than the reference group (x dollars less income).

Saliency:

The effect on utility of interpersonal income comparisons increases with an individual's similarity, proximity and exposure to the reference group. Similarly, the effect of interpersonal comparisons increases the more directly individuals compete for important resources.

2. *Income Comparisons and the Marginal Cost of Incentive Pay.*

If individuals care about relative income, then the income differentials resulting from high powered incentives can cause tensions within the group. We treat the expected level of these social tensions as the expected cost of incentives due to income norms.

In this section we model the costs of incentives due to income norms. Our analysis parallels that for risk aversion, but we will reach the opposite conclusion. Where risk aversion causes the marginal cost of incentives to *increase* with group size, income norms cause the marginal cost of incentives to *decrease* with group size. This difference will play an important role in our empirical investigation.

Our model of interpersonal income comparisons follows directly from the behavioral assumptions presented above. *Reference dependence* specifies that an individual's utility is affected by the comparison of her earnings to others in the reference group. *Loss aversion* requires that the utility gain from earnings above the reference group be more attenuated than utility losses from earnings below the reference group. *Saliency* suggests that partners will constitute each other's reference group.

We can capture these relationships with the following utility function for partner i in a group with n partners

$$U_i = E(Y_i) - \frac{ce_i^2}{2} - E(\text{Inequity}_i), \text{ with} \quad (11.)$$

$$E(\text{Inequity}_i) \equiv E \left[\frac{\left\{ \mathbf{b}_1 \sum_{j \neq i} \max(0, Y_j - Y_i) \right\} + \left\{ \mathbf{b}_0 \sum_{j \neq i} \min(0, Y_j - Y_i) \right\}}{n-1} \right].$$

Parameters \mathbf{b}_1 and \mathbf{b}_0 reflect the utility consequences of unequal earnings within the firm. The first expression in braces is the total utility lost to individual i due to others in the reference group having greater earnings. The second term in braces is the utility gain to i from having earnings greater than others in the reference group. The loss aversion assumption is introduced by specifying that $\mathbf{b}_1 > \mathbf{b}_0 \geq 0$. We simplify our exposition (with no loss of generality) by setting $\mathbf{b}_0 = 0$.⁹

Conditional on partner i 's income, expected inequity is :

$$(12.) \quad E[\text{Inequity}_i | Y_i] = \frac{\mathbf{b}_1}{n-1} \sum_{j \neq i} \int_{Y_i}^{\infty} (Y_j - Y_i) f(Y_j) dY_j$$

$$\text{where } Y_j - Y_i = \left[\mathbf{a} - \frac{1-\mathbf{a}}{n-1} \right] [(e_j + \mathbf{e}_j) - (e_i + \mathbf{e}_i)].$$

Assuming that the error terms are i.i.d, it is straightforward to re-express equation (12) as:

$$(13.) \quad E[\text{Inequity}_i | \mathbf{e}_i] = \frac{\mathbf{b}_1}{n-1} \sum_{j \neq i} \left[\mathbf{a} - \frac{1-\mathbf{a}}{n-1} \right] \int_{\mathbf{e}_i}^{\infty} ((\mathbf{e}_j - \mathbf{e}_i + e_j - e_i) f(\mathbf{e}_j) d\mathbf{e}_j$$

for $\mathbf{a} \geq 1/n$. Integrating over \mathbf{e}_i , $E[\text{Inequity}]$ is

$$(14.) \quad E(\text{Inequity}_i) = \mathbf{b}_1 A \mathbf{q} + \frac{\mathbf{b}_1 A}{2} \left(\frac{\sum_{j \neq i} e_j}{n-1} - e_i \right)$$

$$\text{where } A \equiv \left[\mathbf{a} - \frac{1-\mathbf{a}}{n-1} \right] \text{ and } \mathbf{q} \equiv \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} (\mathbf{e}_j - \mathbf{e}_i) f(\mathbf{e}_j) d\mathbf{e}_j f(\mathbf{e}_i) d\mathbf{e}_i > 0.$$

Thus, in equilibrium, (where $e_j = e_i$), $E(\text{Inequity}_i) = \mathbf{b}_1 A \mathbf{q}$. Note that $A \geq 0$ with the equality holding only when firms adopt the equal sharing rule $\mathbf{a} = 1/n$. The expression $A \mathbf{q}$ represents the expected earnings differential between partners i and j due to differences in *random* shocks. The parameter \mathbf{b}_1 captures the degree of social tension resulting from interpersonal income comparisons.

Equation (14) depicts the relationship between expected inequity, incentive pay and group size. For any group size, expected income differentials increase with \mathbf{a} . When physicians share income ($\mathbf{a} < 1$), however, big groups have higher levels of expected inequity than small groups. This difference narrows and eventually disappears as \mathbf{a} approaches 1.

The differences in $E(\text{Inequity})$ across group size suggested by equation (14) are easy to explain. Doctor i compares herself to other doctors in the group who are more fortunate than her. A more fortunate doctor gets to keep \mathbf{a} of his good luck and shares $(1-\mathbf{a})/(n-1)$ with doctor

i. It follows from this that so long as $\mathbf{a} < 1$, relative earnings differentials will, ceteris paribus, be greater in larger groups.

The relationship between $E(\text{Inequity})$ and group size in equation (14) is the opposite of the relationship between risk aversion and group size from equation (7). Large groups are better at providing income insurance than small groups and the marginal costs of incentives due to risk are, therefore, greater in large groups. Small groups are better at equalizing incomes than large groups. Thus the marginal costs of incentives due to income inequality are greater in *small* groups.

3. *Income Comparisons and the Marginal Benefit of Incentive Pay.*

If income norms only influenced the cost of incentives, then the preceding discussion would be sufficient to demonstrate that $d\alpha/dn < 0$. The story is more complicated, however, because income norms also alter the marginal benefits of incentives by increasing an individual's responsiveness to incentive pay.

Inserting equation (14) into equation (11), we analyze the benefits of incentives due to income norms by writing the utility of physician *i* as :

(15.)

The effort supply function, $e = \hat{e}(\mathbf{a}, \mathbf{b}, n)$, consists of those effort levels that satisfy the following first-order condition:

$$(16.) \quad \frac{dE(U_i)}{de_i} = (\mathbf{a} - ce_i) + \frac{\mathbf{b}}{2} A = 0. \text{ or } e = \frac{\mathbf{a}}{c} + \frac{\mathbf{b}}{2c} A$$

Compare equation (16) with effort supply in the absence of income norms (equation 4b). Notice that for any given level of incentive pay, income norms cause individuals to supply $\mathbf{b}A/2c$ more effort than in the absence of these norms. This extra effort is the direct result of income comparisons within the group. When $\mathbf{a} > 1/n$ some doctors will be high earners and others low earners. Partner *i* can reduce the expected disutility from being a low earner by

working harder than partner j . These gains from relative effort are, of course, dissipated in equilibrium because every partner supplies identical effort. The result is a kind of “rat race” that calls forth more effort from all partners than would be the case in the absence of income norms (Frank 1985a).

From equation (14) we have observed that for any given level of $1/n < \mathbf{a} < 1$, income differentials are greater in large groups than small groups. This means that $\partial A/\partial n > 0$, i.e., that the marginal effect of incentives on work effort is greater in big groups. Since increases in group size increase both marginal costs and marginal benefits of incentives, the effect of group size on α is indeterminate when $\alpha > 1/n$.

While income norm models do not predict how α varies with group size, they do predict that larger groups will be less likely to adopt equal sharing rules, i.e. to set $\alpha=1/n$, the lower bound on α . Groups will adopt equal sharing rules when the marginal costs of social tensions resulting from income comparisons ($\mathbf{b}_1 A_a \mathbf{q}$) exceed the marginal benefits of more high powered incentives:

$$(17.) \quad \frac{dE(U)}{de} \frac{de}{d\mathbf{a}} \leq \mathbf{b}_1 A_a \mathbf{q}$$

When $\mathbf{a} = 1/n$, all partners share equally in the revenues of the group ($A = 0$). We can therefore solve equation (17) to get:

$$(18.) \quad \frac{1}{\left(\mathbf{q}c - \frac{n-1}{2n}\right)(A_a)^2} = \mathbf{b}_1$$

The values of \mathbf{b}_1 that satisfy the preceding equality represent the minimum amount of social tension sufficient to prevent groups from adopting incentives more powerful than equal sharing rules. Notice that $d\mathbf{b}_1/dn = \frac{\mathbf{b}_1}{n(n-1)} [1 + \mathbf{q}\mathbf{b}_1 c A_a^2] > 0$. It takes a greater degree of social tension to sustain equal sharing rules in large groups than small ones. Put differently, since the marginal costs of incentives due to intra-group inequality are smaller in large groups, large groups are less likely to choose equal sharing rules.

D. Group Effort Norms and Incentive Pay:

If group members care about relative income, they are also likely to care about relative effort. We follow our analysis of income norms, therefore, with an analysis of the interpersonal effort comparisons that support effort norms.¹⁰

We use the term effort norm to refer to the informal interactions that make it costly for individuals to perform below the level of others in their work group. Effort norms can be sustained by feelings of guilt or shame when not carrying one's "fair share" of the group's work (Kandel and Lazear, 1992). Alternatively effort norms can be the result of informal processes of monitoring and sanctions within the work group. Finally, effort norms can result from the praise a group member receives from working harder than others in the group. Our analysis can incorporate all of these processes and all are likely to operate in real world settings.

We have in mind a setting where it is more efficient for the group to resolve its incentive problems through a combination of incentive pay and peer pressure rather than through legally binding contracts or the threat to dismiss group members who work below the group norm. This presumption is not unreasonable. In many instances work effort is non-contractible because it is assessed in subjective ways that are difficult to record and difficult for a third party to verify. Even if effort were contractible, dismissing individuals who work below the group norm may not be desirable if dismissal or subsequent hiring entails substantial costs.

We write the expected utility of the i^{th} partner as ¹¹:

$$(19.) \quad E(U_i) = E(Y_i) - \frac{ce_i^2}{2} - \mathbf{g} \sum_{j \neq i} \frac{e_j}{n-1} - e_i), \text{ with } \gamma > 0.$$

The parameter γ is a positive constant indicating the size of the penalty that sub-norm performers receive. The larger is \mathbf{g} the greater is the penalty for working below norm.

Changes in \mathbf{g} and in c influence equilibrium work effort by altering the marginal cost of effort. The two parameters, however, are different in one important respect. Reductions in c cause an increase in first-best effort levels because, at the margin, the individual is getting more pleasure (or less disutility) out of her work. In contrast, increases in γ bring forth more work

effort without altering first-best effort levels. Put differently, under norms the individual works harder, not because the work is more palatable but because the social environment provides sanctions against those who work less than others and rewards for those who work harder than others.

Effort norms do not create any incentive costs in equilibrium. For this reason, groups will pick the level of α that generates first-best effort levels. When effort norms matter, however, groups can achieve first-best effort with $\alpha < 1$. To see this, note that first-best effort occurs when $e = 1/c$. Differentiating (19) leads to the following first-order condition for labor supply in the presence of norms

$$(20.) \quad \frac{dEU}{de} = \mathbf{a} - ce + \mathbf{g} = 0 \Rightarrow \text{first best effort occurs when } \mathbf{a} + \mathbf{g} = 1.$$

If, for example, $\gamma = 0.3$, then first-best effort is achieved by setting $\alpha = 0.7$.

Thus, effort norms, like income norms, cause groups to operate with $\alpha < 1$. Similarly, the logic of effort norms makes equal sharing rules more likely in small groups. The reason for this is that the incentive implicit in equal sharing rules ($\alpha = 1/n$) falls as group size increases.¹² It is therefore less likely that large group will have norms (γ) stringent enough to sustain first-best effort with equal sharing.

Empirically, one can distinguish effort norms from income norms by examining the relationship between α and work effort. In settings where only income norms matter, incentives are costly and groups with $\alpha < 1$ operate with less than first-best work effort. Indeed, under income norms one should observe a positive relationship between incentive pay and work intensity. In settings where only effort norms matter, however, all groups will be operating at first-best effort and there will no relationship between effort and incentive pay.¹³

E. Mutual Help and Incentive Pay

We have so far considered two different informal interactions among group members that influence incentive pay, income and effort norms. The final aspect of group sociology we

consider are mutual help activities. In this section we demonstrate that the presence of valuable mutual help activities creates incentive costs that lead groups to set $\alpha < 1$.

We consider a group in which physicians divide their energy and attention between two different types of activity, e and v . Activity e generates revenues for an individual physician (e.g. seeing patients), while activity v is valuable because it helps others in the group do their jobs (e.g. consulting with other physicians about their cases). We incorporate these two activities into the physician's utility function as follows:

$$(21.) \quad U_i = \mathbf{a} \left(e_i + \sum_{j \neq i} v_j \right) + \frac{(1-\mathbf{a})}{n-1} \sum_{j \neq i} \left(e_j + \sum_{x \neq j} v_x \right) - \frac{ce_i^2 + cv_i^2}{2} - ke_i \mathbf{a}_i \quad \text{with } c > |k|$$

This setup is simply an extension of Baker's (1992) and Holmstrom and Milgrom's (1991) multi-task incentive framework to informal interactions among group members. This application of multi-task models to the analysis of the informal or "sociological" features of groups suggests deeper affinities between economic and sociological approaches than has previously been recognized in the literature on incentive design.

As in more conventional applications of the multi-task framework, incentive costs are due to the interaction term in the utility function, kev . Increases in α call forth more e , but by doing so make the provision of v more costly at the margin. Groups therefore choose low powered incentive pay so as not to discourage valuable mutual help activities.

Individual physicians supply both e and v to satisfy the following first-order conditions:

$$(22.) \quad \frac{dU_i}{de_i} = \mathbf{a} - ce_i - kv_i = 0 \quad \text{and} \quad \frac{dU_i}{dv_i} = (1-\mathbf{a}) - cv_i - ke_i = 0$$

From this system of equations we find

$$(23.) \quad \frac{de_i}{d\mathbf{a}} = \frac{c-k}{c^2-k^2} > 0 \quad \text{and} \quad \frac{dv_i}{d\mathbf{a}} = \frac{-(c+k)}{c^2-k^2} < 0.$$

All members of the partnership are homogeneous and for this reason $e_j = e_i$ and $v_j = v_i$.

The group selects α that maximizes the utility of the representative partner

$$(24.) \quad \max_{\mathbf{a}} U_i = e + (n-1)v - \frac{ce^2 + cv^2}{2} - kev \quad .$$

We are interested in how group size influences the determination of optimal α . It is easy to show that:

$$(25.) \quad \frac{d\alpha}{dn} = \frac{-\frac{\partial^2 U}{\partial \alpha \partial n}}{\frac{\partial^2 U}{\partial \alpha^2}} = \frac{k+c}{\frac{\partial^2 U}{\partial \alpha^2}} < 0$$

We know the sign of this derivative because the denominator is negative from the second order condition. The intuition for the result that $d\alpha/dn < 0$ is straight-forward. Sharing rules allow each physician to keep $(1-\alpha)/(n-1)$ of the revenues their helping activities generate. Since the returns to mutual help activities fall as group size increases large groups will choose to operate with lower values of α .

The finding that $d\alpha/dn < 0$ is not an artifact of the special type of mutual help we specify in equation (21). Similar results obtain if we introduce a more complicated helping technology or if we allow mutual help activities that improve the general reputation of the group rather than the earnings produced by individual physicians.

F. Summing Up

We have analyzed four explanations for groups choosing $\alpha < 1$: risk aversion, group income norms, group effort norms, and mutual help activities. Each of these models yields hypotheses that we can test with our data on medical groups. A summary of these hypotheses is presented in Table 1.

II. Empirical Analysis

In this section we investigate empirically the relationships summarized in Table 1. Table 1 also indicates where the relevant empirical results can be found.

We begin by describing our data. We then analyze the determinants of incentive intensity (Section II.B) and the effect of incentive pay on work effort (Section II.C) and mutual help activities (Section II.D).

A. Data

The data we use in this study are from a national random sample of medical group practices conducted by Mathematica Policy Research during the period March-June of 1978. These data are uniquely suited for our purposes because they contain information about key group level characteristics (a measure of incentive pay, group size, characteristics of the group's practice and clientele) as well as survey data from individuals who are members of the group.¹⁴

Information on incentive pay comes from a question asking each group about the compensation of physicians who had an ownership stake in the practice:

“Excluding fringe benefits, what percentage of the total amount the group distributes to owner physicians is distributed on the basis of productivity?”^{15, 16}

The answers to this question are coded in the variable *Incentive Pay I* with responses ranging from 0 to 100. *Incentive Pay I* differs from the empirical measures of incentives used in other studies in that it describes the incentive *policy* of the group without reference to the ex-post realizations of that policy, individual earnings.

Incentive Pay I does not correspond exactly to the theoretically appropriate incentive parameter, α , because it does not include the incentive effect of revenues that individuals receive after the money is pooled and divided among partners. For this reason we construct a second incentive pay variable, $Incentive\ Pay\ II = Incentive\ Pay\ I + (100 - Incentive\ Pay\ I) / Group\ Size$. The key variable for our purposes, *Equal Sharing*, is a dummy variable equal to 1 when $Incentive\ Pay\ II = 100 / Group\ Size$ and 0 otherwise.

Table 2 presents descriptive statistics for the distribution of the variables *Equal Sharing*, *Incentive Pay I* and *Incentive Pay II* by group size. Information on the size of the group was collected in six categories, each measuring the number of full-time equivalent physicians: 3-5, 6-7, 8-15, 16-24, 24-49 and 50+. ¹⁷ At the time of this survey, physician groups tended to be small: 46 percent of the 794 groups in our sample were in groups with 3-5 physicians and only 2.4 percent were in groups with 50+ physicians. This last figure is inflated because very large physician groups were oversampled in the original survey.

Column 4 in Table 2 presents the proportion of groups in each size category having equal sharing rules. Increased group size is associated with a reduced propensity to adopt equal sharing rules. Similarly both the mean and median values of *Incentive Pay I* and *Incentive Pay II* increase with size for all except the 2.4 percent of groups in the largest size category. In our view, this break in pattern suggests that many of the largest groups are quite different organizations than smaller groups. Specifically, we suspect that the largest groups in our sample are more likely than smaller groups to be associated with research and teaching entities. In academic medicine, high powered incentives linked to such revenue generating activities as seeing patients are likely to be counterproductive.

B. The Determinants of Incentive Intensity

The income and effort norms models predict that incentive pay may increase with group size while the risk aversion and mutual help models always predict the opposite relationship. The risk aversion model also predicts that more risk averse physicians will be found in groups having relatively low powered incentives.

In this section we analyze the relationship between group size, individual risk preferences and incentive pay. We will show that, consistent with the income and effort norms models, incentive intensity increases with group size. However, consistent with the risk aversion model, groups with low powered incentives tend to have more risk averse physicians.

Table 3 presents estimates of the relationship between group size and incentive pay. The dependent variable in Panel A is *Equal Sharing*, a variable taking values of 1 or 0, and all the estimates reported are from probits. The dependent variable in Panel B is *Incentive Pay II*, a variable that ranges from $100/n$ to 100, and all the estimates in panel B are from censored normal regressions.¹⁸ Otherwise the two panels are identical and, as we shall see, they contain similar results.

The estimates in column (1) of panel A regress *Equal Sharing* against dummy variables indicating group size categories. The omitted size category is the smallest size category. The

regressions also contain a vector of variables that condition on characteristics of the practice and its clientele. These coefficients are not presented in the paper, but they are available from the authors upon request.¹⁹ The negative sign on the size dummy variable coefficients indicate that larger groups are *less* likely to adopt equal sharing rules than smaller groups. The magnitude of these effects, however, is not directly interpretable from the probit coefficients. Converting the coefficients to derivatives, we find that increases in group size substantially reduce the probability of equal sharing. Moving from the smallest group size (3-5 physicians) to the next larger (6-7) reduces the probability of equal sharing rules by 8.5 percentage points. Moving from the smallest group size to the fourth largest (16-24 physicians) reduces the probability of equal sharing by 28.5 percentage points. This is a substantial change given that the probability of equal sharing is 38 percent for the sample as a whole. The effect of being in the largest group size (50+) is also negative but the magnitude is small. As noted above, this may be due to the presence in this category of groups involved in academic medicine. The small number of groups in this largest size category (19) makes it difficult to estimate size effects precisely. The 95 percent confidence intervals for this coefficient range from -1.30 to 0.57. Thus, while we cannot reject the statement that the true size coefficient for groups greater than 50 is zero, we also cannot reject the thesis that the true coefficient is the same as that for groups having 24-49 physicians.

Estimates in column (1) of panels A and B tell similar stories. Increases in group size are associated with an increase in incentive intensity as measured by *Incentive Pay II*, although the marginal effect of size falls as the size of the group increases. The largest groups appear to break from this pattern because they have very low incentive parameters. Here, as in panel A, the standard error of this estimate is very high and the 95 percent confidence interval ranges from -70.06 to 27.30.

Columns (2) in panels A and B repeat the analysis of incentive pay presented in column (1), but in these estimates group size dummy variables are replaced with *Inverse Group Size*. Log-likelihood tests do not reject the restrictions implicit in the use of the inverse of group size variable.²⁰ The point estimates are also close to those derived from the dummy variable

specification. For example, moving from a group with 4 physicians to one with 20 physicians reduces the estimated probability of equal sharing rules by 32 percentage points. This change in group size is associated with an increase in incentive pay roughly comparable to that reported in column (1) of panel B.²¹

One possible concern with the analysis presented so far is that we may not be using the appropriate size variable. The theoretical discussion focused on the number of partners while our group size variables measure the total number of physicians in the group. For groups in the bottom five size categories this discrepancy is not likely to pose a substantial problem because a large fraction of the physicians working in a group are owners (in 63.54 percent of the groups with 3-5 doctors, all physicians had an ownership stake in the group). Things are different in the very large group practices. Here only 25.93 percent of groups were comprised solely of physicians who were owners/shareholders. As a check on the importance of this measurement error, we re-estimated the results in column (2) for groups composed only of physician owners. This reduces the number of groups in the sample from 583 to 299. These estimates are reported in column (3) of panels A and B. Restricting the sample in this way does not alter the relationship between group size and the probability of having equal sharing rules.

An alternative explanation for the results in Table 3 might be that introducing high powered performance incentives requires a fixed expenditure on systems of monitoring individual performance. If these expenditures are substantial, small groups may be unwilling to make the investment.

This fixed cost explanation relies on two assumptions: (i) there are substantial fixed costs associated with implementing incentive pay systems; and (ii) these costs increase as incentive intensity increases. We contend that neither of these assumptions are likely to hold in the medical groups we study.

The fixed costs of incentive systems are likely to be negligible because much of the information needed to calculate incentives is information about physician billings and/or patient visits that are already collected by groups in order to obtain reimbursement from insurers. In

addition, low powered incentives entail neither more nor less costs than high powered incentives. Equal sharing rules still require that revenues are appropriately measured, placed in a common pool and accurately divided. There is no reason to believe that $\alpha=1/n$ is any less costly, in this regard, than $\alpha=1$ or any value in between. Indeed, it is easy to imagine settings where $\alpha=1$ is the least cost system because each physician simply keeps the revenues he or she generates. Since medical groups *must* select a value for α , and since the fixed costs of implementing α do not fall as α falls, there is no reason why fixed costs should lead small groups to favor low powered incentives.

We do not have any data on the fixed cost of incentive systems in medical groups. We can make some indirect inferences, however, if we assume that whatever the added costs of setting up high powered incentives, they are smaller for groups having full-time managers. If this assumption is correct, then under the fixed cost hypothesis, the relationship between size and incentive intensity should be attenuated for groups with full-time managers.

The results for groups with full-time managers are presented in column (4) of Tables 3. Comparing columns (2) and (4) of panel A, we do find a small reduction in the magnitude of coefficient on *Inverse Group Size*, but it is well within the 95 percent confidence interval for column (2).²² Similarly, the absolute value of the coefficient on *Inverse Group Size* falls between columns (2) and (4) of panel B, but the value in column (4) is also well within the 95 percent confidence interval of the coefficient in column (2).²³ The bottom line is that we do not reject the hypothesis that the relationship between size and incentive intensity are unchanged between columns (2) and (4) of panels A and B.

The results presented in Table 3 might also reflect the importance of joint production between physicians in a practice. Consider a hypothetical practice composed of two hand surgeons and an anesthesiologist. If these three doctors perform their surgeries together, then an equal sharing rule might only reflect the fact that it is impossible to attribute revenues to any single individual. We can investigate the importance of joint production by restricting attention to specialties where revenues are generated by individual physicians seeing patients individually in

their offices. For this reason we re-estimated column (2) for groups composed entirely of general practitioners, internists and/or pediatricians, specialties for which joint production is unlikely to be important. These estimates, presented in column (5) of Table 3, reveal the same negative relationship between size and incentive intensity observed in column (2).²⁴

Our discussion so far assumes that groups choose \mathbf{a} and that individuals then choose their optimal effort levels. An alternative incentive instrument would be to require that individuals, on average, achieve a certain level of performance as a condition of employment. We can investigate the importance of such productivity guidelines for our key results using data collected from our survey of group practices. Groups were asked to respond to the following yes/no question

“Does the group have a formal policy or explicit guidelines on expected productivity for physicians?”

Roughly 17 percent of groups reported having productivity guidelines.

Column (6) in Table 3 present estimates of incentive equations for groups without productivity guidelines. For these groups there is the same strong negative relationship between size and incentive intensity that we observed in earlier estimates. In unpublished estimates for groups having productivity guidelines, however, *Inverse Group Size* does not have a significant effect on the probability of adopting an equal sharing rule. This pattern is what we would expect if productivity guidelines are substituting for incentive pay. It is worth noting, however, that only 123 groups had productivity guidelines and the coefficients estimated for this subset are therefore not measured with much precision.²⁵

In our theoretical analysis, we assumed away cross-group differences in risk aversion and assumed that individuals had no other preferences regarding the form of compensation. In the real world, however, cross group differences in risk aversion and other preferences regarding the nature of pay are likely to matter in the design of optimal incentive systems. *Ceteris paribus*, a group composed of more risk averse members will have lower powered incentives. Similarly, groups whose members believe productivity based pay is “fair” will tend to choose high powered incentives.

We examine these possibilities in columns (7) of Table 3. We assess risk aversion by taking the group's average response to a question asking about the importance of regular income (*Importance of Regularity of Income*).²⁶ Group average responses to a similar question asking about the importance of linking pay to productivity (*Importance of Pay for Performance*) is used to capture preferences regarding the form of pay.

In panel A of Table 3, the coefficient on *Importance of Regularity of Income* was positive and statistically significant while the coefficient on *Importance of Pay for Performance* was negative and significant. In panel B the analogous coefficients were also statistically significant and their signs reversed. These results indicate that preferences regarding the form of compensation matter: groups with more risk averse physicians are more likely to operate with low powered incentives and groups whose members prefer linking pay to productivity operate with high powered incentives.

Before leaving the discussion of risk preferences, it is important to reconsider the predictions of the risk aversion model regarding equal sharing rules. Under risk aversion, rational groups should never choose equal sharing rules because when $\alpha=1/n$, the marginal cost of additional incentives is zero. The only way to reconcile equal sharing with the risk aversion model is to assume that groups selecting equal sharing rules are doing so because they have mistakenly chosen incentives that are too low-powered. If we denote optimal incentives by α^* , it is easy to show that $(\alpha^* - 1/n)$ increases with group size. Put differently, the cost of mistakenly choosing equal sharing rules is greater in larger groups. If the likelihood of mistakes decreases with the costs of a mistaken action, the risk aversion model *can* be reconciled with the results of panel A of Table 3.²⁷ Such a reconciliation is not possible with the results of panel B. We conclude, therefore, that the patterns in Table 3 *taken together* cannot be explained solely on the basis of risk aversion. We can also conclude, however, that the patterns in the data are consistent with a model in which risk aversion is one of a number of factors determining incentive pay.

C. Incentive Pay and Work Intensity

Models of income norms and effort norms both predict that smaller groups will be more likely to adopt equal sharing rules than larger groups. The two models can be distinguished, however, by the relationship between equal sharing rules and work intensity. In income norms models, the social costs created by income comparisons cause groups to adopt incentives that generate less than first best effort levels. In effort norms models, groups set $\alpha < 1$ because they can achieve first-best effort levels with low powered incentives. Thus, if effort norms alone were accounting for the patterns described in Tables 2-3, we should observe no relationship between incentive pay and work intensity.

As discussed above, the Mathematica survey asked individual physicians to report the number of office visits and office hours they worked in the week prior to the survey. In Table 4, we use the number of office visits (columns (1), (2), (5) and (6)) and the number of office hours (columns (3), (4), (7), and (8)), as measures of work intensity.

Columns (1)-(2) of Table 4 examine the relationship between *Equal Sharing* and *Log of Office Visits*. In interpreting the coefficient on *Equal Sharing*, it is important to note that it is the result of both incentive effects and selection effects. Groups with more incentive pay or more stringent work norms will, by virtue of these features, elicit higher levels of work intensity from their members than other groups. These same groups will, however, tend to attract physicians better able to tolerate high levels of work intensity. Both incentive and selection effects operate in our model, but in ways subtly different than in other settings. Lazear (1986) argues that individuals with a low marginal cost of effort will be drawn to firms offering piece rates. In our setup, individuals for whom high effort is not very costly will be drawn to groups with lots of incentive pay *or* to groups with little incentive pay but stringent work norms.

The equation in column (1) is estimated for groups in the smallest size category, 3-5 physicians. The coefficient on *Equal Sharing* in this equation is small and imprecisely measured. The estimates in column (2) are for groups with more than five physicians. In contrast to column (1) the coefficient on *Equal Sharing* is -0.1637 with a t-statistic above 2.7. Thus, ceteris paribus,

equal sharing in the smallest groups has virtually no effect on the number of office visits while in larger groups equal sharing reduces the number of office visits in a week by roughly 16 percent. Similar results are found if we substitute *Incentive Pay II* for the *Equal Sharing* variable (see columns (5) and (6)).²⁸

Columns (3), (4), (7) and (8) in Table 4 estimate the effect of incentive pay on *Log Office Hours*. In contrast to the results for *Log Office Visits*, none of the coefficients on our measures of incentive pay, *Equal Sharing* or *Incentive Pay II*, are large or statistically significant.

Taken together, the results in Table 4 indicate that work intensity, as measured by office visits per week, increases with incentive pay for large groups but not for small groups. We interpret these results as indicating that our effort norms model may account for variation in incentive pay for groups in the smallest size category, but not for the variation observed in larger groups. Put differently, our results suggest that in small groups, effort norms reduce the costs due to free-riding that accompany low powered incentives. Groups in larger size categories, however, pay a productivity price for choosing equal sharing rules.²⁹

We find additional support for our interpretation of Table 4 from data on the distribution of productivity guidelines across groups. Large groups with equal sharing rules are more than twice as likely to adopt productivity guidelines as other groups. This pattern suggests that larger groups with equal sharing rules are trying to find alternatives to costly incentive pay and ineffective group norms.³⁰

It is interesting to speculate why small groups with $a=1/n$ can sustain first best effort levels while larger groups cannot. The explanation we emphasized in our theoretical analysis is perhaps the simplest. When $a=1/n$, incentive intensity falls as group size increases. Thus less stringent effort norms are required to sustain first-best work effort in smaller groups. In terms of our earlier notation, this would mean that $d\gamma^*/dn > 0$. An alternative explanation may be that the psychological sanctions for violating group effort norms (guilt, shame, etc.) are more keen in smaller groups.³¹ Untangling these competing explanations would require data that is not currently available.

D. Incentive Pay and Mutual Help Activities

In this section, we consider whether incentive pay discourages mutual help activities. The focus of our investigation is the frequency with which physicians consult one another about cases.

Making oneself available for consultation is just the sort of activity highlighted by our model of mutual help. Agreeing to discuss another partner's case is likely to help the other doctor deliver medical services to his or her patients. Increasing incentive pay increases the opportunity cost of providing this help. Evidence that physicians in groups with high powered incentives engage in less consultation would thus be indirect evidence that concern over mutual help activities may also shape incentive pay decisions.

The Mathematica survey asked individual physicians how frequently they consulted with other doctors in their group about their patients. We use the group average response to this question to indicate the amount of time and energy doctors devote to mutual consultation. Table 5 presents estimates of the relationship between incentive pay and the frequency of consultation within the group.

The consultation equation is presented in column (1). The negative and significant coefficient on *Incentive Pay II* suggests that increases in incentive pay are associated with reductions in the frequency with which doctors in the group consult one another. The estimated coefficient appears to be behaviorally as well as statistically significant. In a group of 4 physicians, increasing incentives from equal sharing to full incentive pay reduces the frequency of consultations by 0.19 per day. This represents a greater than 13 percent reduction from the mean number of consultations per day (1.5). Column (2) replaces *Incentive Pay II* with *Equal Sharing*. The positive coefficient on *Equal Sharing* suggests that physicians in groups with equal sharing rules have an average of 0.22 more consultations per day than physicians in other groups. Unfortunately our data do not allow us to tell if this fall-off in consultations would produce a significant change in the quality, cost or quantity of medical care provided by the group. Similarly, we do not know if the increase in incentive pay causes a fall off in consultation or if

groups for whom consultation was more important (because of some unobserved feature of the practice) would choose a more “group oriented” pay system.

E. An Unresolved Question: Why Do Groups Choose $\alpha=1$?

The descriptive statistics in column 11 of Table 2 indicate that a sizeable proportion of medical groups operate without physicians sharing any income. According to the models in this paper, groups should only choose $\alpha=1$ when high powered incentives are costless. It is easy to show that in the presence of any incentive costs (from risk aversion, income norms, effort norms or mutual help activities) groups should choose $\alpha<1$. Are groups with $\alpha=1$ groups for whom incentives are costless? Our data on risk aversion suggests not. We find that 47 percent of groups with $\alpha=1$ are more risk averse than the mean for groups with $\alpha<1$.

If costless incentives do not explain the observed mass points at $\alpha=1$, what might? We suggest four plausible explanations. The first is that $\alpha=1$ is simply an approximation to choosing an optimal α close to 1. Groups, for example, might optimally set $\alpha=0.9$, but find it easier just to round up to 1.

A second hypothesis relies on ideas concerning procedural justice. Consider a setting where group members value high powered incentives, not simply because of the rewards they expect but because linking pay to individual productivity appeals to their sense of justice. Formally, these procedural concerns could be modeled by entering α directly as a term in the utility function. If “fair procedures” were sufficiently strong, groups might choose $\alpha=1$ even when there are non-trivial costs to high powered incentives.

We have some indirect evidence concerning individuals’ preferences for pay procedures. Our results in column (7) of Table 3 suggest that preferences for having “income dependent upon your own productivity” correlate with the degree of incentive intensity in the group.³² This relationship is consistent with the idea that preferences for certain pay procedures (as opposed to pay outcomes) may explain why some groups choose $\alpha=1$ even when incentives are costly. If

such procedural concerns are indeed important for the setting of incentives, then our analysis of group sociology may be too narrow to completely account for pay practices in medical groups.

A third explanation for $\alpha = 1$ may derive from a desire to reduce the power of income norms. When $\alpha = 1$ it is possible that each partner might get no information about the income of the other partners. If $\alpha = 0.95$, however, one would at least find out whether one was subsidizing or living off the other partners. Put somewhat differently, dissension arising from income differentials may cause employers to keep employee salaries secret. Might $\alpha = 1$ allow, and $\alpha < 1$ prevent, the same secrecy in a partnership?³³

The final explanation for setting $\alpha = 1$ can be found in an expanded model of effort norms. The effort norms model we have analyzed in our paper requires that individuals react symmetrically to the work effort of others in the group. We can, however, generalize our effort norms model to allow individuals to react differently to group members who work harder and less hard than they do.

To implement this norms model, we write the utility of individual i as:

$$(26.) \quad E(U_i) = E(Y_i) - \frac{ce_i^2}{2} - \frac{g}{n-1} \sum_{j \neq i} [h(e_j - e_i) + g(e_i - e_j)]$$

where $h(\cdot)$ is the disutility of working too little compared to others in your group (due to shame, guilt or peer pressure) and $g(\cdot)$ is the disutility of working harder than others in your group (due to anger at subsidizing weak performers). We give structure to this norms model by stipulating $h(x) = g(x) = 0$ if $x \leq 0$; $0 < h(x), g(x)$ for $x > 0$; and $0 < h'(x), g'(x)$ for $x \geq 0$.

In equilibrium, all group members exert identical effort, and there are three possible equilibria. In the first equilibrium, individuals supply the level of effort they would if there were no norms, $e = a/c$. In the second equilibrium, effort norms cause individuals to supply more effort than they would in the absence of norms. In the third equilibrium, norms are dysfunctional

and cause individuals to supply *less* effort than they would in the absence of norms. These last two effort equilibria are described in equation (27)

$$(27.) \quad e = \begin{cases} \frac{\mathbf{a} + \mathbf{g}'(0)}{c} & \text{norms increase effort and groups achieve 1st best effort at } \mathbf{a} < 1 \\ \frac{\mathbf{a} - \mathbf{g}'(0)}{c} & \text{norms reduce effort and groups do not achieve 1st best effort at } \mathbf{a} = 1 \end{cases}$$

The case where effort norms increase effort is a more general specification of the case we analyzed above. When social or psychological processes make individuals experience disutility when working less hard than others, the group can sustain higher levels of effort than would otherwise be possible given the value of α .³⁴ For this reason, groups can reach 1st best effort with $\mathbf{a} < 1$.

In the last case people work *less* hard in the presence of effort norms. This equilibrium describes a setting in which group members are so strongly averse to feeling “cheated” by working harder than others that the group gets stuck at a low level of effort.³⁵ Put somewhat differently, this 3rd equilibrium describes a group in which members say, “why should I put in extra effort if nobody else is.” The group can try to offset the dysfunctional norms by increasing \mathbf{a} , but they cannot achieve first best effort levels even when $\mathbf{a} = 1$. Thus, under dysfunctional effort norms, firms might find it beneficial to set $\mathbf{a} = 1$, even when incentives are costly.

III. Conclusion

What accounts for the variation in incentive pay in the medical groups we study? We consider four, widely discussed explanations: (1) risk aversion; (2) income norms; (3) effort norms; and (4) mutual help activities. The last three models describe the various informal interactions between group members that make up the “sociology” of the group.

Our empirical findings indicate that none of the four candidate models of incentive pay can individually account for all the patterns in the data. The relationship between group size and incentive pay is consistent with (2) or (3), but not (1) or (4). The relationship between incentive pay and work effort suggests that (3) may explain “equal sharing rules” in the smallest groups, but not in larger ones. The relationship between incentive pay and intra-group consultations is consistent with (4), while the sorting of physicians across groups suggests that (1) also plays a role in setting pay policies. None of the four explanations can account for groups choosing $\mathbf{a} = 1$, although this result may be consistent with some expanded models of norms.

The conclusion we draw from these results is that even in the very simple organizations we study, the determination of incentive pay in groups is too complex to be fully captured by any of the candidate models taken individually. The data is, however, consistent with a richer model in which the sociology of the group and the risk aversion of individual members together determine the group’s incentive pay policy.

Indeed, combining sociological and economic models of behavior may prove generally fruitful for understanding the many settings (in medicine and elsewhere) where individuals both produce and are paid in groups.

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- * Early in this project we benefited from conversations with Ashish Arora, Linda Babcock, George Baker, Bob Frank, Bengt Holmstrom, Reuben Gronau, Kevin Lang, Bentley MacLeod, Steve Pischke, David Sappington, Mark Satterthwaite, Scott Stern, Lowell Taylor, Bill Vogt, and participants in the Harvard-MIT Labor Economics Seminar, the

Princeton Labor Economics Seminar, the Harvard-MIT Economics of Organizations Seminar and the NBER's Health Care Program Meeting . More recently we benefited from the ideas and insights of our two referees. Encinosa acknowledges financial support from the Robert Wood Johnson Foundation. We, of course, remain responsible for any errors.

- ¹ For economic theory on “group norms” see George Akerlof (1997, 1990) on conformity and reciprocity, Robert Frank (1985) on status seeking, Kreps on corporate culture (1990) and on intrinsic vs. extrinsic motivations (1997). Papers that analyze the importance of social interactions for organizations are Milgrom (1988), Lazear (1989) and Kandel and Lazear, (1992)
- ² Sharing space and costs are key parts to the American Medical Association's definition of a medical group practice (Havlicek, 1996).
- ³ Homogeneity is reasonable if work propensities and abilities are observable by others in the group. So long as partners share some fraction of income, high output partners will end up subsidizing low output partners. Thus the best any physician can do would be to join a group comprised of other, equally productive, individuals (Farrell and Scotchmer, 1988).
- ⁴ All the theoretical results that rely on equations (2) and (3) generalize to settings where revenues are a concave function of effort and the cost of effort function is convex.
- ⁵ The following model of optimal linear incentives with risk averse partners is adapted from Gaynor and Gertler (1995) and Lang and Gordon (1995).
- ⁶ In this variant of the model, utility maximizing groups will not choose $0 \leq \alpha < 1/n$ because for any such α there exists an $\alpha > 1/n$ that offers the same level of income variation with higher levels of work incentives.
- ⁷ This result still holds if the assumption that random shocks are i.i.d. is relaxed.

8 For empirical and theoretical analyses of reference dependence see Babcock, Wang and Lowenstein (1995); Frank (1985a and b), Kahneman, Knetsch and Thaler (1986), and Levine (1993). For an extensive discussion of loss aversion in income see Tversky and Kahneman (1991). For discussions of saliency see Frank (1988) and Baron and Pfeffer (1994).

9 If we maintained our assumption that $\beta_1 > \beta_0$ and also allowed $\beta_0 > 0$, then $E(Inequity_i) = (b_1 - b_0)Aq$ in equation (14) in equilibrium. None of our results would be changed by this. Another feature of this setup is that preferences regarding relative income are assumed to be invariant with respect to group size. Alternatively we may stipulate that $(b_1 - b_0)$ increases with the closer social interactions of small groups, but this would only strengthen our reported findings. In unpublished work we also demonstrate that our results hold when $(b_1 - \beta_0)$ increases with group size, provided the increase is not “too fast”.

10 Income and effort norms are conceptually distinct and have distinctive empirical predictions. In real world settings, however, income norms are likely to be most salient where effort comparisons are most salient. In unpublished work, we incorporated this assumption into our analysis of income norms. The resulting income norms model is considerably more complex than the one in this paper, but the core predictions remain unchanged.

11 This representation of effort norms is adapted from Kandell and Lazear (1992). Our model differs from theirs in that we derive optimal incentive pay rather than assuming equal sharing ($a=1/n$) prevails.

12 That is, $a = 1/n$ if $g \geq g^* = 1 - 1/n$, and $\frac{\partial g^*}{\partial n} = 1/n^2 > 0$. A second implication of equation (20) is that α varies within group size categories only if γ varies across groups.

13 These *ceteris paribus* assumptions describe special cases chosen to highlight features of the theory. In taking the theory to the data, other more complicating factors must also be considered.

- ¹⁴ A group was defined as a medical practice having three or more full-time equivalent physicians. For details see Gaynor and Pauly (1990) as well as a data appendix available from the authors upon request.
- ¹⁵ The question forces the respondent to allocate *compensation* across four categories: productivity, straight salary, equal shares, and other. The emphasis on the allocation of *compensation* rather than gross revenues to the partnership is important. If the question asked about the allocation of gross revenues, then fixed employment costs (if they rose less rapidly than group size) would reduce the fraction of revenues devoted to incentive pay or any other sort of pay.
- ¹⁶ In the survey individual productivity is defined as “billings, patient visits or some other individual productivity measure”. Thus, the survey instrument states, if “none of the physician’s compensation from the group was directly related to individual physician productivity; it was all based on equal shares of group net income or some similar criteria.” Similarly, if the physician’s compensation was based entirely on individual productivity, then the survey states “no part of the physician’s income from the group was from equal shares, seniority, board certification and the like; it was all based on billings, patient visits or some other individual productivity measure”
- ¹⁷ In the regressions that follow, each group was assigned the mid-point of its size category. The top category was assigned a value of 113.5, a figure derived by assuming that the empirical distribution of the two largest group sizes follows a Pareto distribution. We also experimented with different values (ranging from 60 to 160) and found our basic results were not sensitive to these different assumptions.
- ¹⁸ The term, censored normal regression, refers to a generalization of tobits in which each observation can be left and right censored at a different point. We treat *Incentive Pay II* as being left censored at $Incentive Pay II = 100/n$ and right censored at $Incentive Pay II = 100$.

19 Group practice variables included in the regressions measure: the percent of revenues from HMOs, the percent of revenues from outside specialty referrals, the percent of the group that is board certified, whether the group is multi- or single specialty, the specialty composition of the group (percent physicians in internal medicine, general practice, specialty surgeon, OB/GYN, and pediatrics). Patient variables include: the percent of clientele who are white; the income distribution of clients, and the percent who are covered by Medicare and Medicaid.

20 Twice the difference in the log-likelihood between Columns 2 and 1 in panel A of Table 3 is 4.93 and 8.64 in panel B. For a 95 percent confidence level, the critical value of the chi-square distribution with four degrees of freedom is 9.48. We therefore cannot reject the restrictions.

21 It is possible that the positive relationship between group size and measures of incentive pay in columns 2 of Table 3 are artifacts due to measurement error in the top size category. We think this possibility is remote, however, because we get the same pattern when we use dummy variables to indicate group size (see columns 1 in Table 3). We also believe that the results are not likely due to mechanical relationships between group size and incentives. Substituting *Incentive Pay I* for *Incentive Pay II* yields results quite similar to those in columns 2 of Table 3.

22 This confidence interval ranges from 2.5 to 6.22.

23 This confidence interval ranges from -252.717 to -43.242.

24 Adding specialty dummies to the estimates in column 5 of panel A in Table 3 produces the following coefficient (t-statistic) on *Inverse Group Size*: 3.108 (1.895). In panel B, the analogous coefficient (t-statistic) on *Inverse Group Size* is -138.93 (-1.158). Both these results are within the 95 percent confidence interval for the coefficients presented in the text but in both cases the t-statistics fall. We conclude from this that adding the specialty dummies to the regression forces us to rely on cell sizes too small to yield precise estimates.

25 Columns 6 in Table 3 look only at groups without productivity guidelines. The corresponding coefficient (std. error) of the variable *Inverse Group Size* for groups with productivity is guidelines is: -1.862022 (2.894975) for panel A and 256.9904 (186.2838) for panel B.

26 The wording of the question was “Listed below are some factors that physicians might consider when choosing a new practice. Please check in the columns below how important each of the factors....is to you.” The factor measuring risk aversion is “Regularity of income (lack of fluctuation)”. Responses are coded in a four point scale with 1= of little or no importance and 4 = very important.

27 The mutual-help model, in contrast, does *not* predict that (a^*-1/n) increases in n .

28 Very similar results are found if we re-estimate equations (1), (2), (5) and (6) conditioning on office hours worked in the previous week. Similar results are also found if we pool across group size categories and include a size/incentive interaction term.

29 The finding of “shirking” in larger groups with low powered incentives is consistent with Nalbantian and Schotter’s (1997) experimental study of productivity under group incentives with groups having 12 members. At present, we cannot explain why variations in incentive intensity influence office visits per hour but not hours of work.

30 For groups in the smallest size category, 12.6 percent of those with equal sharing rules and 13.7 percent with more high powered incentives adopted productivity guidelines. For bigger groups, the analogous figures are 31 percent and 13.3 percent.

31 In terms of our theoretical framework, this would suggest that the saliency of social sanctions fall as group size increases, or equivalently $dy/dn < 0$.

32 A linear probability model that regresses a dummy variable for $\alpha=1$ against our measure of incentive preferences yields a coefficient of 0.15 (t-statistic = 6.05). This suggests the 0.4 point difference between the two groups would increase the probability of equal sharing rules by 6

percentage points. This result is quite substantial considering that roughly 20 percent of the sample choose $\alpha=1$. These results are not likely due to a correlation between risk aversion and preferences for linking pay to performance. If we introduce our measure of risk aversion into the linear probability model, the relationship between α and pay preferences is unchanged. Similarly, if we introduce our measure of pay preferences into the equations in columns (7) of Table 3, we find that it also has a statistically and economically significant effect on the incentive policies chosen by the group. Including this variable does not significantly alter the results in Table 3.

³³ We are grateful to one of our referees for suggesting this explanation.

³⁴ Define $e^* = \mathbf{a}/c$ as equilibrium work effort in the absence of effort norms. Now consider a group in which every member works $e > e^*$. The effect on individual i 's utility of deviating below the group equilibrium is $-[\mathbf{a} - ce + \mathbf{g}h'(0)]$. Thus the group can sustain $e > e^*$ so long as $-[\mathbf{a} - ce + \mathbf{g}h'(0)] = 0$ or, equivalently $e = (\mathbf{a} + \mathbf{g}h'(0))/c$.

³⁵ Define $e^* = \mathbf{a}/c$ as equilibrium work effort in the absence of effort norms. Now consider a group in which every member works at $e < e^*$. The effect on individual i 's utility of deviating above the group equilibrium is $-[\mathbf{a} - ce - \mathbf{g}g'(0)]$. Thus the group can sustain $e < e^*$ so long as $-[\mathbf{a} - ce - \mathbf{g}g'(0)] = 0$ or, equivalently $e = (\mathbf{a} - \mathbf{g}g'(0))/c$. It is clear from this effort supply function that groups will not achieve 1st best effort even with $\alpha = 1$.

Table 1

Four Models of Low Powered Monetary Incentives ($\alpha < 1$) and Their Empirical Implications

If choice of α were due solely to:	then $\alpha < 1$ and:	Evidence in:
<p><u>Risk Aversion</u></p> <p>Groups accept less than 1st best effort to provide income insurance for members. This effect most pronounced in large groups because large groups provide income insurance more effectively than small groups.</p>	<p>$d\mathbf{a}/dn < 0$</p> <p>$e < e^*$</p> <p>$de/d\mathbf{a} > 0$</p> <p>More risk averse</p> <p>doctors sort to groups with smaller α.</p>	<p>Table 3B</p> <p>Table 4</p> <p>Table 3A, B</p>
<p><u>Group Income Norms</u></p> <p>Groups adopt equal sharing rules and accept less than 1st best effort (e^*) in order to avoid social tension due to earnings differentials. This effect is most pronounced in small groups.</p>	<p>$d\text{Prob}(\mathbf{a} = 1/n)/dn < 0$</p> <p>$e < e^*$</p> <p>$de/d\mathbf{a} > 0$</p> <p>$d\mathbf{a} / dn > 0$ is possible</p>	<p>Table 3A</p> <p>Table 4</p>
<p><u>Group Effort Norms</u></p> <p>Peer pressure allows groups to achieve 1st best effort with equal sharing rules. This effect is most pronounced in small groups.</p>	<p>$d\text{Prob}(\mathbf{a} = 1/n)/dn < 0$</p> <p>$e = e^*$</p> <p>$de/d\mathbf{a} = 0$</p>	<p>Table 3A</p> <p>Table 4</p>
<p><u>Mutual Help Activities</u></p> <p>Groups accept less than 1st best effort because high powered incentives “crowd out” valuable mutual help activities (v). This effect is most pronounced in large groups.</p>	<p>$d\mathbf{a}/dn < 0$</p> <p>$e < e^*$</p> <p>$de/d\mathbf{a} > 0$</p> <p>$dn/d\mathbf{a} < 0$</p>	<p>Table 3B</p> <p>Table 4</p> <p>Table 5</p>

Table 2

Descriptive Statistics for Group Size and Incentive Pay Measures

Distribution of Group Size ^a			Groups With Equal Sharing Rules ^b		Distribution of Incentive Pay I ^c			Distribution of Incentive Pay II ^d			Groups With No Sharing	
(1)	(2)	(3)	(4)	(5)	(6)	(6)	(8)	(7)	(8)	(9)	(10)	(11)
Group Size Category	Number of Groups in Size Category	Percent Groups in Size Category	$\alpha = 1/n$	Mean	25th Percentile	Median	75th Percentile	Mean	25th Percentile	Median	75th Percentile	$\alpha=1$
3-5	365	46%	54.2%	31.2	0	0	70	48.4	25	25	77.5	19.7%
6-7	100	12.6	42.0	38.9	0	22.5	75	48.3	15.4	34.4	78.8	20.0%
8-15	153	19.3	21.6	55.4	15	60	100	59.3	22.4	63.5	100	28.1%
16-24	85	10.7	23.5	55.5	10	60	95	57	14.4	62	92.3	22.3%
25-49	72	9.1	6.9	65.2	50	70	95	66	51.3	70.8	95.1	20.8%
50+	19	2.4	31.4	29.7	0	20	46	30.4	0.88	20.7	46.5	10.5%
All	794	100.0	38.3	42.49	0	37.5	90	52.67	25	40.8	90	21.5%

^a Group Size refers to the number of physicians in the group. ^b Equal Sharing occurs when Incentive Pay II = 100/Group Size

^c Incentive Pay I is the percent of compensation (excluding fringe benefits) distributed to owner physicians on the basis of individual productivity.

^d Incentive Pay II = Incentive Pay I + ((100-Incentive Pay I)/Group Size).

Table 3
Determinants of Incentive Pay

Dependent Variable+A14	Panel A: Determinants of Equal Sharing						
	<i>Equal Sharing</i>	<i>Equal Sharing</i>	<i>Equal Sharing</i>	<i>Equal Sharing</i>	<i>Equal Sharing</i>	<i>Equal Sharing</i>	<i>Equal Sharing</i>
Independent Variables	(1) ^b	(2)	(3) ^c	(4) ^d	(5) ^e	(6) ^f	(7)
<i>Group Size: 6-7</i>	-0.2450						
	-(1.4090)						
<i>Group Size: 8-15</i>	-0.7170						
	-(3.8420)						
<i>Group Size: 16-24</i>	-1.0196						
	-(3.9090)						
<i>Group Size: 25-49</i>	-1.0564						
	-(3.2640)						
<i>Group Size: 50+</i>	-0.3673						
	-(0.7680)						
<i>Inverse Group Size</i>		4.3694	4.2692	3.6456	3.6753	5.7284	5.9033
		(4.6110)	(2.8027)	(3.3172)	(2.2976)	(5.4175)	(4.4526)
<i>Importance of Regularity of Income</i>							0.31138109
<i>1=no importance; 4= very important</i>							(2.4305)
<i>Importance of Pay for Performance</i>							-0.9851
<i>1= no importance; 4 = very important</i>							-(8.0423)
<i>Constant</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Groups	583	583	299	454	231	500	413
Log Likelihood	-326.8308	-329.2973	-171.1422	-245.1437	-154.0229	-269.5646	-192.97764

All estimates in Panel A are probits. Numbers in parentheses are z scores.

Table 3
Determinants of Incentive Pay

Panel B: Determinants of Incentive Pay Parameter

<i>Dependent Variable</i>	(1) <i>Incentive Pay II</i>	(2) <i>Incentive Pay II</i>	(3) <i>Incentive Pay II</i>	(4) <i>Incentive Pay II</i>	(5) <i>Incentive Pay II</i>	(6) <i>Incentive Pay II</i>	(7) <i>Incentive Pay II</i>
<i>Independent Variables</i>							
<i>Group Size: 6-7</i>	6.1050811						
<i>(t-statistics)</i>	(0.615)						
<i>Group Size: 8-15</i>	26.071988						
	(2.586)						
<i>Group Size: 16-24</i>	34.634168						
	(2.703)						
<i>Group Size: 25-49</i>	26.493509						
	(1.726)						
<i>Group Size: 50+</i>	-21.377436						
	-(0.863)						
<i>Inverse Group Size</i>		-147.98009	-182.53815	-84.18416	-207.46803	-201.68698	-199.27353
		-(2.775)	-(2.153)	-(1.440)	-(1.732)	-(3.655)	-(3.417)
<i>Importance of Regularity of Income</i>							-12.506576
<i>1=no importance; 4= very important</i>							-(2.289)
<i>Importance of Pay for Performance</i>							49.083386
<i>1=no importance; 4= very important</i>							(8.895)
<i>Constant</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>
Log-Likelihood	-1658.6866	-1663.0069	-795.48558	-1377.3297	-548.92867	-1449.7287	-1167.8655
# of Groups	583	583	299	454	231	500	413

All estimates in Panel B are censored normal regressions and () are t-statistics.

Table 3
Determinants of Incentive Pay

In Panels A & B, column (3) refers to groups comprised solely of owner physicians. Estimates in column (4) are for groups having full-time managers.

In Panels A and B, estimates in column (5) are for groups comprised only of internists, pediatricians and/or general practitioners.

In Panels A and B, estimates in column (6) are for groups having no productivity guidelines.

The models in panels A and B also include variables describing characteristics of the group practice, and its clientele. Group practice variables included in the regressions measure: the percent of revenues from HMOs, the percent of revenues from outside specialty referrals, the percent of the group that is board certified, whether the group is multi- or single specialty, the specialty composition of the group (percent physicians in internal medicine, general practice, specialty surgeon, OB/GYN, and pediatrics). Patient variables include: the percent of clientele who are white; the income distribution of clients, and the percent who are covered by Medicare and Medicaid. The coefficients (and descriptive statistics) for these variables are available from the authors upon request or on the World Wide Web at http://equilibrium.heinz.cmu.edu/mgaynor/papers/norms_abstract.htm.

Table 4
Work Intensity and Incentive Pay^a

Independent Variables	(1) <i>Log Office Visits^b</i>	(2) <i>Log Office Visits^c</i>	(3) <i>Log Office Hours^b</i>	(4) <i>Log Office Hours^c</i>	(5) <i>Log Office Visits^b</i>	(6) <i>Log Office Visits^c</i>	(7) <i>Log Office Hours^b</i>	(8) <i>Log Office Hours^c</i>
<i>Equal Sharing</i>	-0.0026 (-0.0395)	-0.1637 (-2.7654)	0.0200 (0.4238)	-0.0162 (-0.3150)				
<i>Incentive Pay II</i>					0.0005 (0.4450)	0.0015 (2.0568)	-0.0007 (-0.8751)	0.0002 (0.2765)
<i>Inverse Group Size</i>		0.2483		0.3750		0.1496		0.3660
Constant	. yes	(0.2947) yes	. yes	(0.5757) yes		(0.1757) yes		(0.5669) yes
Number of Groups	204	285	204	289	204	285	204	289
R ²	0.3189	0.35826	0.31834	0.32936	0.3197	0.2789	0.2419	0.1547

^a Numbers in parentheses are t-statistics calculated using White's formula for heteroskedasticity consistent standard errors.

^b Estimated for groups in the smallest size category.

^c Estimated for groups not in the smallest size category.

These models also include variables describing characteristics of the group practice and its clientele. The coefficients

(and descriptive statistics) for these variables are available from the authors upon request or on the Web at http://equilibrium.heinz.cmu.edu/mgaynor/papers/norms_abstract.htm.

Table 5
Incentives and Mutual Help

Dependant Variable	(1) Intra-Group Consults	(2) Intra-Group Consults
Independent Variable		
<i>Incentive Pay II</i>	-0.0025 -(2.0158)	
<i>Equal Sharing</i>		0.2244 (2.3013)
<i>Inverse Group Size</i>	-1.9002 -(2.2802)	-2.1081 -(2.5441)
Constant	yes	yes
Number of Groups	413	413
R ²	0.076	0.0744

All estimates are OLS. Numbers in parenthesis are t-statistics calculated with heteroskedasticity consistent standard errors. In columns (1) and (2) we can reject the hypothesis that all coefficients are jointly significant 2% and 1% confidence levels respectively.

Physicians were asked how frequently they consulted with other doctors in the group about their patients: 3x/day; 2x/day; 1x/day, 2-3x/week; 1x/week; 1x/month <1x/month. The dependent variable is the average response for the group expressed as consults per day. The 25th, 50th and 75th percentile of this variable are 0.840, 1.428, and 2.166 respectively.

These models also include variables describing characteristics of the group practice, and its clientele. The coefficients

(and descriptive statistics) for these variables are available from the authors upon request or at http://equilibrium.heinz.cmu.edu/mgaynor/papers/norms_abstract.htm.