

Productive Efficiency, Incentives and Employee  
Participation: A Study of West German Firms\*

by

John R. Cable\*\* and Felix R. FitzRoy\*\*\*

NUMBER 145

**WARWICK ECONOMIC RESEARCH PAPERS**

DEPARTMENT OF ECONOMICS

UNIVERSITY OF WARWICK  
COVENTRY



Productive Efficiency, Incentives and Employee  
Participation: A Study of West German Firms\*

by

John R. Cable\*\* and Felix R. FitzRoy\*\*\*

NUMBER 145

\* An earlier version of this paper was delivered to the Second Bosphorus Workshop on Industrial Democracy, Istanbul, July 1978; the European Association for Research in Industrial Economics, Nurnberg, September 1978; the First International Conference on the Economics of Workers Management, Dubrovnik, October 1978; and the Outer Circle Policy Unit Conference on the Political Economy of Third-Sector Enterprises, London, November 1978. We are extremely grateful to the many firms who responded to our questionnaire and to Michael Lezius of the AGP. We should also like to thank for their helpful comments and suggestions Keith Cowling, Paul Kleindorfer, Bridger Mitchell, Dennis Mueller, Hans Nutzinger, Aubrey Silberston, Christian von Weizsäcker and Bernhard Wilpert, together with F.C.Heng and Hartmuth Lohmann for programming assistance.

\*\* University of Warwick and International Institute of Management, Berlin.

\*\*\* International Institute of Management, Berlin.

May, 1979

This paper is circulated for discussion purposes only and its contents should be considered preliminary.



## 1. Introduction

The organisation of productive activity within firms has received increasing attention in recent years. Problems of motivation, productivity and "quality of working life" have become central concerns at both policy and academic levels (Hackman and Suttle, 1977). Co-determination and worker participation in management are now major issues in Europe and elsewhere.<sup>(1)</sup> A number of economists including FitzRoy and Mueller (1977) have begun to study the contractual relationships and internal organisation of the firm, while successful co-operative ventures at Mondragon and elsewhere (Oakeshott, 1978) provide counter examples to received doctrines in this area.

A major deficiency in the existing relevant literature, in our view, is the insufficient attention that has been paid to social interaction at the workplace and to factor immobility. Thus traditional writers on property rights (Furubotn, 1976; Pejovich, 1978) and on internal organisation (Alchian and Demsetz, 1972) neglect entirely the interactions and collusion amongst members of a closely-knit work-force, which modify the effects of individual economic incentives. The costs of mobility are similarly ignored, though these are a basic factor explaining the permanence of employment relationships, and the specificity of skills and rents. These considerations suggest that "voice" as well as "exit" may be necessary to match organisational design with members' requirements (Freeman, 1976) and that contractual innovations like participation may promote efficiency rather than otherwise.

We develop a detailed economic theory of social interactions elsewhere (FitzRoy and Cable, 1979). The main purpose of the present paper is to present empirical evidence on the relationship between worker participation, incentive pay and the productive efficiency of firms. In the following section we briefly summarise those parts of our theoretical arguments

which bear directly on the hypotheses tested in our empirical work. This has focussed on a sample of 42 West German firms, members of the Arbeitsgemeinschaft zur Förderung der Partnerschaft in der Wirtschaft e.V. (AGP) headed by Michael Lezius. The types of firm involved and the data they supplied are described in section 3. Our empirical results follow in the next two sections, which look respectively at the means and recent growth in certain key variables for 'high' and 'low' participation firms, and at estimated production functions for the various groups. Section 6 briefly summarises our conclusions and policy recommendations.

## 2. Theoretical Framework

Unlike simple market exchange, employment is usually an ongoing relationship. Skills learned on-the-job may be less productive or inapplicable elsewhere, so termination of employment is risky, while mobility requires search and transport costs. In a world of imperfect and changing information enduring employment cannot be economically regulated by a detailed and explicit contingent contract, so tacit or formal agreements generally include acceptance of employers' authority to direct productive activity within specified limits without costly haggling or overt conflict.<sup>(2)</sup> The individual worker who immobilises himself by developing specific skills becomes vulnerable to employers' opportunism. As a result, collusion by workers and formalised collective-bargaining agreements are encouraged. The tables are then turned on employers, because installed capital is also immobile, while the replacement of the specific skills embodied in, say, a striking labour force will involve major costs.

The traditional firm is thus a bargaining arena, prone to conflict and endemic mistrust as labour and capital expend resources on the socially unproductive activity of attempting to extend or defend their share of

jointly produced wealth. The traditional economist's reliance upon individual incentives to exact optimal effort from rational workers thus neglects their overriding motivation for collusive and strategic behaviour in the social context of productive organisation (Fox 1974; Oakeshott, 1978). No less important, and equally neglected in the economic theory of Walrasian competition is the destructive effect that rivalry and the "rat-race" for individual rewards and promotion can have on productive co-operation and communication in a closely-knit organisation. Distorting information flows to obtain personal benefit is a pervasive phenomenon, whether by exaggerating one's own performance or by denigrating a rival's. Increased costs of monitoring are thus incurred to counteract dishonesty, while ever-finer division of labour and specialisation of tasks to aid supervision reduce workers' autonomy and job-satisfaction.

While collective bargaining and unionisation have been the historical response of workers attempting to increase their share of the "pie", there may be an alternative: to enlarge the pie by avoiding conflict and mobilising collusion to maximise joint wealth rather than one party's share. The basic hypothesis which we seek to test in this paper is whether worker participation can be a means of achieving this alternative. No single, simple operational formula for participation can or indeed should be given - and a wide variety of practice was revealed in our sample. Participation, as we view it, essentially involves some form of post-contractual worker involvement, embracing at least access to information which is normally confined to management and, in many cases, some involvement in the decision-making which traditionally defines the managerial function. It in general falls short of full workers' control.

The hypothesis is that if workers participate in decisions affecting their jobs - in 'managerial' activities - their ability to prevent

opportunism directly rather than by threat of strike will increase. Trust in the fairness of decisions which inevitably involve some element of redistribution will increase when these decisions are in some sense taken jointly. Acceptance and efficient implementation of such decisions will consequently be fostered.

If workers agree to co-operate in maximising the joint wealth of owners and employees (including non-pecuniary components), they will also require a share of profit, or any surplus above contractual rents and wages (Bernstein, 1977). Conversely, and in contradiction to received and authoritative opinion (Samuelson, 1977), we hypothesise that profit sharing should motivate efficient behaviour. The traditional counter-argument is that any individual worker appropriates only a small fraction of his marginal product under a group incentive like profit sharing, but receives all the benefits from shirking or leisure-on-the-job.<sup>(3)</sup> This argument follows the Crusoe-approach to economic man in neglecting the social interaction among individuals at work in an organisational framework. If the numbers involved are not too large and shirking imposes perceptible losses on co-workers with whom there is some personal interaction, then "positive collusion" and "horizontal monitoring" to encourage effort is the rational response for the peer group. This represents a reversal of the widely observed "negative collusion" to restrict output under traditional piece-pay schemes, where informal social sanctions and even violence against "rate-busters" have a lengthy history.

The motivating effect of profit sharing is likely to depend on workers' perceived ability to influence managerial decisions affecting profitability. Furthermore, participation should increase workers' awareness of a reliable connection between their individual exertions and received profit shares, and reduce fears that managerial opportunism will deprive them of



the fruits of their extra labour. Hence, we expect a significant interaction between worker participation and profit sharing. Without participation, the high-trust relations necessary for positive collusion are less likely to be achieved, and profit shares are more likely to be regarded as random and unrelated to each individual's unco-ordinated performance. This explains the preference for wage increases rather than profit-related bonuses in the typical low-trust, conflict-prone organisation under collective bargaining.

Even limited elements of participation or partnership are likely to generate loyalty and attachment to the work place which is rationally founded in the knowledge that personal prospects including promotion and job security do depend heavily on firm growth and profitability to finance investments. Thus, as the contractual status of labour becomes closer to partnership so should incentives for joint-wealth maximising co-operative behaviour become more powerful.

The effect will arguably be more pronounced for "appropriate" forms of incentive scheme i.e. profit sharing or other group incentive systems. In the case of individual incentives the outcome is ambiguous. If effort and promotion are rewarded via individual incentives which do not penalise rivalrous actions (such as distorted signals, obstructing fellow workers and lack of initiative which does not raise one's standing) the disruptive effects of such rivalry may still outweigh the positive influence of participation in raising trust and fostering co-operation.

In sum, our theoretical expectations are as follows. We expect productivity to increase with participation, holding other factors constant. We also expect profit-sharing to raise productivity and to interact with participation by having a stronger effect when participation is high. Individual incentive payments have opposing tendencies, but at least for low participation

firms a negative net effect is quite strongly suggested.

### 3. Data Base : Questionnaire and Sampling Frame

More than 700 firms in the Federal Republic of Germany currently practise some form of profit sharing and/or employee shareholding in the firm's capital stock. Many of these firms are loosely represented in the AGP. Guski and Schneider (1977) in collaboration with Lezius have compiled a register of these firms, which reveals a variety of legal configurations heavily influenced by existing tax and company law. The size of employee profit and stock shares also varies greatly, most being relatively small. About half the firms in the sample have instituted some form of employee participation in what is normally regarded as managerial decision making. These schemes are voluntary, and quite distinct from employee representation on the supervisory board under the German codetermination laws. Thus the worker participation on which we focus in this study is at a much more grass-roots level, and quite different from the legal form for which West Germany is internationally known, although the grass-root developments have no doubt been indirectly influenced and encouraged by the climate of opinion leading to and fostered by the legislative developments. The schemes introduced by AGP members range from employee control in a few worker-managed co-operatives among the many small firms, to minimal consultative and informative practice in the more sparsely represented larger firms.

The nature of the foregoing sample, as well as the good working relationship of the AGP with leading personalities involved in the often innovative organizational experiments carried out, presented a unique opportunity for gathering data with which to explore the questions raised in the previous section. A questionnaire was

designed in co-operation with Lezius and sent to most of the firms in the sample. The response rate approached ten per cent, which is not unsatisfactory given that we relied mainly on the initial mailing for this preliminary analysis, and given also the traditional German entrepreneurial penchant for secrecy among the mostly unquoted firms in the sample. After discarding some utilities and the very largest firms, in order to preserve sufficient homogeneity of the sample, the 42 remaining respondents were well distributed across a wide range of (generally) manufacturing industries, with 20 - 6000 employees. None of the few existing worker cooperatives supplied data, but several of the more participatory respondents are well known for the efforts of their owners or managers to introduce democratic practices into their internal decision-making processes.

For the most part the questionnaire asked for accounting or other 'objective' data, subject, of course, to the usual variations in accounting definition and practice. Judging from the letters received from some non-responding firms, it was the questions relating to 'sensitive' financial variables at which they balked. This reaction has to be seen in the context of the minimal information disclosure rules governing the (unquoted) GmbH form of company, which is numerically (4) dominant both in the West German economy and in our sample.

The questions on the degree of participation, on the other hand, involved managements' subjective evaluation of worker involvement in various areas of decision making. For each of eight decision making areas, ranging from determining piece rates to price and investment policy, firms were asked to classify themselves as having no participation or workers involved as observers, advisers, or active participants. Without extensive (and expensive) interviewing in case studies these evaluations have obvious

limitations. But it is worth stressing that the subjectivity was on the part of the questionnaire respondents, who had no detailed knowledge of the way in which the data was to be analysed. Moreover any systematic tendency to overstate the degree of worker participation, which might be expected, does not give rise to a problem in our analysis, since we need to observe only the relative degree of participation between different firms or groups of firms not its absolute level. And, in the event, incorporating the participation data in our regressions yielded significant and interesting results, whereas the presence of non-negligible measurement error in variables will, as is well known, generally pull coefficient values towards zero.

On the basis of the questionnaire returns we developed a number of indices of the degree of worker participation, taking account of both the purpose of workers' presence and the topics discussed. The practical problem was to determine the weighting structure for the different purpose categories and decision making areas, in order to derive a points score for each firm. In the absence of any economic or sociological theory generating operational weighting schemes the choice of weighting scale is arbitrary. We therefore experimented with many different specifications and schemes, but found our results generally insensitive to the choice of weights over a fairly wide range. In the regression equations reported in section 5 below the P1 variable is based on weights of 0, 1, 2, and 3 for "no participation", "observer", "adviser" and "active participation" respectively, and equal, unit weights for each decision-making area.

As well as continuous P-indices we developed zero/one dummy variables dichotomizing the sample into high- and low- participation groups. This was done by finding critical values of P with the aid of hill climbing techniques using the regression models of section 5. In the case of the P1 index, the criterion for inclusion in the high

participation group is  $P1 \geq 13$ .<sup>(5)</sup> It is worth noting that this value requires at least some minimal worker participation in what may be called the "strategic" decision making areas - investment, price and product policy - even if employment-related participation, in areas such as the payment system, production methods, job design and piecework rates, etc., is at a maximum. In practice the firms entering the high-participation group on the P1-based dummy do so mainly because of participation over the employment-related issues. At the same time there was a considerable amount of reported worker participation over strategic questions. This is confirmed by the fact 28-30 firms would enter the high-participation group, if to qualify only employment issues were considered, compared with 11-14 on the basis of strategic questions only.

#### 4. Empirical Results : Overview of Questionnaire Responses

Table 1 reports the group averages for certain descriptive and performance variables across the high- and low-participation groups of firms, classified according to the procedure described in the previous section. The most striking differences are that the capital-labour ratio is much higher in the low-participation group, while employment is much greater in the high set. Both differences are statistically significant at the five per cent level.<sup>(6)</sup> In most other respects - hours worked, ratio of blue- to white-collar workers, wage rates and earnings - the sub-sample means are the same or very similar.

No difference appears in either of two performance variables often used as proxies for "alienation" or job-discontent: absenteeism and quit rates. Thus, on this evidence, worker participation of the type under observation does not radically transform the work situation in a way or to a degree which is reflected in these variables. The

only evidence which might conceivably be consistent with reduced alienation is the absence of higher earnings in the larger, high-participation firms. This absence of a significant increase in wages with firm size was confirmed by a regression of hourly wage rates on relevant variables, and contrasts with Scherer's (1976) finding of a significant positive relationship between wage rates and establishment size, which he associated with the need to pay more in large firms to offset the higher alienation levels to be expected there.

By most conventional measures, however, the high participation firms appear to outperform the low group, by 5%, 177% and 33% respectively in terms of output per man, output per unit of capital, and profitability. The one respect in which the low participation firms have the better record is output growth.<sup>(7)</sup> This is brought out in table 2(a) which compares the growth performance of the high- and low-participation groups over the years 1972-76 of our data, which go from boom through recession to (partial) recovery. Output at constant prices grew twice as fast in the low participation sample, although the high group itself turned in an above-average performance, leading GDP growth by four percentage points.

Table 2 also reveals a much more rapid growth of productivity in the high participation firms to the extent that the productivity level ranking reversed over the five year period (table 2(b)), high participation firms starting below and finishing above the level of output per man in low-participation firms. Significantly, perhaps, we know from other sources that the first half of the nineteen-seventies was a period in which there was a significant spread of worker participation in Germany.<sup>(8)</sup> The relative growth of high-participation firms' productivity could, therefore, reflect growth in the development of participation itself.

Table 1  
MEANS 1976

	HIGH	LOW
Value Added	31,318	20,316 ('000 DM)
Total Assets	43,749	77,181 ('000 DM)
Total Employment	914	584
Return on Capital	0.178	0.134
Value Added/Empl.	35.7	33.9 ('000 DM)
Value Added/Assets	0.72	0.26
Assets/Empl.	66.9	90.4 ('000 DM)
Manual/Tot. Empl.	0.67	0.61
Manual hourly wage	13	14 DM
Ave. earnings p.a.	25,200	25,300 DM
Manual earnings p.a.	22,100	23,600 DM
Total hours per manual worker year	1,793	1,772
Absentees/Tot. Empl.	13.2	13.5
Quits/Total Empl.	0.07	0.07

Table 2 (a)  
INDEX NUMBERS OF OUTPUT, EMPLOYMENT  
AND PRODUCTIVITY 1972-76

	1976	1975	1974	1973	1972
OUTPUT (1)					
High	110.8	103.6	107.3	105.7	100.0
Low	122.7	121.2	126.5	117.3	100.0
GDP	106.7	101.0	106.9	104.7	100.0
EMPLOYMENT					
High	89.0	87.9	94.0	101.0	100.0
Low	93.4	91.2	95.0	99.5	100.0
PRODUCTIVITY (2)					
High	117.4	109.9	110.7	105.4	100.0
Low	104.2	102.3	105.0	102.3	100.0

Table 2 (b)  
RELATIVE LABOR PRODUCTIVITY: HIGH/LOW

	1.05	1.00	0.99	0.96	0.93
--	------	------	------	------	------

(1) value added at 1970 prices.

(2) " " " " per man.

Finally, we observe in table 2(a) a sharper reduction in employment during the recession years among the high participation firms. This is at odds with the suggestions often made that worker participation will lead to what in management eyes appears as downward rigidity in manning levels, and appears to workers as greater job security.

#### 5. Empirical Results : Production Function Estimates

We test further for the impact of worker participation and incentive payments on productive efficiency within the framework of statistical production functions. In doing so we encounter some well-known difficulties: at the conceptual level concerning the nature of capital and its measurement in other than specific physical units; and at the technical level insofar as, under orthodox assumptions, the production function is hard to identify, being merely a technical constraint embedded in a set of simultaneous equations describing the economic behaviour of the firm.<sup>(9)</sup> While we cannot entirely avoid these problems, we enjoy two advantages. First, since our estimates are inter-firm we avoid the capital problem at its most intense, i.e. in the context of the aggregate production function. Even so, of course, we do not entirely avoid the problem of quality differences in capital stock across our sample that are not captured in its value. Secondly because we use cross-section survey data, we are arguably less prone to mistake a simple accounting relationship for the true production function, as perhaps occurred in early Cobb-Douglas estimates using time series (Wallis, 1973). In our analysis so far we have employed only production functions of the Cobb-Douglas type. Experimentation with CES and boundary production functions remains for future study.



Following convention we interpret the error term  $u$  in the basic Cobb-Douglas formulation

$$Q = AK^{\beta_1} L^{\beta_2} u \quad (1)$$

(where  $Q$ ,  $K$  and  $L$  denote output, capital and labour inputs respectively) as the technical or productive efficiency of the firm, with  $u$  lognormally distributed, a positive factor taking values on either side of unity. If the effects of participation and incentive payments on efficiency operate in a disembodied fashion, via the multiplicative factor  $Au$ , we may simply add to (1) the relevant measures of worker participation  $P$  and incentive pay  $I$ :

$$Q = AK^{\beta_1} L^{\beta_2} P^{\beta_3} I^{\beta_4} u_2 \quad (2)$$

Alternatively, the effects could be embodied in particular inputs, modifying their productivity in different ways. To capture this would require the further addition of specific interaction terms between  $P$ ,  $I$  and  $K$ ,  $L$ . In the light of our earlier arguments, inclusion of a specific interaction term between  $P$  and  $I$  is also called for. In the multiplicative Cobb-Douglas framework, this involves introducing the products of the logarithms of the relevant variables, as well as the variables themselves, in the estimating equation. However, to proceed in this manner is likely to be unfruitful, encountering severe multicollinearity problems, and in our case expanding the sample is not a viable option. We therefore estimate separate regressions for sub-samples of 'high' and 'low' participation firms. In effect the productivity of each factor (and of incentive payments) becomes a function

of the level of participation, while disembodied effects of participation on productive efficiency are captured in the constant term. Economically, this procedure is the equivalent of estimating (2) with the addition of the specific interaction terms, for the case where  $P$  takes the form of a zero/one dummy variable.

Thus, we have estimated two basic models: equation (2) for all 42 firms in our sample; and separate equations, in which participation variables do not explicitly appear, for the 'high' and 'low' participation sub-samples.

The regressions we report below are pooled time-series/cross-section models using data for the years 1974-1976. Pooling the annual cross-sections enabled us to maintain degrees of freedom despite the introduction of 18 industry dummy variables, to normalize for inter-industry differences in technology, market power and so forth. To avoid singularity problems in estimation one industry dummy, for the leather clothing and textiles industry was dropped. The reason for confining the sample to 1974-1976 period was that, when responding to our questionnaire, firms will have tended to report the current (1977) degree of worker involvement in decision making. How long previously this level of participation had existed we do not know. Thus the participation variables, and our division of the sample into high and low participation groups, are more likely to be accurate in later years. To allow for changes in relevant prices and in economic conditions from year to year, time dummies for 1975 and 1976 were added and found to be significant. These considerations are supported by separate cross-section regressions for each year of our data reported in in earlier version of this paper (FitzRoy and Cable 1978).

The dependent variable  $Q$  was measured as value added (in

thousand DM). In the regressions we report below  $K$  is defined as total assets (thousand DM) and labour input is captured in two variables, the number of white-collar workers ( $L_W$ ), and total man-hours of blue-collar works ( $L_B$ ). The separate inclusion of white- and blue-collar labour input was to allow for the different effects employee participation and incentive pay may have as between shop-floor workers and others. Measuring blue-collar input by total man-hours is intended to capture the effect of variations in the utilization of the capital stock as man-hours increase say with overtime, as well as changes in numbers employed.

In unreported regressions we tested an array of alternative measures of factor inputs in terms of both stocks and flows (Griliches, 1967). We measured  $K$  alternatively as total assets, and assets multiplied by a capacity utilization index, obtained from the questionnaire.  $L$  was variously defined as total employment and the number of manual and non-manual workers (separately), with and without the addition of an hours-worked variable, included to allow for the possibly different effects of extra hours due to variations in the length of the working week and in numbers employed (Feldstein (1967) Lucas (1970)). For the most part, the results proved rather insensitive to variations in the measurement of these variables.

Participation indices and dichotomies were developed from the

questionnaire returns in the manner outlined in the previous section. The questionnaire responses also yielded three variables relating to financial incentives offered to workers. The first, and quantitatively most important, was total employee remuneration in the form of incentive pay. Our impression is that this consisted mainly of piecework earnings (I). The two other incentives variables are total profits distributed to workers ( $\Pi_E$ ) and workers' capital (M). These are related more to overall performance than to individual effort, and may be expected to operate via peer-group pressure. Inspection of the data did not, interestingly, indicate that  $\Pi_E$  and M are confined mainly to white- rather than blue-collar workers, but the total amounts reported were typically very small. While various specification possibilities exist for all three incentives variables, we allow only for a general interaction in the regression reported below. Our final specification is

$$\begin{aligned} \ln Q = & \ln A + \beta_1 \ln K + \beta_2 \ln L_W + \beta_3 \ln L_B + \beta_4 \ln I \\ & + \beta_5 \ln \Pi_E + \beta_6 \ln M + \beta_7 \ln P + \beta_8 D^{75} + \beta_9 D^{76} \\ & \sum_{m=10}^{m=27} \beta_m D_m + \log u \end{aligned}$$

where the  $D_j$  are time dummies for 1975 and 1976, and the  $D_m$  are industry dummies. Both sets of dummies capture deviations from our basic observation, a firm in the leather clothing and textiles industry in 1974. The P variable employed in the reported regressions is P1, described in section 3 above.

The salient features of our results can be illustrated by

TABLE 3 : OLS Estimates : Pooled time series/cross section\* (t values in parenthesis)<sup>†</sup>

EQUATION	SAMPLE	CONSTANT	K	L <sub>W</sub>	L <sub>B</sub>	M	I	Π <sub>E</sub>	P	R <sup>2</sup>	F
1	ALL FIRMS n = 126	-.5588 (-4.704)	.0008 (.015)	.3350 (8.171)	.6711 (16.384)	-.0079 (-1.108)	-0.0134 (-2.341)	0.0102 (1.511)	0.1494 (4.163)	.988	395.2
2		-.4756 (-3.765)	.0243 (0.425)	.3005 (6.938)	.6782 (15.364)	-.0093 (-1.211)	-.0073 (-1.232)	.0124 (1.717)		.986	352.7
3	HIGH n = 63	-.1406 (-.437)	.1711 (2.148)	.2509 (2.383)	.4865 (6.184)	.0255 (2.113)	.0061 (.9560)	.0593 (7.242)		.995	630.1
4	LOW n = 63	-.0393 (-.402)	.1279 (2.353)	.3754 (11.880)	.4890 (10.718)	-.1657 (2.460)	-.0031 (-.448)	-.0115 (-1.397)		.996	736.2

\* Time and industry dummy coefficients not reported

† Critical t (two-tailed) = 1% : 2.62  
5% : 1.99  
10% : 1.66

TABLE 4 : Implied Marginal Products, High vs Low Participation Firms  
(evaluated at Sample Means)

	High	Low
$\hat{MPL}_W$ (per annum)	26,029	33,414
$\hat{MPL}_B$ (per hour)	13.87	15.93
$\hat{MPK}$	0.12	0.03

reference to the four equations reported in table 3. In equation 1 we observe a positive and highly significant participation coefficient, and comparison with equation 2 confirms that inclusion of the P-variable is justified.  $\bar{R}^2$  and the F-score both increase, while the results for the other individual variables are largely unaffected. The two labour input coefficients are highly significant, though the values seem somewhat high, but the capital stock and various incentives variables attract coefficients which are either of 'wrong' sign or statistically insignificant or both.

However, these unsatisfactory aspects of the results disappear from the separate estimates for the 'high'- and 'low'-participation groups. In these less restrictive models, we allow different elasticities of all the variables to emerge. All three factor-input variables now attract significant coefficients of plausible, though differing, size, while markedly different coefficients, consistent with our hypotheses, are obtained for the incentives variables. Both  $\bar{R}^2$  and especially the F-scores are materially improved, and a Chow-test revealed statistically significant differences between the estimates for the two sub-samples, the relevant F-value of 6.98 being around four times the required critical value at the five per-cent level.<sup>(10)</sup> Evidently our P1 variable, whatever defects there may be in its construction, divides our sample into sub-groups that are both statistically distinct and economically meaningful.

Weighting the estimated output elasticities of capital, white- and blue-collar labour (table 3) by the average output/(relevant) factor-input ratios for the high- and low-participation sub-samples, yields estimates of the respective marginal products of the three factors, which

are set out in table 4. We observe that labour, especially white-collar labour, is more productive in low-participation firms, but capital has much higher productivity in high participation firms. This is as we would expect from neoclassical theory, in view of the relative scarcity of labour in the former, and of capital in the latter. It may, however, be wondered whether the 15% higher blue-collar productivity in low-participation firms and 28% higher white-collar productivity is sufficient to outweigh the huge (four-fold) difference the other way in the productivity of capital. There is at least a suspicion of non-cost-minimising behaviour by low-participation firms, due either to the choice of over-capital-intensive methods or the inefficient utilization of their capital stock or both, and this would be consistent with their poorer overall financial performance reported in section 4.

The results for the three incentives variables  $I$ ,  $\Pi_E$  and  $M$  lend rather strong support to our theoretical expectations concerning the relationship between participation and the effectiveness of incentive payments, via its effect on the level of trust within the firm, and the operation of peer-group pressures. Thus all three coefficients are positive for high-participation firms, and two are highly significant. Among low participation firms, on the other hand, all three variables attract negative coefficients, one of which is significantly different from zero at better than five per cent.

## 6. Conclusions

On the evidence yielded by our questionnaire, the firms most committed to worker participation are more efficient and apparently also more profitable than others. Their performance relative to low participation firms improved steadily over the period covered by our study, during which

time the adoption of participatory practices in Germany is known to have increased significantly. Thus it may be that within our sample the introduction of participation has been quite recent. If so, the effects we have observed are unlikely to capture the impact of participation in full. In particular, at least some of the high participation firms are likely to have been experiencing transactions costs from the transition to more worker involvement: developing and learning to operate new decision-making routines and so forth. Then our estimates of the impact on efficiency would contain a systematic downward bias.

Within a participatory setting, but not elsewhere, there are fairly strong indications that profit-sharing exerts a positive effect on productivity, and this is consistent with our arguments concerning patterns of social interaction and 'positive' versus 'negative' collusion in high versus low-trust environments. On the other hand, there does not appear to be a systematic reduction in worker alienation where participation is high, at least to the extent that alienation is accurately reflected in quit rates and absenteeism. However, in the light of previous findings, the fact that the larger, high-participation firms in our sample were not obliged to pay higher wages is one possible sign of lower levels of worker disaffection.

These findings result from the initial phase of a continuing programme of research and should be regarded as preliminary. Thus far, the effects of participation and its interaction with incentive payments which we have observed have been measured across a relatively narrow range of the spectrum from classical firms to full worker control. Moreover, we have so far relied entirely on management's assessment of the degree and nature of participation within the firms. In future work we intend to broaden the existing sample, both by the addition of on the one hand classical firms and



on the other hand a number of co-operatives, and by a separate, comparative analysis encompassing the experience of a number of European countries including France, Great Britain and Sweden. In order to help with the interpretation of our results we also require more information on the timing of the development of worker participation in individual companies. In further work we also propose to recognise explicitly the endogeneity of participation and explore its determinants. If, as we surmise, participation tends to be introduced as a managerial initiative to improve low productivity - and generally succeeds - our present estimates of the impact of participation on efficiency could be subject to negative simultaneity bias.

While a fully-fledged treatment of the welfare and policy implications of our work must await the outcome of further research, two points may be made at this stage. Firstly, our existing results are sufficient to render untenable the argument that worker participation, whatever its advantages in terms of human aspirations and quality of working life, comes at a high price in terms of resource costs and efficiency loss. Secondly, we wish to stress that participation, as we have observed it, both falls well short of worker control, and is quite distinct from what is formally provided for under German co-determination law. We know that the participation schemes amongst the firms in our sample are very varied and the result of individual initiatives. In view of the generally encouraging effects these individual social experiments appear to have had on average, it would seem important that future public policies intended to promote economic democracy should be carefully designed so as not to impose too regimented a model of participation on firms in general, but rather seek to create a favourable climate for a diversity of social experiments to be tried.

### Footnotes

- (1) See Garson (1977) on the politics thereof, and Vanek (1975), Steinherr (1977), Nutzinger (1977), Meade (1972) on the economics.
- (2) See Williamson, Wachter and Harris (1975), Stiglitz (1975), FitzRoy and Mueller (1977), Arrow (1974)
- (3) See Alchian and Demsetz (1972), who do briefly mention the "public good" benefits of loyalty and "team spirit", but fail to incorporate any aspects of these notions into their economic analysis.
- (4) German joint stock companies (Kapitalgesellschaften) are of two main types: Aktiengesellschaften (AG) and Gesellschaften mit beschränkter Haftung (GmbH). Both enjoy limited liability status. The AG companies are on average much larger, with assets of DM38.9m in 1977, compared with DM0.5m for GmbH's. But GmbH companies numbered 168,423 in 1977 compared with only 2,148 companies AG. Only the latter are eligible for stock market quotations, and less than 500 are currently quoted on German stock exchanges.
- (5) As it turned out this divided the sample exactly into two equal groups of 21, but this was fortuitous.
- (6) The relevant t values are                      and                      respectively, compared with a critical value of                      for                      degrees of freedom.
- (7) Except insofar as one effect of worker participation we may be witnessing is a constraint on the pursuit of growth as a managerial objective, as mooted by Baumol (1962), Marris (1964) and others, which growth could be excessive from the point of view of social welfare.
- (8) There were significant developments at the legal level over the period: the 1972 amendment of the 1952 Betriebsverfassungsgesetz (works constitution law), and the new co-determination law of 1976. The direct impact of the legislation on our firms would not have been very great (for example the 1976 legislation affects only firms with over 2,000 employees, of which there are only four in our sample). But the encouraging climate of opinion at the political level no doubt both reflected and reinforced a more positive attitude at the grass roots, especially among the member firms of the AGP. For a succinct outline of the West German law see Nutzinger (1977).
- (9) For a review of these and other issues, see for example, Heathfield (1971), Wallis (1973).
- (10) The Chow test simultaneously tests the hypotheses that

$$\ln A^{\text{High}} = \ln A^{\text{Low}}, \quad \beta_1^{\text{H}} = \beta_1^{\text{L}}, \quad \dots, \quad \beta_{27}^{\text{H}} = \beta_{27}^{\text{L}}.$$

The value of F is calculated as

$$F = \frac{(\text{RRSS} - \text{URSS}) / k + 1}{\text{URSS} / (n_1 + n_2 - 2k - 2)}$$

where RRSS is the restricted residual sum of squares, obtained from equation 2 of table 3, and URSS is the unrestricted residual sum of squares obtained by adding the residual sums of squares in equations 3 and 4.

## References

- ALCHIAN, A.A. and DEMESETZ, H. "Production, Information Costs, and Economic Organisation", American Economic Review, Vol.62, No.5 (December 1972).
- ARROW, K.J. The Limits of Organization, Norton (1974).
- BAUMOL, W.J. "On the Theory of the Expansion of the Firm", American Economic Review, (December 1962).
- BERNSTEIN, P. Workplace Democratization: Its Internal Dynamics, Kent State University Press (1976).
- ESPINOSA, J.G. and ZIMBALIST, A.S. Economic Democracy, Academic Press (1978).
- FELDSTEIN, M. "Specification of the Labor Input in the Aggregate Production Function", Review of Economic Studies, 34 (1967).
- FITZROY, F.R. and CABLE, J.R. "Economic Incentives and Social Interaction", IIM (1979).
- \_\_\_\_\_ and \_\_\_\_\_ "Incentives Participation and Productivity in German Firms", IIM (1978)
- FITZROY, F.R. and MUELLER, D.C. "Contract and the Economics of Organization", IIM (1977)
- FOX, A. Beyond Contract: Work, Power and Trust Relations, Faber (1974)
- FREEMAN, R.B. "Industrial Mobility and Union Voice in the Labour Market", American Economic Review, 66, 2 (1976).
- FURUBOTN, E.G. "The Long-Run Analysis of the Labor-Managed Firm: An Alternative Interpretation", American Economic Review, 66, No.1 (March 1976).
- GARSON, G.D. (ed) Worker Self-Management in Industry, Praeger (1977).
- GRILICHES, Z. "Production Functions in Manufacturing: Some Preliminary Results", in M.BROWN, ed., The Theory and Empirical Analysis of Production, N.B.E.R. (1967).
- GUSKI, H.G. and SCHNEIDER, H.J. Betriebliche Vermögensbildung in der Bundesrepublik Deutschland, D.V. Köln (1977)
- HACKMAN, J.R. and SUTTLE, J.L. Improving Life at Work, Good Year (1977).
- HEATHFIELD, D.F. Production Functions, Macmillan (1971).
- LUCAS, R.E.B. "Capacity, Overtime and Empirical Production Functions", American Economic Review (May 1970).
- MARRIS, R. The Economic Theory of Managerial Capitalism, Macmillan (1964).
- MEADE, J.E. "The Theory of Labour Managed Firms and Profit Sharing", Economic Journal (March 1972).
- NUTZINGER, H.G. "Co-determination in the Federal Republic of Germany: Present States and Perspectives", Economic Analysis, 11, 3-4 (1977)

- OAKESHOTT, R. The Case for Workers' Co-ops, Routledge and Kegan Paul (1978)
- PEJOVICH, S. (ed) The Codetermination Movement in the West, Heath, Lexington, (1978)
- SAMUELSON, P.A. "Thoughts on Profit Sharing", Zeitschrift für die Gesamte Staatswissenschaft, Special Issue: Profit-Sharing (1977).
- SCHERER, F.M. "Industrial Structure, Scale Economies, and Worker Alienation", Ch.6 in R.T.MASSON and P.D.QUALLS (1976).
- STEINHERR, A. "On the Efficiency of Profit Sharing and Labour Participation in Management", The Bell Journal of Economics (Autumn 1977).
- STIGLITZ, J.E. "Incentives, Risk and Information: Notes Toward a Theory of Hierarchy", The Bell Journal of Economics, 6, 2 (Autumn 1975).
- VANEK, J. (ed) Self-Management: Economic Liberation of Man, Penguin (1975).
- WALLIS, K. Topics in Applied Econometrics, Gray-Mills (1973).
- WILLIAMSON, O.E., WACHTER, M.L. and HARRIS, J.E. "Understanding the Employment Relation: The Analysis of Idiosyncratic Exchange", The Bell Journal of Economics (Spring 1975).