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Metrix committed a violation of § 2(c), the court found that MBNA had standing to sue, i.e., that Metrix's incentive program caused MBNA to suffer actual injury of a type that § 2(c) was designed to prevent. 828 F.2d at 1046. See, Brunswick, supra, note 31.

Section 4 of the Clayton Act provides: "[A]ny person who shall be injured in his business or property by reason of anything forbidden in the antitrust laws may sue therefor... and shall recover threefold the damages by him sustained...." 15 U.S.C. § 15(a). Even if a defendant has committed a violation of the antitrust laws (i.e., antitrust injury), it does not necessarily follow that a plaintiff has antitrust standing. To recover treble damages... a plaintiff must make some showing of actual injury attributable to something the antitrust laws were designed to prevent. Brunswick v. Pueblo Bowl-O-Mat, Inc., 429 U.S. 477 (1977). The United States Supreme Court has enumerated several factors it will consider on a case-by-case basis to determine whether a plaintiff has antitrust standing: the nature of the plaintiff's alleged injury (i.e., does it fall squarely within the area of injury [the competitive market] or is it tenuous and speculative?), the directness or indirectness of the alleged injury, the potential for duplicative recovery or complex apportionment of damages, and the existence of more direct victims. Assoc. Gen. Contractors v. Cal. v. Cal. St. Council, 459 U.S. 519 (1983). See also, Sharp v. United Airlines, Inc., 967 F.2d 404 (10th Cir. 1992). (Employee of Frontier Airlines lacked standing to sue United Airlines, even if United engaged in violations of the antitrust laws causing Frontier to fail.)

BARGAINING WITH STAKEHOLDERS:
CORPORATE CODES OF CONDUCT AND SHAREHOLDER WEALTH

by
Julianne Nelson*

Corporate codes of conduct or ethics have become increasingly popular in recent years. Of the 264 companies responding to a recent Conference Board survey, more than 75% had some form of ethics code; almost half of the firms with codes in place had adopted them since 1997. Nor is the adoption of codes merely a recent phenomenon; a 1980 study by White and Montgomery found that almost 100% of the largest US corporations had codes in place.

When, if ever, would a self-interested shareholder support a corporate code of conduct? Do such codes ever increase shareholder wealth? If one relies on instincts honed by the study of competitive markets, one is likely to assume that benefits for customers, suppliers, employees and the local community necessarily come at the expense of corporate shareholders. The very structure of the much-publicized Johnson and Johnson (J&J) Credo (reprinted in the Appendix) appears to support this hypothesis. When detailing corporate responsibilities, the Credo mentions the interests of corporate shareholders last, only after it enumerates the duties owed to a variety of other stakeholders. In effect, the J&J Credo seems to implement a plural purpose view of the firm that asks managers to serve a number of constituencies. It remains to be seen whether or not this approach could also benefit a strictly self-interested shareholder.

Recent results from applied bargaining theory suggest that the J&J Credo may actually increase shareholder wealth in some circumstances. Institutional theorists have recently turned to "cooperative" solution concepts to determine the efficiency implications of different corporate ownership structures. In general, research in this area starts from the assumption that

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the output of a particular firm is the result of joint effort and that at least some individual contributions to this output cannot be observed or measured accurately. Since "complete contracting" on the basis of individual effort is impossible in this context, it becomes necessary to specify an alternative rule for allocating corporate profits among the relevant claimants.

In general, the rules proposed depend on both the surplus generated by the group as a whole and the alternatives available to subgroups (or "coalitions") would they choose to opt out of the bargain. The available alternatives (or default options) are in turn defined by the property rights of the coalition members. For example, Hart and Moore (1990) use the surplus sharing rule proposed by Lloyd Shapley (1953) to study the impact of decentralized asset ownership on the investment efforts of corporate claimants. In a related work, Holmstrom and Tirole (1991) use the Nash bargaining solution to characterize the impact of allowing subsidiaries to "defect" by refusing to trade with their parent company.

In this paper, I adapt the model developed by Hart and Moore (1990) to illustrate the incentive effects of the ownership structure implied by the J&J Credo. I assume the social value of a firm's activities depends on the effort (or investment) undertaken by both shareholders and (non-equity-owning) stakeholders. In other words, I assume that both shareholders and stakeholders may take costly (and noncontractible) actions to increase the value of output produced by the firm. The benefits and the costs of this noncontractible effort depend on the share of corporate assets initially allocated to each player.

This scenario arises whenever the firm's cost of manufacturing depends on employee care, on employees' firm-specific expertise or on the range of amenities provided by the local community. It also arises when company profits depend on the firm's reputation or on the care and precautions taken by consumers. Each of these examples can be characterized as a duopoly in which each player's investment incentive depends both on his or her anticipated share of the firm's surplus and on the action taken by the other player.

Read literally, the J&J Credo strengthens the bargaining position of corporate stakeholders by enhancing their default options. If treated as a contract, the Credo would essentially give workers, suppliers, customers, the local community, etc. grounds for suit if J&J fails to treat these stakeholders fairly. To formalize this commitment by J&J, I characterize the Credo as a transfer of some corporate assets from shareholders to stakeholders.

For the purposes of exposition, I limit discussion to workers as representative (non-equity owning) stakeholders, and assume that the asset to be allocated between shareholders and workers is worker health. For example, J&J shareholders would have - in the absence of the Credo - an ownership claim to both the tangible assets of the firm and the health of its employees. Without the Credo, J&J would be limited only by imperfect OSHA supervision and workers' compensation. If it chose to overlook workplace hazards, the Credo promises workers better health on-the-job conditions, it reduces the precautions that workers must take on their own to protect their physical (and emotional) health.

In this paper, I show that such an asset transfer may increase both the total surplus generated by the firm and the wealth of shareholders. As the asset transfer strengthens the bargaining position of workers vis à vis shareholders, it strengthens the incentive (and lowers the cost) for employees to exert themselves on behalf of the firm. Shareholders have the incentive to transfer assets if the gains from increased worker effort more than offset the cost of the enhanced worker-bargaining position combined with the cost of the transfer itself.

1. Notation

The first task is to define the surplus generated by the different player combinations for a given allocation of corporate assets. I assume that there are two "players": player 1 is the representative shareholder/manager (the "owner") and player 2 is the representative worker/stakeholder (the "worker"). I assume that production requires a combination of two existing assets (a, a) and player effort (x, x). For consistency of notation, let x represent the level of managerial effort chosen by player 1 and let x represent the level of worker effort chosen by player 2.

The existing assets to be allocated are the firm's physical plant and worker health. I assume throughout that while shareholders own all of the firm's physical plant, workers may only own a fraction of their health. More formally, let a represent the existing physical plant and let a represent worker health. I assume that player 1 owns all of asset a, while player 2 owns only a fraction a of asset a, or asset a. The remaining fraction (1-a) of asset a is owned by player 1.

To illustrate the structure of the bargaining problem that arises between owners and workers, I use the following general notation to indicate the value of output (or joint surplus) produced by different player coalitions:
output of owner and worker together: \( v(x_1, x_2 | a_i, a_j) \)

Output produced by owner alone: \( v(x_1 | a_i, (1-\delta) a_j) \)

Output produced by worker alone: \( v(x_2 | a_2) \)

Output of the "empty" coalition: \( v(0) = 0 \)

From this notation it follows that the value of output for a particular coalition depends on both the assets owned \( (a_i) \) by coalition members and the levels of effort \( (x_1) \) that members undertake.

I assume that the structure of asset ownership also affects the cost of effort for individual players. In particular,

Cost of owner effort: \( c_i(x_1 | a_i, (1-\delta) a_j) \)

Cost of worker effort: \( c_j(x_1 | a_2) \)

This notation indicates that an individual player's cost of effort depends on the assets he or she owns, but not on the level of effort undertaken by the other members of the coalition. These cost functions also reflect the assumption that the representative worker owns a share \( \delta \) of asset \( a_i \) and has no ownership claim on asset \( a_j \).

2. The Bargaining Problem

Given the production and cost functions specified in Section 1, it remains to define and solve the bargaining problem that arises between owners and workers for a given allocation of existing assets. To divide up the results of joint production, I rely on the "cooperative" approach proposed in Shapley (1953). This solution concept gives to each player a share of output equal to the player's average incremental contribution to the coalitions of which it might be a member.

There are a variety of reasons to use a "Shapley value" mechanism to allocate the rewards of joint effort. It is well-known that such a mechanism implements the "Nash bargaining solution" for two-person games. In other words, output allocated on the basis of Shapley values would maximize the product of gains realized by individual players relative to their respective default utilities. More formally, a Shapley value mechanism would solve the allocation problem

\[
\max \{ \delta v(x_1, x_2) - v(x_i) \} \quad (1-\delta) v(x_1, x_2) - v(x_i) \]

proposed by Nash (1950).4

Starting from a slightly different notion of justice, Young (1988, p. 271) demonstrates that the Shapley value is the only sharing rule that (1) fully distributes output; (2) treats identical players equally; and (3) determines individual shares strictly on the basis of individual contributions to output. Hart and Moore (1990, p. 1129) observe that the Shapley value mechanism gives each player his or her "expected contribution to a coalition, where the expectation is taken over all coalitions to which [the player] might belong."10 Any of these cooperative bargaining approaches provide the basis for an argument that market participants would agree in advance to use a Shapley value mechanism as the means of allocating output in the future.11

To define the Shapley values for the bargaining game between a representative owner and a representative worker, I first observe that each of these two players is potentially a member of two coalitions: a coalition "of the whole" and a coalition consisting of the player alone. If each player bears his or her full cost of effort, then the net benefit to each player when output is allocated using Shapley's method is given by

\[
W_i = .5[v(x_1, x_2 | a_i, a_j) - v(x_i | a_2)] \\
+ .5[v(x_1 | a_i, (1-\delta) a_j) - v(0)] - c_i(x_1 | a_i, (1-\delta) a_j) \quad (2.1)
\]

\[
W_j = .5[v(x_1, x_2 | a_i, a_j) - v(x_i | a_2)] \\
+ .5[v(x_1 | a_2) - v(0)] - c_j(x_1 | a_2) \quad (2.2)
\]

The first bracketed term in each of these equations represents the contribution the player makes to the coalition of the whole; the difference between the value of output with both players and the value of output with only one player indicates the "value added" by the second player. The second bracketed term in each of these equations represents the contribution of (or value added by) each player to the empty coalition, \( v(0) \).

Using the payoffs specified in equations (2.1) and (2.2), we can now define the equilibrium for the bargaining problem at issue. Assume that both the representative owner and the representative worker choose their effort levels \( x_1 \) and \( x_2 \) to maximize their respective payoffs. If each player takes the choice made by the other as given, then the first order conditions

\[
\frac{\partial W_i}{\partial x_1} = .5v_1(x_1*, x_2* | a_j, a_i) + .5v_1(x_1* | a_i, (1-\delta) a_j) - c_i(x_1* | a_i, (1-\delta) a_j) = 0 \quad (2.3)
\]
\[ \frac{\partial x_i}{\partial x_j} = 0.5v(x_i, x_j | a_i, a_j) + 0.5v(x_j | a_j) - c_i(x_j | a_j) = 0 \]  

(2.4)

jointly determine the equilibrium effort choices, \( x_i \) and \( x_j \). Given these effort choices, the equilibrium payoffs (i.e., net benefits) for the representative owner and the representative worker are found by substituting \( x_i \) and \( x_j \) into the objective functions given in (2.1) and (2.2).

3. The Asset Allocation Problem

The previous section defined equilibrium for a given allocation of the assets \( a_i \) and \( a_j \). It now remains to see if the representative owner has the incentive to adopt a code of corporate conduct that would effectively transfer some (or all) of \( a_i \) to the representative worker. (This transfer is formally characterized as an increase in the parameter \( a_i \).)

To determine the effect of adopting a code, it is first necessary to indicate the specific impact of asset ownership on the productivity and cost of player effort. Increasing \( a_i \) (and thereby increasing a worker’s ownership claim on his or her health) would potentially have several effects. It could strengthen the bargaining position of workers by increasing the default utility \( v(x_i | a_i) \) for each level of effort \( x_i \). The asset transfer could also lower worker effort costs by decreasing \( c_i(x_i | a_i) \) and/or raise owner effort costs by increasing \( c_i(x_i | a_i, (1-\alpha)a_j) \). In summary, I characterize a code of conduct as a commitment to an improvement in workplace conditions. This transfer of corporate assets to workers gives workers a greater ownership claim on their own health. It potentially increases the productivity and lowers the cost of worker effort while it raises the cost of owner effort.

To evaluate the impact of such transfers on equilibrium effort choices and on the net benefits realized, I examine a specific production technology and set of cost functions. Let the value of output produced by the set of possible coalitions be given by

- **Owner and worker together:**
  \[ v(x_i, x_j | a_i, a_j) = [(a_j x_j)^* + (a_i x_i)^*]^{1/2} \]

- **Owner alone:**
  \[ v(x_i | a_i, (1-\alpha) a_j) = a_i x_i \]

- **Worker alone:**
  \[ v(x_j | a_j) = a_j x_j \]

This specification reflects the assumptions that player 2 is indispensable to asset \( a_j \); player 1’s ownership share of asset \( a_j \) has no impact on output unless player 2 is also a member of the coalition. In other words, the owner’s claim on worker health \([(1-\alpha)a_i]\) is meaningless unless the worker is involved in production. Restricting the parameter \( \rho \) so that \( 1 > \rho > 0 \) ensures that (1) worker effort is an imperfect substitute for owner effort (and vice versa); and that (2) owners and workers produce more when working together than when working separately.

Let the cost of effort for the representative owner and the representative worker be given by

\[ c_i(x_i | a_i, (1-\alpha) a_j) = c_i x_i^2 / (1+\delta a_i) \]

and

\[ c_i(x_j | a_j) = c_i x_j^2 / (1+\lambda a_j) \]

respectively. This specification reflects the assumption that asset ownership may influence the cost of effort for either or both players. The extent of the effect depends on the parameters \( \delta, \epsilon, \) and \( \lambda \): the larger any of these parameters, the larger the cost-reducing impact of asset ownership.

4. The Owner’s Incentives to Adopt a Code of Conduct

We can now determine when, if ever, a code of conduct can increase shareholder wealth. As mentioned above, I characterize the adoption of a code as an increase in \( \alpha \), i.e., a (partial or complete) transfer of asset \( a_j \) from owners to workers. Given the technology specified in Section 3, the increase in \( \alpha \) has three direct effects on effort choices: as it (1) increases the representative worker’s marginal benefit of effort and (2) lowers the worker’s marginal cost of effort, it also (3) raises the representative shareholder’s marginal cost of effort. It follows that, for a wide range of parameter values, an increase in \( \alpha \) implies more worker effort and less owner effort in equilibrium. The net impact of adopting a code of conduct therefore depends on the balance between these effort effects.

Figures 1 and 2 illustrate the equilibrium effort choices and net benefits for the following parameter values:

\[ v(x_i, x_j | a_i, a_j) = [(20x_i)^5 + (20x_j)^3]^{1/2} \]

\[ v(x_i | a_i, (1-\alpha) a_j) = 20x_i \]

\[ v(x_j | a_j) = a_j x_j \]

\[ c_i(x_i | a_i, (1-\alpha) a_j) = 20x_i^2 / (1+20+(1-\alpha) 160) \]

\[ c_i(x_j | a_j) = 20x_j^2 / (1+\alpha 160) \].
For this specification of the bargaining problem, we see that the owner does have some incentive to adopt a code of conduct: the owner's net benefit is at a maximum when \( q = .36 \). In other words, if owners had title to 100 percent of \( a \), then they could raise the value of their stock (i.e., the market value of their claim on firm profits) by transferring 14 percent of \( a \) to workers.

The bad news is that what is best for owners is not necessarily best for the more complete set of corporate stakeholders. From Figure 2, it follows that \( q = .36 \) maximizes the sum of owner and worker net benefits. In other words, owners have some incentive to improve workplace conditions, but not to the extent that "total surplus" is at a maximum.

5. The Role of Economic Analysis

This stylized view of corporate codes of conduct provides an opportunity to review an ongoing debate in the "law and economics" field: the relationship between the efficiency of the assignment of property rights and the efficiency of equilibrium. Figure 2 indicates that some ownership structures for the asset \( a \) are more efficient (i.e., generate a higher surplus) than others. This observation leaves open the question of whether or not there is a need to mandate a particular ownership structure.

The "first theorem" of welfare economics tells us that Pareto efficiency is the result of voluntary exchange in a competitive market. Coase (1959, 1960, 1988) examines a particular instance of this result: the case in which there is a unique efficient allocation. In reviewing the importance of liability rules for competitive market outcomes, Coase concludes that "in a regime with zero transaction costs, the allocation of resources remains the same whatever the legal formulation of transaction costs.

It is generally agreed that this efficiency result breaks down if exchange is costly. Nevertheless, disputes abound when it comes to defining the appropriate policy responses to these costs. The formal structure of the model presented in this essay provides a framework that enables us to identify at least some of the reasons for these disputes.

First, it is clear that the model proposed in this essay satisfies a "necessary condition" for the presence of transaction costs: the initial assignment of rights does not satisfy the "optimal" code of conduct. Figure 2 illustrates how the initial allocation of assets affects the equilibrium level of surplus in the economy.

The next step is to discover why the assignment of rights matters. Is the reason plausibly described as a "transaction cost"? It is clear that the allocation of rights in the model affects both effort costs and output shares for market participants. It therefore influences the equilibrium level of production. However, the source of the transaction costs is not immediately obvious since the code of conduct (i.e., the transfer of \( a \)) is assumed to be costlessly enforceable.

The transaction costs in the model can be traced to the assumption that owner and worker effort levels are "non-observable." In other words, neither owners nor workers can write binding "forcing" contracts to ensure optimal levels of effort. There are a variety of possible justifications for such an assumption: effort levels may not be directly observable or the courts may have found contracts contingent on effort to be "against public policy." In any event, the non-observability assumption forces market participants to resort to sharing rules such as the Shapley value mechanism.

Given the impossibility of achieving a first-best optimum with forcing contracts, we must then ask whether or not voluntary exchange will at least support a second-best optimum. In other words, will initial trade in the asset \( a \) ensure that the surplus-maximizing level of \( q = .36 \) in Figure 2 prevails in equilibrium? Economists are conditioned to respond to this question with an affirmative almost as a matter of faith. In fact, the appropriateness of this response depends on the extent of transactions costs at the very earliest stage of the bargaining process.

In their description of a model that served as an inspiration for the one presented in this paper, Hart and Moore (1990, p. 1131) write:

"We shall take the point of view that efficient trading at date 0 leads to a control structure \( \alpha \) that maximizes \( W(x^*(\alpha)) \). That is, if the initial \( \alpha \) does not maximize \( W(x^*(\alpha)) \), someone will propose a new \( \alpha \) and a set of side payments such that everyone is better off..."

In the model I propose, the equilibrium level of total surplus depends on the scope for trade in \( a \). Figure 2 and the analysis in Section 4 indicate that owners do have some incentive to make unilateral transfers to workers for a wide range of parameter values. However, the value of \( \alpha \) that maximizes shareholder wealth (\( q \) in Figure 2) generally fails to maximize total surplus. It is therefore not likely that owners would in general adopt the "optimal" code of ethics unilaterally.

Would workers have the incentive to purchase a greater stake in \( a \) and thereby make it possible for society as a whole to...
realize a second best optimum? In other words, can we rely on workers (along with other stakeholder groups) to bargain for the optimal code of ethics? Such a transaction would resurrect a "Coase-like" invariance result at this earlier stage in the contracting process: if there were a competitive market in $a$, then there would be no efficiency justification for regulating the contracting process. There would be no reason to require minimum workplace health and safety standards, to adopt environmental protection laws, or to set minimum product safety standards.

Economic analysis cannot provide a definitive answer to these policy questions; it merely enables us to examine the consequences of difference sets of assumptions. All policy applications of economic models start with a strong set of assumptions. The "transferrable utility" model presented in this paper requires that rights (however assigned) be costlessly enforceable and that $\bar{a}$ be worth the same to workers as to managers. If we further assume that there is a competitive market in assets like worker health and environmental quality, then equilibrium will be (second-best) efficient; the initial allocation of assets will simply determine the final distribution of wealth. If, on the other hand, we assume that there are unavoidable transaction costs at this earlier bargaining stage, then the initial allocation of assets affects both the level of total surplus and its distribution.

6. Concluding Observations

Do we wish to use this type of economic analysis as a guide to the initial allocation of rights? Economic analysis itself cannot resolve this issue. We must ultimately return to extra-market notions of justice, fairness and probably just plain common sense.

The discussion in Section 5 provides an outline for this expanded view of policy analysis. The first task is to identify the transaction costs at each stage in the bargaining process. If there are no transaction costs, we are left to determine the fairness of the equilibrium distribution of wealth given the initial allocation of rights. If the transaction costs (like the non-contractibility of effort) render (competitive) bargaining impossible at some stage, we are faced with a more difficult task, that of choosing the appropriate trade-off between equity and efficiency.
Appendix: The Johnson & Johnson Credo

We believe our first responsibility is to the doctors, nurses and patients, to mothers and all others who use our products and services. In meeting their needs everything we do must be of high quality. We must constantly strive to reduce our costs in order to maintain reasonable prices. Customers' orders must be serviced promptly and accurately. Our suppliers and distributors must have an opportunity to make a fair profit.

We are responsible to our employees, the men and women who work with us throughout the world. Everyone must be considered as an individual. We must respect their dignity and recognize their merit. They must have a sense of security in their jobs. Compensation must be fair and adequate, and working conditions clean, orderly and safe. Employees must feel free to make suggestions and complaints. There must be equal opportunity for employment, development and advancement for those qualified. We must provide competent management, and their actions must be just and ethical.

We are responsible to the communities in which we live and work, and to the world community as well. We must be good citizens - support good works and charities and bear our fair share of taxes. We must encourage civic improvements and better health and education. We must maintain in good order the property we are privileged to use, protecting the environment and natural resources.

Our final responsibility is to our stockholders. Business must make a sound profit. We must experiment with new ideas. Research must be carried on, innovative programs developed and mistakes paid for.
New equipment must be purchased, new facilities provided and new products launched. Reserves must be created to provide for adverse times. When we operate according to these principles, the stockholders should realize a fair return.

Endnotes:
3. DeGeorge (1990, p. 163) defines stakeholders to be all constituencies to which the firm "has any moral obligations". Freeman's (1984, p. 46) definition includes "any group or individual who can affect or is affected by the achievement of the organization's objectives." For convenience of exposition I adopt a somewhat narrower definition: In this paper, I use the term "stakeholder" to indicate the set of all (potential) corporate claimants except equity owners. This group typically includes employees, suppliers, customers, clients, and the surrounding community.
4. This treatment of effort costs and asset ownership differs from that found in Hart and Moore (1990). I allow for "partial" asset ownership rather than assuming that assets are indivisible lumps that must be allocated in full to a single player. I also allow asset ownership to influence the marginal cost of effort as well as its marginal product.
5. By "ownership" here I mean the right to use an asset without having to purchase it; the right to obtain full compensation if the asset is damaged; and the right to withhold access to the asset.
6. This assumption reflects a more general definition of ownership than the one found in Hart and Moore (1990). Allowing fractional values for a enables me to treat worker health as a diverse asset. "Fractional ownership" makes it possible to consider a variety of compensation levels for worker illness or injury.
7. Note that since the functions
   \[ v(x_i|\ldots) = c_i(x_i|\ldots) \] and
   \[ v(x_i|.) = c_i(x_i|.) \]
   indicate the opportunities available to individual players when acting alone, these functions define the "default" or "reservation" utilities at given levels of effort for owners and workers respectively.
9. This is a game with "transferrable" utility: monetary transfers have the same value to both players. The parameter \( \delta \) serves to allocate joint output between the two players. The first bracketed term represents the difference between the output share received by player 1 and that player's default utility. The second bracketed term represents the corresponding difference for player 2.
10. Rothblum (1998) provides three specifications of the Shapley mechanism in which 'a player gets 'the average relative payoff to coalitions that contain him'.

11. For transferrable utility games with two players, the Shapley value allocation also coincides with the cooperative bargaining solution proposed by David Gauthier. See Gauthier (1986) and (1985) for a discussion of the ethical underpinnings of his approach to individual rights in social contracts. The Shapley value mechanism also generalized to allow for differences in bargaining ability and/or broader definitions of egalitarian allocations. See Kalai and Samet (1985, 1988).

12. Recent authors have also argued that the Shapley value mechanism can be interpreted in a more "strategic" context as a noncooperative bargaining solution. Hart and Moore (1990, pp. 1129-30, footnote 11) observe that the Shapley value can be interpreted as the subgame perfect equilibrium for a multistage game involving a sequence of take-it-or-leave-it contracts. Gul (1989) provides an alternative interpretation for the Shapley value as a subgame perfect equilibrium.

13. More formally, these first order conditions are necessary and sufficient for an equilibrium if both objective functions (w_i) are differentiable and strictly concave and, therefore, have a maximum. Sufficient for concavity is that additional effort increases output at a decreasing rate and increases cost at an increasing rate: \( v_i(x_i, x_j) > 0, v_i'(x_i, x_j) > 0, v_j(x_i, x_j) > 0, v_j'(x_i, x_j) > 0, c_i''(x_i) > 0, c_i'''(x_i) > 0, c_j''(x_j) > 0, c_j'''(x_j) > 0, \) and \( c_i''(x_i) > 0. \) The equilibrium defined by (2.3) and (2.4) is stable if \( v_i(x_i, x_j) \) is sufficiently small. This last condition ensures that a change in effort choice by a given player has a greater impact on its own objective function than on the objective function of the other participants in the game.

14. This terminology is due to Hart and Moore (1988).

15. To see the benefit of joint effort with this specification, let \( a_i = a_j = 1; \alpha = 1 \) and \( \rho = 5. \) It follows that \( v(x_i, x_j) = x_i + x_j + 2(x_k x_l)^2 \). This result clearly indicates that the allocation of assets that exist when bargaining begins, while \( w(x^*(a)) \) represents the sum of net benefits realized by market participants.

16. In particular, \( \rho = 5, a_i = a_j = 0, c_i = 20, \delta = 1 \) and \( e = \lambda = 8. \)

17. Coase (1988), p. 170. For an earlier version of the Coase theorem, see Coase (1959), p. 27: "The delimitation of rights is an essential prelude to market transactions...the ultimate result is independent of the legal decision."

18. Newberry (1989, pp. 215-16) provides an overview of the policies that are involved in pollution externalities that has involved Pigou, Coase, Balznl, Oates and others since the 1930s.

19. Since it is impossible to write and enforce this type of contract, the cost of the "transaction" is effectively infinite.

20. A forcing contract promises payment if and only if effort (or in some cases output) reaches a pre-specified level. See Miller (1992, Chapter 5) for a discussion of the uses and limitations of this device as a method of eliminating free riders.

21. A "first best" optimum is an equilibrium that is fully Pareto efficient: all gains from trade have been realized.

22. A "second-best" optimum is the best feasible equilibrium given the constraints imposed by technology and various transaction costs.

23. In the notation used in Hart and Moore (1990) is similar to that used in this paper: \( \alpha \) indicates the allocation of assets that exist when bargaining begins, while \( w(x^*(a)) \) represents the sum of net benefits realized by market participants.

24. This latter assumption ensures that there are no "wealth effects" that distort owner and/or worker willingness-to-pay.


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