

WHY IS PARTICIPATORY PRODUCTION NOT THE NORM?

A Prisoners' Dilemma in the Choice of Work Organisation*

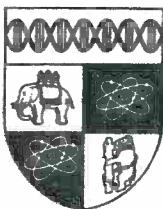
by

John Cable
(University of Warwick)

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ABSTRACT

Research suggests that there are potential mutual gains to be had from participatory production, yet traditional non-participatory organisation remains the norm in Western economies, and participatory 'alternatives' constitute a deviation. The paper argues that this apparent non-realisation of mutually beneficial outcomes by rational economic agents may be explained with the aid of a prisoners' dilemma game framework, which provides an insightful new way of looking at the participation issue. Two conceptually separate origins of potential participatory gains are distinguished, in 'efficient bargaining' effects and in technology shifts; and an important distinction between 'ultimate' and 'effective' technology is made. Public policy intervention to promote participation, it is argued, is not ipso facto a denial of mutual social gains, and may be necessary to secure them.

1. Introduction: A Conflict of Evidence and Outline of the Approach

After decades of neglect there has been a recent surge of interest in the economics of work organisation, and the firm as a economic institution, not least in the Journal of Economic Behaviour and Organisation, in response to Oliver Williamson's provocative paper in its inaugural issue (Williamson, 1980). There is, however, a paradox in the literature to date, which has yet to be resolved. Thus, on the one hand, research shows that workers prefer to have a say over issues and matters that affect them at work (e.g. IDE, 1981; Whelan, 1982), while in addition, recent empirical findings also suggest a balance of evidence indicating positive productivity gains from various forms of employee participation (e.g. Backus and Jones, 1977; Cable and FitzRoy, 1980; Defourney et al 1985; FitzRoy and Kraft, 1985; Jones, 1982; Jones and Svejnar, 1985; Svejnar, 1982). Hence it appears that mutual gains to both workers and capital-owners are to be had. Yet, on the other hand, participatory production remains the exception rather than the rule in most economies. For example, though producer cooperatives have shown a dramatic increase in numbers in recent years, they typically still account for only a small fraction of total economic activity (Estrin, 1985). Likewise though codetermination, informal participation 'schemes' and profit-sharing have become much more widespread than formerly, their effects have been neither extensive nor intensive enough to transform the social relations of production. So traditional organisation remains the norm, under which capital-owners and their agents, management, exercise control over production, and labour is regarded primarily as a resource input; and participatory 'alternatives' constitute a deviation.

To the more outspoken critics of industrial democracy in its various forms (especially Furubotn, 1976, 1985; Jensen and Meckling, 1979; Pejovich, 1978), this continued predominance of traditional work-organisation after more than two hundred years of industrialisation represents both a vindication of their position, and sufficient testimony to the absence of mutual gains. Thus, invoking a form of economic Darwinism, they argue that efficiency will out, and that natural selection has declared traditional organisation to be the winner. This is an unsatisfactory position, however, because it fails to explain the accumulating econometric evidence of productivity gains in the (albeit minority) cases where participation does occur. Radical economists and economic historians, on the other hand, argue that the system of production which comes to predominate depends not only on efficiency in a narrow, technological sense, but on power, and on who is in control of the system at critical points in history (Marglin, 1974). There is therefore no contradiction for them in the non-normality of 'alternative' production. While many economists would make some concessions to the radical line of argument, mainstream opinion has not been wholly won over; further explanation is needed.

Essentially the paradox lies in the apparent non-realisation of mutually beneficial outcomes by rational economic agents. The classic example of such situations in received theory is, of course, the prisoners' dilemma. If determining the form of work organisation can be shown to have the essential characteristics of a prisoners' dilemma game, this would effect a reconciliation of the paradoxical 'facts' which we observe.

This paper argues that the choice of work organisation can indeed plausibly be viewed as a PD game. The 'two sides of industry' - employers, and workers - are viewed as having two broad strategic options: to cooperate in joint control over the work process with a view to joint welfare maximisation, or to strive for sole control.⁽¹⁾ A game-theoretic approach may be applied in this case because exit is costly for both workers and employers, and because neither has complete control of all decisions variables; outcomes are thus uncertain and dependent on the interaction of strategic choices, in situations where both sides are locked in over a range of alternative payoffs. Exit is costly in part because of non-trivial search costs of re-employment, but more importantly because of capital equipment, labour skills and organisational know-how which are more or less specific to the firm due to quasi-permanent association with it. This specificity of factors makes the productive potential of the firm, as an entity, greater than would be possible through 'mere casual combination of marketed factors' (Aoki, 1980). Hence, factor specificity creates organisational quasi-rent which is available for distribution among the firm's members. Any who quit forego their claim, but also reduce the total available to those who stay. It is this which gives the members both an incentive to stay and their bargaining power within the firm.

Table 1 illustrates the hypothesized payoff structure which the paper seeks to justify. If either side is successful in imposing control, (E1, W2 or E2, W1) a high total payoff is generated, which is distributed asymmetrically in favour of the successful player. When both players simultaneously seek control (E2, W2), however, mutually frustrating tactics and conflict reduce the total payoff; this is the Nash equilibrium where each side attempts to maximise individual

welfare. Ex hypothesi, the participatory outcome (E1, W1), where the players collude to maximise joint welfare, is Pareto superior to the non-cooperative Nash equilibrium, and this makes the game a prisoners' dilemma. Thus participation, both within conventionally owned firms and under producer cooperatives (PCs), is seen as a possible solution to a latent or manifest prisoners' dilemma - a device by which, as Leibenstein (1982) has argued in the case of effort conventions, "individuals can turn choices based on individual rationality into choices based on group rationality".

When participation is looked at in this light, the increase in total payoff under participation is seen to have two possible, conceptually separate origins. Firstly, participation may operate as an efficient bargaining institution, enabling the bargaining frontier to be reached for a given technology. Secondly, however, participation may produce an outward shift in the bargaining frontier, due to a change in the underlying, technological opportunity set, as production methods previously precluded by considerations of strategic control become available under participation.

Table 1: Payoff Matrix

WORKERS	EMPLOYERS	
	E1 (Co-operate)	E2 (Control)
W1 (Co-operate)	6,6 Participation	4,7 Autocratic Management
W2 (Control)	7,4 Dominant Workers	5,5 Conflict

The argument builds on a number of previous analyses, in particular by Aoki (1980, 1984), Ben-Ner and Estrin (1985), Leibenstein (1982), McCain (1980, 1982) and MacDonald-Solow (1981). Aside from its main objective of demonstrating a PD game structure for the case in hand, the analysis incidentally provides a new way looking at not only the participation issue, but also the more general power vs efficiency controversy. In particular, it draws attention to the interdependence of power and of efficiency, suggesting an important distinction between power-unrelated 'ultimate' technology, and power-constrained 'effective' technology. On the policy front, the paper shows that public intervention to promote participation may be needed and justified, whereas the fact that e.g. codetermination has typically been introduced not voluntarily, but by law, has previously been considered by its opponents as yet further evidence of the non-existence of mutual gains.

2. Participation as Efficient Bargaining

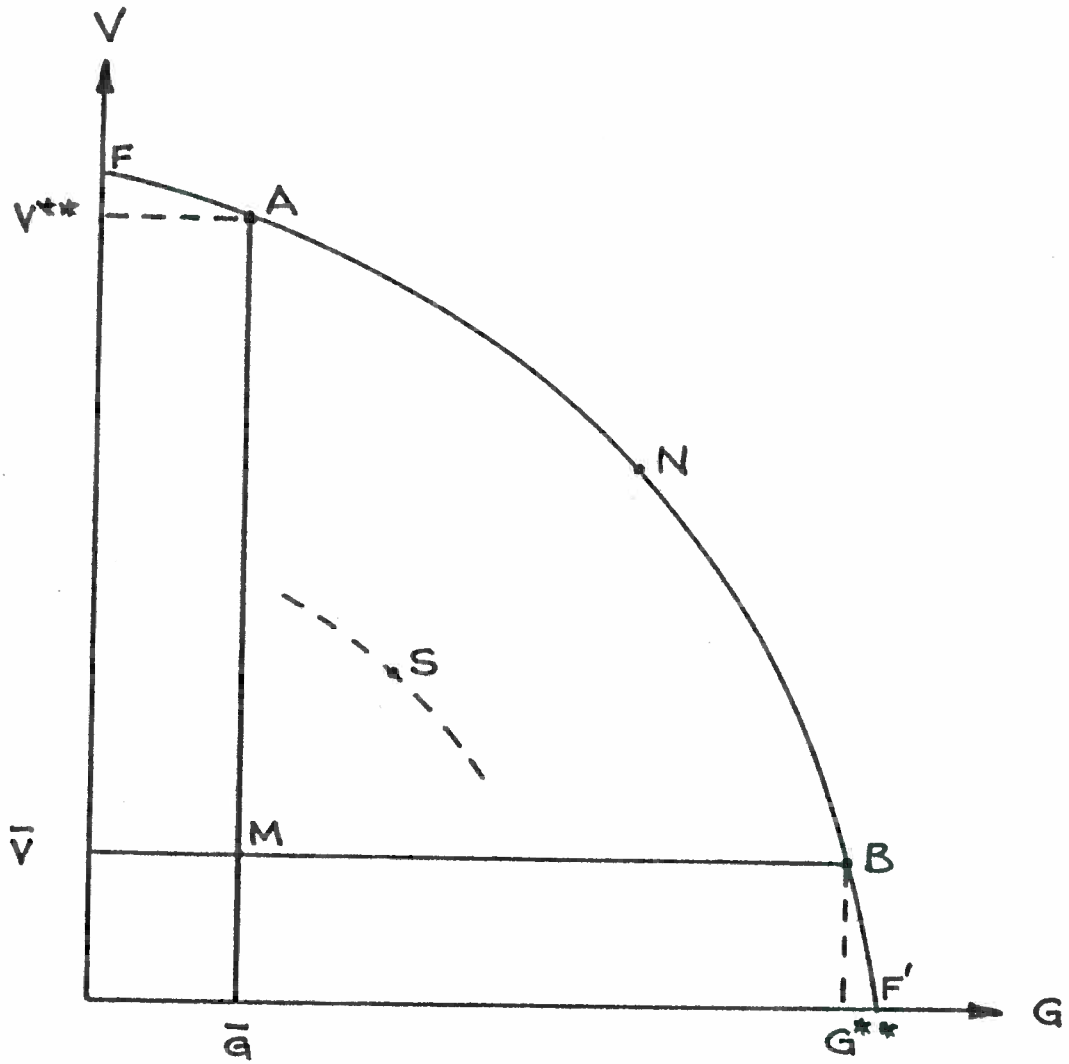
Consider a simple model where workers' utility (G) depends on employment (L) as well as earnings (w): $G = G(w, L)$. Similarly, employers' interests in dividends and capital gains, etc., (V) are proxied by profits: $V = V(\pi)$. The firm's production activity is governed by an orthodox, concave production function $Q = Q(K, L)$, where Q is physical output and K is the per-period flow of capital services. Given the firm's demand constraints,⁽²⁾ the underlying objective production function determines all feasible utility vectors, which map through the utility functions $G(\cdot)$, $V(\cdot)$ into a set of

utility pairs G, V bounded by the Nash-Zeuthen-Harsanyi efficient bargaining frontier FF' in figure 1.(3)

In a strictly orthodox, pure market model the only outcome would be at point M . Here workers' and employers' utility levels (\bar{G}, \bar{V}) are set at exogenously given, market-alternative levels in the case of w and π , L is then endogenous, and each side is indifferent between working in the firm and elsewhere. Hence all $G, V \leq (\bar{G}, \bar{V})$ are non-viable as one side exits. At the same time all $G, V \geq (\bar{G}, \bar{V})$ are eliminated via competition in capital, labour, and corporate control markets, with entry and exit occurring in response to excess rewards (here calibrated in terms of G and V). Thus the bargaining set, bounded by FF' and containing all technically feasible $(G, V) \geq (\bar{G}, \bar{V})$, is empty.

Previous writers have, however, offered persuasive arguments for the existence of non-empty intrafirm bargaining sets, notably Aoki (1980, 1984). Essentially a form of organisational rent is invoked, and the arguments primarily concern market frictions and the specificity of human and capital assets. As a result, in Aoki's words: "The employees, in cooperation with assets supplied by the stockholders, can produce economic gains which would not be possible through a mere casual combination of marketed factors of production" (i.e. at point M in our framework), and, "through the acquisition of firm-specific skills and knowledge, the employees may be able to exert implicit or explicit bargaining power over the disposition of the organisational rent" (1980, p600).

Figure 1



Given the existence of the bargaining set and its associated frontier FF' , we can consider alternative reference outcomes in figure 1. As we have seen M may be interpreted as a market outcome, and the most that a 'mere casual combination of marketed resources' can yield. In Nash-bargaining terms M is also the mutual threat point, below which employers and workers will exit. Points A and B , with utility pairs (V^{**}, \bar{G}) and (\bar{V}, G^{**}) are respectively dominant-employer and dominant-worker outcomes, where one side has 100 per cent bargaining power and the other zero. These are analogous to Stackelberg leader-follower duopoly outcomes, where one player maximises own-utility subject to a low level opponent's reaction function, viz, in this case $\max (\pi | \bar{w} L)$ in the case of Point A , and $\max (w, L | \pi)$ in the case of B . These are however limiting cases which, like their Stackelberg counterparts are not full but conditional equilibria and, as discussed in section 4, are likely to be observed only in extreme circumstances. Intermediate points such as N , on the other hand, are efficient bargaining outcomes, determined according to a model of the bargaining process. In the most familiar, generalised Nash-bargaining case, N is obtained by maximising the weighted product of the differences between the players utility levels and threat points: $\max [G - \bar{G}]^{\delta} \cdot [V - V]_{\mu}$ where the parameters δ, μ denote relative bargaining strengths.

No combination of points on the frontier FF' will satisfy the PD structure of table 1. However, if the conflict outcome $(E2, W2)$ can be associated with an interior point such as S , and participation $(E1, W1)$ with an efficient bargaining outcome (N) then, with suitably calibrated axes, a conforming structure emerges (given that points A and B describe the 'autocratic management' $(E2, W1)$ and 'dominant workers' $(E1, W2)$ outcomes respectively). To

make this association we thus need to demonstrate that participation may serve as an institutional mechanism for efficient bargaining. This has already been done for the case of codetermination by McCain (1980), though not, as here, in the context of a PD game structure. The argument goes as follows.

Inefficient outcomes such as S occur whenever there is a failure to reach full agreement, for example as the outcome of any sequential game. McCain focusses on suboptimization games where, in the absence of an agreed bargain, certain variables \underline{P} are precommitted by player X , and the remaining free variables $\underline{F}_x, \underline{F}_y$ are then suboptimised by players X and Y given \underline{P} as data. The outcome is inefficient because (i) free variables can vary only over a restricted range determined by the values of the precommitted variables, and (ii) \underline{P} may also be set suboptimally, on the basis of expectations of opportunistic behaviour.

McCain defines workers' utility over earnings (w) and effort (E): $U_w = g(w, E)$, and employer's utility, as before, over profits: $u_s = h(\pi)$. The underlying production process is characterised by a function of factor inputs and variable effort: $q = f(K, L, E)$, where $E = \underline{x}$ is a multidimensional vector of 'dimensions of work activity'. Suboptimisation occurs because in a world of incomplete labour contracts not all the x_i are specified. Codetermination is then presented as a potential source of mutual gains to workers and shareholders, by shifting variables from the precommitted set \underline{P} to the free set \underline{F} ; thus the commitment structure of the game is altered. In effect the frontier shifts from the broken line through S to the real frontier through N .⁽⁴⁾

Clearly the role of participation as an efficient bargaining mechanism need not be confined to the particular case of codetermination; McCain himself adds comments on the case of workers' management. Equally, the precommitted variables which participation liberates need not be confined to 'dimensions of work activity' or 'effort'. In general, it can be said that the essence of any form of participatory arrangement is that joint decision making between workers and employers is extended over a broader range of decision variables in the firm than wages alone: employment, investment, job-design, working conditions, supervisory arrangements, and so forth. Thus, generalising from McCain's model, consider the role of participation in general where the underlying production relationship is written $Q = Q(\underline{K}, \underline{L}, \underline{O}, \underline{m}, \underline{f}, \underline{e}, \underline{u})$, where $Q = Q(\cdot)$ is a single-valued, concave function, and the factor-input augmenting variables are all multidimensional vectors of organisational variables (\underline{O}); workers' effort (\underline{e}); workers' strategic sanctions (\underline{u}); employers' monitoring intensity (\underline{m}); and employers' discretionary authority (\underline{f}).

The organisation vector \underline{O} registers the firm's choice of job, batch or flow production methods, control-spans, hierarchical structure, payments and communication systems, etc. Some areas of discretion over these matters may be assumed to exist, subject to technological limits, for a given product and capital and labour inputs, though clearly \underline{K} , \underline{L} , and \underline{O} choices must be to some extent interrelated; for example, a given system of control-spans implies certain relative employment relationships within the \underline{L} vector, and so forth. Workers' effort \underline{e} resembles McCain's E , and the range of workers' sanctions \underline{u} is familiar from the industrial relations literature: strikes, restrictive work-norms, demarcation rules,

absenteeism, pilferage, non-communication, etc. Employers' monitoring \underline{m} refers to vertical supervision, (as opposed to horizontal monitoring among peer-groups of workers) and clearly may vary in intensity for a given control span. Finally, employers' authority \underline{f} includes 'legitimate authority' under incomplete employment contracts, but is more especially intended to capture retaliatory actions such as threats and lockouts in the face of workforce militancy. In general terms, \underline{K} , \underline{L} and \underline{O} determine the firm's technical inputs - its internal organisation structure and factor utilisation - whereas \underline{e} , \underline{u} , \underline{m} and \underline{f} define the way in which employers and workers behave towards each other.

Given this framework it is clear that in the traditional, non-participatory firm, employers typically precommit $\mathcal{P} = \{\underline{K}, \underline{L}, \underline{O}\}$ leaving the free variable $\mathcal{F}_E = \{\underline{m}, \underline{f}\}$ and $\mathcal{F}_W = \{\underline{e}, \underline{u}\}$ to be suboptimized by workers (W) and employers (E). Just as in McCain's specific case of codetermination, so any form of participation which enlarges the range of jointly-decided variables within the firm, shifting some or all of the \underline{K} , \underline{L} , and \underline{O} variables from the precommitted to the free set, can be regarded as an efficient bargaining institution, capable in principle of moving the firm from interior point S in figure 1 towards the efficient frontier FF'.

3. Participation, Human Capital and Technology

In the foregoing analysis participatory and traditional firms face the same technological opportunity set; the underlying true objective payoff frontier is common to both, and hence also its transformation to the curve FF' in figure 1. In these circumstances, a mechanism for reaching this boundary is the most

participation can offer. ¹ Suppose, however, that participation can have more fundamental effects via the opening up of technological opportunities that are not available to non-participatory firms. The basic idea is simple: that in traditional firms the available technical choice set is constrained not only by technological knowledge, but also by the need to maintain control over the workforce. Thus we can draw a distinction between ultimate technology - the global set of technical opportunities associated with a given state of scientific knowledge - and effective technology - the subset of technical choices not precluded by control considerations. Then the argument is that effective technology is more tightly constrained under traditional organisation, where control considerations are paramount, than under participation, where control is shared.

Formally, we define the ultimate technical opportunity set \mathcal{Y} associated with a given state of knowledge, the elements of which may be thought of as exhaustive input-output vectors T . Control-maintaining technical choices are a subset of the ultimate set, $\mathcal{Y}_c \in \mathcal{Y}$. The twofold question at issue is (a) whether the complement $\mathcal{Y} - \mathcal{Y}_c$ in \mathcal{Y} is economically speaking non-trivial, which involves questions concerning productivity and welfare, and (b) whether participation in any institutional guise can make it available.

The concept of control-constrained technology has been developed in some detail in the radical economics literature, for example by Edwards (1979), mostly in the form of a critique of scientific management or 'Taylorism', with its emphasis on deskilling, machine-pacing, monitoring, and hire-and-fire tactics. In the game-theoretic framework adopted here, the control-precluded technical

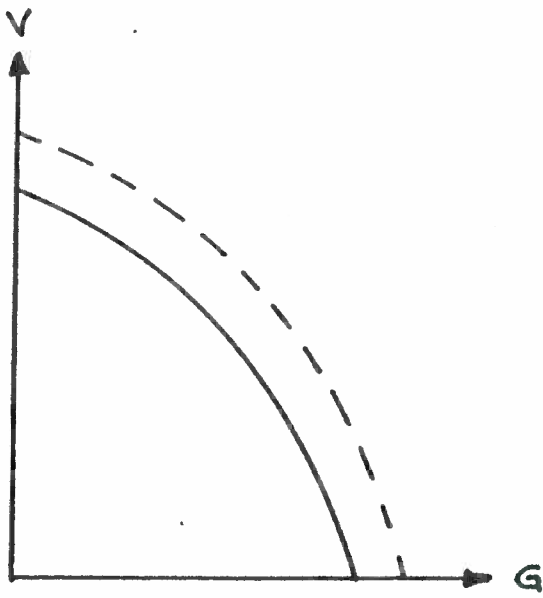
options in the traditional firm would be those which, if chosen, give workers enhanced bargaining power. Thus the significance of deskilling will be not merely to reduce the costs of hiring, training, and firing (with respect to marketable labour skills), but also to minimise the acquisition of firm-specific skills and knowledge through which, as we have seen, employees derive 'implicit or explicit bargaining power' (Aoki, op cit). In abstaining from these choices the traditional firm stakes its chances on a control-oriented strategy.⁽⁵⁾ However it thereby foregoes the productivity and welfare gains which might be obtained by developing the potential human capital of its workforce. Thus, where participation does open up new technical opportunities, we should be able empirically to observe significant differences in the characteristics of the workforce between participatory and traditional firms, along various observable dimensions of physical and human capital.⁽⁶⁾

Once it is recognised that the firm's choice of production methods is a matter of strategic behaviour in the firm, as well as of exogenous laws of nature, it is evident that technology is not the wholly exogenous constraint it is assumed to be in orthodox theory. Nevertheless, the potential scope for participation to open up new technical opportunities will vary from industry to industry, according to technical limits which truly are exogenous: the boundaries of the relevant ultimate technical opportunity sets.⁽⁷⁾ Suppose that, in a particularly restricted case, the new technical opportunities which participation offers lead only to an increased density of utility pairings below and to the left of point S in figure 2, and that S is the relevant, traditional alternative in the firm in question: a suboptimal game outcome following the employers' original, control-oriented precommitment of K, L, and O. Clearly participation

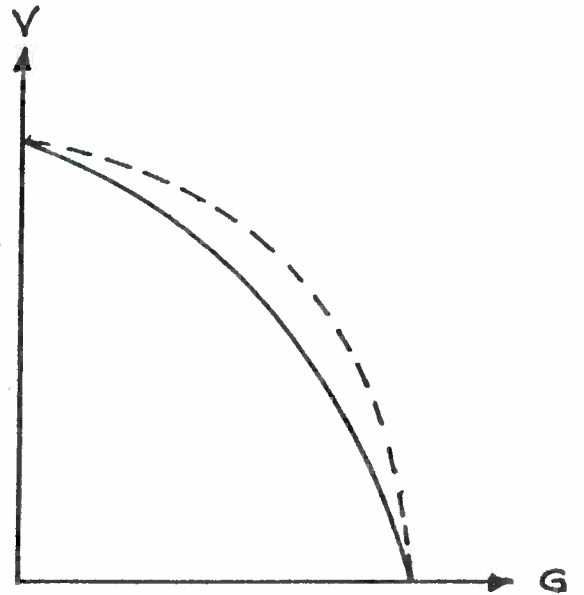
offers no additional technological gains here (though it may of course still offer a potential for improvement towards the frontier FF' via efficient bargaining).

If, on the other hand, the newly available utility pairings lie above and to the right of S up to the frontier FF' , participation offers dual scope for mutual gains, via technology shifts and efficient bargaining effects. But participation still offers no potential improvement over efficient outcomes arrived at by other means using restricted (non-participatory) technical choices, e.g. union-employer bargaining (McDonald and Solow, 1981; Freeman and Medoff, 1984). Finally, however, consider the case where the new technical opportunities underlying the utility frontier cause it to shift. Figure 2 shows a number of possibilities. (a) and (b) are optimistic of participation's potential, involving shifts in the frontier along its entire length (excepting the end-points in the case of (b)). (d) extends the range of potential workers' utility G , but there is no mutual gain for employers. However, in case (c) there are mutual gains. Note that in this case the participation outcome P can be Pareto preferred not only to S but also to the 'traditional' (i.e. non-participatory) efficient bargain N . As a result a PD payoff structure may be formed not only from points P , A , B , and S , as before, but also from points P , A' , B' , and N . Note also that in this case the one-side-dominant outcomes A' , B' now offer lower utility than the previous maxima V^{**} , G^{**} . Moreover the mutual exit-threat point has risen to M' , for example because increased non-specific skills raise the market alternative wage. These changes are of no consequence as long as the participatory outcome is held. But they illustrate a form of no-return risk when entering participatory agreements that may fail.

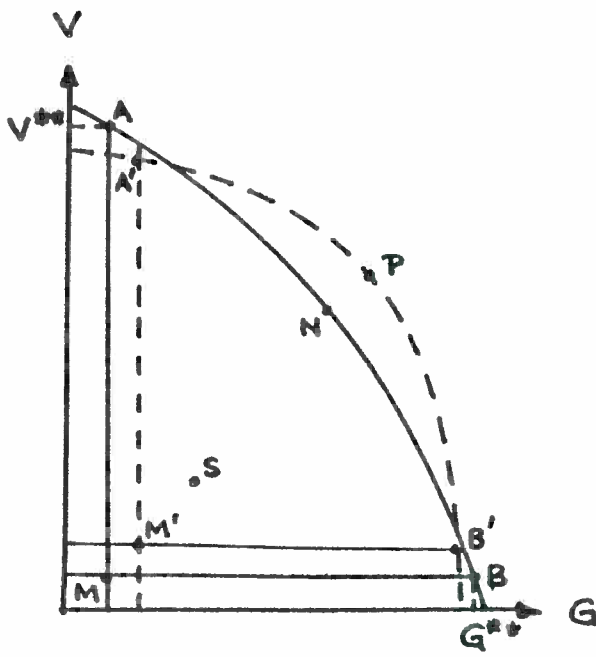
Figure 2 Technology Shifts



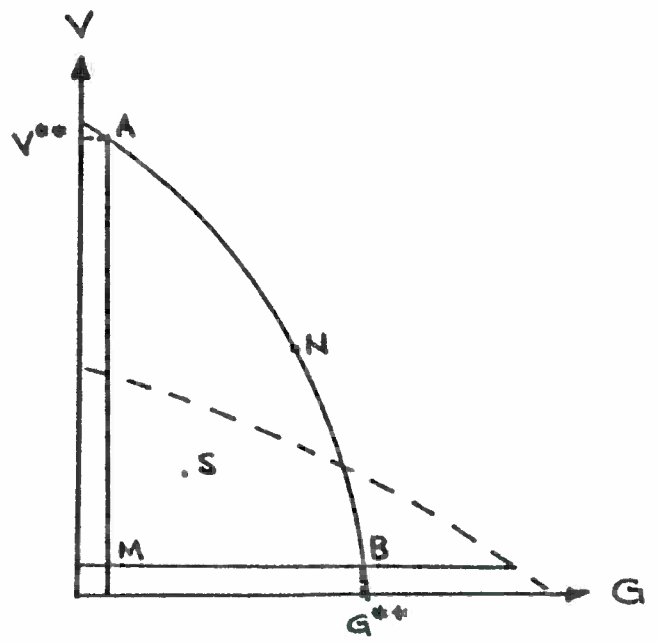
(a)



(b)



(c)



(d)

4. Participation and Equilibrium in a Prisoners' Dilemma

In purely theoretical terms, we know that the conflict outcome in table 1 is the individually rational (Nash) equilibrium in a one-shot game, and on the equilibrium path at every stage in a finitely repeated game.⁽⁸⁾ However prisoners' dilemma games are inherently unstable, with an incentive always to do other than at present; if there is Nash-equilibrium it is worth cooperating to secure the Pareto superior outcome (W1, E1) whereas under Pareto-equilibrium there is incentive to cheat (though in repeated games the possibility of retaliation must be taken into account). Moreover experiments by Axelrod and Smale have produced results where, at least for some time, players cooperate and end up with payoffs strictly greater than under equilibrium play. Noting that in Axelrod's PD tournament, the "strikingly simple and quite natural strategy" of 'tit-for-tat' play⁽⁹⁾ emerged as the winner, Kreps, Milgrom, Roberts and Wilson (1982) show that such cooperation until the last few stages of a repeated game is consistent with rational, self-interested behaviour if either it is not common knowledge that the opponent is not 'tit-for-tat', or there is two-sided uncertainty over the stage payoffs (and hence of the opponents' incentive to renege).

Incomplete information of this kind is not unlikely in the complex production game under consideration. However, the cooperation it produces occurs only in the finitely repeated game, whereas the production game is in practice most likely one-shot. Though production itself is obviously a repeated activity, workers and employers typically do not view determining the form of work organisation as a recurring issue, not least because of the high

transaction costs involved. And while far-reaching organisational changes do occur from time to time, it is neither obvious nor very likely that they have been anticipated at the previous stage, as is required in a repeated game. Hence the reality may be a sequence of (infrequent) one-shot games rather than a single, repeated game. In any case the level of transactions costs is such that even in a genuine repeated game, the number of repetitions within the players' time horizons must be small, whereas the cooperation discussed by Kreps et al continues only until the last few plays, and is therefore of interest only in large, frequently repeated games.

Can we nevertheless envisage situations in which participation is chosen as the solution to a latent PD problem? The existence of such situations turns on the players' perceptions of (a) the probability that the opponent will renege on a participatory arrangement if established; and (b) the probability of achieving outright domination and maximising individual benefits under the relevant off-diagonal, Stackelberg leader-follower equilibria.

In the absence of statutory or other forms of public intervention, ensuring that probability (a) is low enough is a matter of establishing adequate mutual trust and security in the design of participatory institutions and contracts. Here the distinction between producer cooperatives (PCs) and participatory 'schemes' may be important. Once the conflict between workers' and employers' interests has been internalised via large worker-ownership stakes, the incentive to revert to sectional utility maximisation is removed; this is the argument put by Oakeshott (1978), Horvat (1982 a,b) and some other writers, that a substantial ownership stake by workers is essential to break down the traditional antagonism between labour and

capital and support the required changes in working practices and social relations of production.⁽¹⁰⁾ The point is of course strongest when all the workers in a PC are owner-members - there are no distinct categories of member (e.g. the original founding group and others), no non-working members, and no contracted labour. Where any or all of these are present, internalisation is incomplete and the enterprise may begin to exhibit symptoms of 'degeneracy' including the domination of some sectional interests or open conflict between them,⁽¹¹⁾ so that PC behaviour comes to resemble the other outcomes highlighted by the present analysis: (W1, E2), (W2, E1) or (W2, E2).

Thus while the 'pure' form of PC may offer a full solution to problem (a), not all PCs will be of this type. On the other hand, participation 'schemes' may also have trust-enhancing features. This is particularly true where they involve mutual release and sharing of each sides' strategic information. By so doing each side signals its willingness not to revert to sectional behaviour and, indeed, forfeits an important strategic advantage where it to attempt this. Similarly, profit-sharing schemes introduce a further element of 'bonding'. For example, if employers renege on a participatory cum profit-sharing arrangements, and succeed in maximising V, workers at least receive monetary compensation via their profit-sharing entitlements. Conversely, if workers defect, the financial loss to employers is mitigated by reducing profits-to-workers payments. However, the strength of the bonding effect is clearly a function of the amount of profit-sharing (more specifically the proportion of total income for which it accounts), which in practice is often small.

In sum, it appears that both PCs and participation schemes may be routes to the Pareto-superior outcome (W1, E1). But this is

not automatic, and much will depend on the institutional or contractual arrangements in specific cases. Moreover, in view of the problems involved and the social gains at state, a case may exist for the intervention of the state as endorser and guarantor of participatory arrangements, one example of which, though perhaps an imperfect one, may be seen in codetermination laws.

With respect to (b) - the perceived probability of one side achieving outright domination - it is important to recognise that in the real-world production game the availability to each player of a choice of strategy is not absolute, but a function of environmental factors. Thus if there is heavy unemployment and acute domestic or international competition; if government policies curb union organisation and activity (e.g. by removing closed shops, restricting picketing, increasing unions' legal liabilities over disputes, enforcing 'contracting in' to political levies, and so forth) and at the same time reduce unemployment benefits and strikers' social security; and if social attitudes emphasize respect for material and private property and deference to hierarchical authority; then the chances of worker domination will be perceived to be small and those of employers correspondingly large.⁽¹²⁾ Conversely, the opposite economic, political and social environment will generate the opposite predictions.

These effects can be captured in the model by attaching the players' subjective probabilities to the payoffs in table 1, where these probabilities are then a function of the prevailing economic, political and social environment.⁽¹³⁾ When the probability of one player being able to play his 'control' strategy falls below a certain level (in the limit zero), the game simply collapses to a single

leader-follower outcome (W1, E2 or W2, E1), one side having no option but to comply.

In certain cases environmental factors may have an overriding influence in ruling out particular outcomes. For example, the pathological, low performance Nash equilibrium (W2, E2) may be viable only in a favourable economic climate, such as an economic boom, or under tariff protection or monopolistic advantage, and be driven out under economic adversity. Experience in the UK in the post-1979 recession is of interest here, showing evidence of a polarized response to the crisis - some firms reverting to strong managerial control but others, despite the presence of a government policy favourable towards reassertion of managerial prerogatives, seeking a participatory solution.⁽¹⁴⁾ Also, as we have already seen, technological imperatives may rule out an effective participatory solution in certain cases, most especially when they dictate giant plant size, extremes of machine-pacing, etc. (though as has also been seen, we should be wary of treating technology as truly exogenous, when the nature and direction of R & D effort may have been biased towards work-control enhancing technologies).

The upshot is that when naive theoretical predictions are tempered with practical and political considerations, none of the four outcomes in table 1 can be ruled out in principle. However, in present times, though perhaps not in the past, the off-diagonal leader-follower outcomes are unlikely to be encountered, except as occasional, observational outliers. Under 'normal', present day circumstances we should therefore expect to observe basically two firm types: participatory and traditional enterprises; and in view of the practical and contractual difficulties in the design of participatory

arrangements, and the socio-political climates in most Western economies, a situation of mainly traditional organisation with a minority of participatory exceptions is not unexpected. Thus the observational pattern with which this paper began is model-compatible.

5. Conclusions

Mutual gains to workers and capital-owners under participatory production can be reconciled with the continued predominance of traditionally organised firms when account is taken of a prisoners' dilemma in the choice of work organisation. Whether participatory gains arise from the striking of efficient bargains within a given technology, or from the opening up of technological choices not otherwise available to traditional firms, is a question for future empirical work, focussing on the structural and performance characteristics of production firms. Such work may be seen as part of a more general enquiry into the interplay of institutional factors and effective technology. Public policy intervention to promote participatory alternatives is not ipso facto a denial of mutual social gains, and may be necessary to secure them.

Footnotes

1. Each side is treated holistically, as a single acting entity. In the case of employers, a transactions-cost efficient reconciliation of owners' and managerial objectives is assumed to have taken place within the agency framework developed by Jensen and Meckling (1976). Similarly, we abstract from problems of goal-conflict and intra-group conflict on the labour side.
2. For simplicity, the firm is assumed to produce a single product and face market-determined prices. In empirical work market structure variables and industry dummies should be included to normalise for possible market power effects.
3. As is customary we show FF' concave from below. We assume non-increasing returns in production and diminishing marginal utility over the relevant range in all utility arguments.
4. McCain's frontier is defined in effort/productivity terms rather than utility as here, but this does not affect the general argument.
5. Contemporary examples in the UK might include the displacement of traditional newspaper technology by computerised methods in the revolution of Fleet Street led by Shah and Murdoch, and the government's preferential treatment of road over rail haulage in its transport policy.
6. For some empirical evidence on the origins of participatory gains see Cable, 1986.
7. Oil refining, for example, probably offers rather limited opportunities, at least at the relative input prices ruling in developed and oil-producing countries.
8. The logic is similar to Selten's backwards induction in the chain-store game. By contrast, in an infinite game, "any average payoff vector in the intersection of the positive orthant and the convex hull of the four possible stage payoff vectors can be achieved through a perfect equilibrium" (Kreps, Milgrom, Roberts and Wilson, 1982).
9. 'Tit-for-tat' play requires cooperation at first, which is then continued only if the opponent also cooperated at the previous stage.
10. This is not, however, a universally held view, and in principle there is no reason why similar results should not be achieved by agreement between separate groups of workers and employers, just as in principle colluding oligopolists can achieve the results of a multi-plant monopolist.
11. As, for example in the case where Furubotn (1976) considers domination by an original founding group of members.
12. There are now two kinds of uncertainty in the model, one concerning rival's behaviour and one (mutual) uncertainty about stage payoffs (c.f. Kreps et al).

13. The outstanding example of political impact is perhaps the case of Chile under the short-lived Allende government (see Espinosa and Zimbalist, 1978). Striking examples of politico-social influence are also to be seen in developing countries. Current policies to 'liberalise labour markets' in the US and UK offer further, in this case negative, illustrations.
14. Source: spokesman for West Midlands Engineering Employers Federation. The opinion is substantiated by empirical data collected by Nick Wilson for the UK Work Organisation project.

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