NBER WORKING PAPER SERIES

DOES PROFIT SHARING AFFECT PRODUCTIVITY?

Douglas L. Kruse

Working Paper No. 4542

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November, 1993

This study is based on research funded by the W.E. Upjohn Institute for Employment Research. Useful comments have been provided by Kevin Hollenbeck and the Institute staff, Joseph Blasi, Tom Clifton, Jeff Keefe, Mark Killingsworth, David Levine, Eric Schulz, Ted Shepard, Marty Weitzman, and Mike Zigarelli. Hsiu-Yu Lin and Arup Varma provided excellent research assistance. Errors are mine. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

Existing research tends to show that profit-sharing plans for employees are associated with higher company productivity and profitability, though the causality and mechanisms are unclear. This study uses new data from a survey of 500 U.S. public companies, and panel data on corporate performance, to examine the relationship between productivity measures and the adoption and presence of profit sharing. Controlling for a variety of influences on productivity, profit sharing adoption is found to be associated with average productivity increases of 4-5%, with no subsequent positive or negative trend. The productivity increase is dispersed; it is found to be larger for small companies and for cash plans, and to be unaffected when controlling for personnel policies which may affect productivity. There is, however, no evidence on the mechanisms through which profit sharing may affect productivity, since there are no strong interactions with information-sharing or other policies in affecting productivity.

Douglas L. Kruse
Institute of Management and Labor Relations
Levin Building
Livingston Campus
Rutgers University
New Brunswick, NJ 08903
and NBER

A. Introduction

Profit sharing has long been promoted as a way to improve company performance by tying the incentives of the employees more closely to those of the owners and managers. Such an incentive is theorized to encourage employees to put forth extra effort ("working harder"), or to develop ways to reduce costs or improve quality ("working smarter"). As a group incentive, it encourages such activity in cooperation with other employees. Such cooperation can be productive in itself, and encourage "peer pressure" or "horizontal monitoring" so that employees encourage better performance by their fellow employees.

Examples of profit-sharing plans exist from the birth of the U.S. The concept received support from 19th-century scholars such as John Stuart Mill, Charles Babbage, and Stanley Jevons. In the U.S. today an estimated one-sixth to one-fourth of employees participate in some form of workplace profit-sharing plan (BLS, 1990; Chelius and Smith, 1990; Chamber of Commerce of the United States, 1991). Outside of the U.S., profit sharing has been attracting strong interest and attention (Blanchflower, 1991; Uvalic, 1990; Perry and Kegley, 1990; Florkowski, 1991).[1]

This paper reviews theory and evidence on the relationship of profit-sharing plans to productivity, and presents new evidence based on a survey of 500 U.S. companies with publicly-traded stock. This survey includes detail on the features of profit sharing, and types of policies which may compete or interact with profit sharing in affecting productivity.

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[1] Evidence on the prevalence and trends in profit sharing is reviewed in Kruse (1993: 7-13).

B. Theory

The theory that profit sharing can raise productivity relies on the idea that supervision is costly. If it were costless, desired worker behaviors could be directly measured and rewarded, and the form of payment should not matter.[2] Compensation options in the presence of costly supervision include: 1) Piece rates, in which a portion of worker pay is tied to units of well-defined output (Lazear, 1986; Brown, 1990; Keefe, 1991). Drawbacks of piece rate systems include the possibility of excessive wear or misuse of capital equipment, and difficulty in setting appropriate piece rates (particularly in cases where worker collusion is possible)(Levine, 1992);[3] 2) Deferred compensation, in the form of a steeply-tilted tenure-earnings profile, or a pension with vesting and/or a final pay formula, which motivates employee effort out of concern to maintain the job (Lazear, 1979); 3) An above-market "efficiency" wage, to induce optimal employee effort motivated by the fear of being caught shirking and losing the wage premium (Akerlof and Yellen, 1986; Katz, 1987).

Finally, collective incentive schemes such as profit sharing are a fourth option in the presence of costly supervising. Bringing employee and employer incentives into closer alignment by tying a portion of pay to a measure of company performance, the employer may be able to lessen the principal-agent problems of costly supervision. Profit sharing may be a better than individual piece rates when: (a) output is not easily ascribed to an individual, that is,

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[2] If worker effort is public knowledge, profit sharing which is proportionate to individual effort can produce excessive incentives (Sen, 1966; Israelsen, 1980). For further discussion of alternatives under costly supervision, see Calvo (1987), Lazear (1992), and Parsons (1986).

[3] See Lawler (1971) for a summary of studies showing the development of adversarial relations between system designers and employees when piece rate systems are put into place.

production is interdependent and/or aided by worker cooperation; (b) setting piece rates is too costly; or (c) potential misuse or abuse of capital equipment is a concern.

The most serious problem with profit sharing as an employee incentive is that the fruits of any extra effort must be shared with all other workers in the plan. With N workers, each receives an average of only 1/N of any increased profits going to workers, leading to a very weak individual incentive as N grows large. This may be counteracted in part by an incentive to improve the performance of co-workers through, for example, sharing ideas, encouraging co-workers, or using ostracism, guilt, or shame (Kandel and Lazear, 1992). There may be gains to "horizontal monitoring" by co-workers, rather than by supervisors, since employees may have readier access to information on co-worker performance and efficiencies in the work process, and the appropriate information transfers may be more likely under a group incentive system (Fitzroy and Kraft, 1987; Nalbantian, 1987: 26).

While such considerations may mitigate the 1/N problem through enlarging the individual's range for affecting group performance, this problem would still be a strong deterrent to individual incentives. The 1/N problem may be seen as a classic "prisoner's dilemma" from game theory, where any one worker lacks sufficient incentive to work harder, though all workers may be better off if all put forward better performance. Several equilibria can develop in a repeated-game setting (or where the continuation of the game is uncertain), one of which is the establishment of a cooperative agreement to work harder and share the rewards (see, e.g., Fudenberg and Maskin, 1986; Axelrod, 1984). How this gets established and enforced, however, is not certain. Factors such as group size, history, criteria for membership, personal connections, task interdependence,

communication system, and physical environment may be important in establishing and enforcing a willingness to cooperate for higher performance. These considerations make it clear that a profit-sharing plan cannot simply be installed and expected to improve performance. "To get the productivity-enhancing effects, something more may be needed--something akin to developing a corporate culture that emphasizes company spirit, promotes group cooperation, encourages social enforcement mechanisms, and so forth" (Weitzman and Kruse, 1990: 100). The development and enforcement of worker norms supporting higher performance may be enhanced by empathy with coworkers (Kandel and Lazear, 1992; Lazear, 1992). Gross and Bacher (1993: 55) note the importance of a "supportive culture" in which "teamwork, trust, and involvement at all levels are important."

A different perspective is that group incentive schemes may motivate better performance by providing a psychological stake in the organization.[4] "Theories that suggest that workers' productivity is related to their sense of fair treatment imply that profit-sharing plans may still lead to an increase in productivity even when the individual's own effort has a negligible effect on profits" (Stiglitz, 1987: 66).

Two other issues raised by profit sharing are: managerial incentives to monitor workers, and worker self-selection into or out of profit sharing plans. Alchian and Demsetz (1972) argued that the optimal level of monitoring requires that the monitor receive the residual income (profits) from the activity being monitored. If profits are shared with workers, the incentive for monitoring

[4] "[I]n the absence of any relationship between the success of the organization and the pay of individuals, an important part of the business experience for the individual is missing. Everything known about motivation clearly points out that it is greatest when people have both a psychological and a financial stake in the organization's success" (Lawler, 1987: 85).

workers is diluted, and both owners and workers are hurt by the lower efficiency that results. This argument relies on several assumptions, including that there are no principal-agent problems between owners and managers, and that the decrease in monitoring by management will not be accompanied by an increase in workers monitoring each other.[5] As noted by Bonin and Putterman, this argument "is limited to the effects of a particular specification of property rights on incentives to monitor but not on the ability to observe accurately," and the advantages of concentrating residual claimancy "could be partly or wholly offset by reduced efficacy of monitoring . . [when] workers' real productivities cannot be easily observed from 'above'" (1987: 48). Reviewing the theory that central monitoring induces more optimal labor effort, Putterman and Skillman (1988) show how this is sensitive to compensation scheme, workers' risk preferences, and the informational content of monitoring, and conclude that

> closing the story which says that a particular assignment of residual rights will best elicit the desired monitoring effort remains a difficult challenge, especially if monitoring is itself difficult to observe and there are reasons why the monitor or monitors might want to misrepresent their information. (1987: 118)

Finally, what types of employees select into, or out of, profit sharing? Any differences in productivity associated with profit sharing may simply reflect the quality of workers selecting such plans. A priori, it is not clear that profit sharing would attract high-quality or low-quality workers: higher-quality employees should prefer performance-dependent compensation systems, but should be attracted to ones that are highly sensitive to individual performance, while lower-quality workers may be attracted to group-based systems in which the

[5] Alchian and Demsetz mention the "public good" benefits of loyalty and "team spirit," but these play no role in their analysis.

costs of shirking are shared with co-workers. Self-selection would also be affected by employee risk aversion--those who are averse to income variability will presumably tend to avoid compensation systems like profit sharing that have variable payments (balanced against the possibility of greater stability under Weitzman's (1984) theory). One piece of evidence on self-selection comes from Weiss (1987), who found that both the initially high and low performers were more likely to quit the company after their pay became tied to group incentives. Among those who stayed, the performance of the best and worst workers moved toward group averages, suggesting co-worker influence upon performance. This suggests that labor quality imparts no general upward or downward bias to estimates of the effects of group incentive systems.

C. Prior Research

The relationship between profit sharing and economic performance has been addressed in a variety of studies. These range from employee and employer attitude surveys, to comparisons of simple statistics, to formal econometric studies (see Kruse, 1993, and Weitzman and Kruse, 1990). The attitude surveys and simple statistical comparisons will only be briefly reviewed here. When employees in profit-sharing plans are asked for general opinions of profit sharing, or about the effect of profit sharing on individual and company performance, they strongly tend to respond favorably.[6] Similarly, employers who have adopted and maintained profit-sharing plans strongly tend to view it

[6]Bell and Hanson (1987), Colletti (1969), Jehring (1956), Opinion Research Corporation (1957), Industrial Participation Association (1984), Poole and Jenkins (1990). On the negative side, Bell and Hanson (1987) found that 42% of respondents from 12 British profit-sharing companies felt that profit sharing "can cause disappointment or resentment because profits can go down."

favorably.[7] Among the many biases in attitude surveys, the selection bias is strong here: employees who have chosen to work in profit-sharing companies, and employers who maintain profit-sharing plans, are clearly likely to view it positively.

In regression analysis, profit sharing was found to have positive effects on employer opinions on firm performance in Voos (1987), but not in Blanchflower and Oswald (1988). Simple statistical comparisons have shown that, relative to non-profit-sharing companies, profit-sharing firms had higher mean or median values on substantial majorities of performance measures (Howard and Dietz, 1969; Howard, 1979; Jehring and Metzger, 1960; Metzger and Colletti, 1971; Metzger, 1978; Bell and Hanson, 1987[8]). Case study material from the UK is more mixed: studying British enterprises that had either profit-sharing or employee-shareholding schemes, Poole and Jenkins (1990) find no clear evidence that these schemes reduce strikes or absenteeism, although they might reduce turnover (1990: 50). Also, Blanchflower (1991) found that worker attitudes about the quality of industrial relations were no more favorable among profit-sharing participants than among all private sector workers in the UK.

Formal econometric studies of profit sharing and productivity have been done only within the last twelve years. Profit sharing is generally measured as a dummy, dollar figure, or percent of compensation. Most are based on a Cobb-Douglas, CES, or translog production function, and attempt to control for other

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[7] Brower (1957), Knowlton (1954), Metzger (1966, 1975), New York Stock Exchange (1982), Nightingale (1980), Wider Share Ownership Council (1985), O'Dell and McAdams (1987), Smith (1986), Nickel (1990).

[8] Unlike the other studies, Bell and Hanson also included a longitudinal pre/post comparison of profit-sharing adopters, finding that performance improved in seven of nine measures. These data were re-analyzed with similar results in Hanson and Watson (1990).

firm policies or characteristics. Common problems include standard econometric difficulties of proper specification, the endogeneity of profit sharing, potential omitted variable bias, and possible bias from the use of financial rather than physical output measures (Gerhart and Milkovich, 1992).

A total of 26 econometric studies have been identified, with seven studies analyzing worker cooperatives, and the others analyzing capitalist firms in the U.K., France, West Germany, Japan, Korea, and the U.S.[9] Instrumental variables estimates of profit sharing were reported in six studies. Eight studies measured not just the direct effect of a profit-sharing variable on the productivity measure, but also the effect of profit sharing interacted with capital, labor, and other variables.

Overall, the prior results from econometric studies strongly indicate positive relationships between productivity and profit sharing. There are 265 reported coefficients on profit-sharing variables when interactions or lags are not included. Of these 265 coefficients, 8.7% take negative values, and only

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[9] The studies of cooperatives comprise Defourney, Estrin, and Jones (1985), Estrin, Jones and Svejnar (1987), Jones (1982, 1987), Jones and Pliskin (1991), and Jones and Svejnar (1985). Conte and Svejnar (1988) include both cooperatives and capitalist firms, while the studies covering only capitalist firms comprise Bhargava (1991), Bradley and Smith (1991), Cable and Fitzroy (1980a, 1980b), Cable and Wilson (1989, 1990), Cahuc and Dormont (1992), Carstensen Gerlach, and Hubler (1992), Cooke (1993), Fitzroy and Kraft (1986, 1987, 1992), Florkowski (1988), Kim (1993), Kruse (1988, 1992), Lee and Rhee (1992), Mitchell, Lewin, and Lawler (1990), Shepard (1986, forthcoming), and Wadhwani and Wall (1990).

Unlike the studies reviewed in Weitzman and Kruse (1990), this list does not include studies of productivity-gainsharing plans such as Scanlon and Rucker plans (Schuster, 1983, 1984), and IMPROSHARE (Fein, 1981; 1983; Globerson and Parsons, 1987; Kaufman, 1992). For gainsharing case studies see the meta-analysis in Bullock and Tubbs (1990), as well as Robertson and Osuorah (1991), Markham et al. (1992), Masternak (1991/92), and Masternak and Ross (1992).

two of these are significantly different from zero,[10] while 57.4% take positive values that are significantly different from zero ($p<.05$). The positive association between profit sharing and productivity was also reflected in the specifications with interactions and lagged values.[11] If the true relationship between profit sharing and productivity is zero, and the coefficients represent an unbiased sample of estimates of this relationship, the odds are infinitesimally small of finding such positive coefficients (as indicated by a variety of meta-analyses)(Weitzman and Kruse, 1990: 138). There is clearly no guarantee that this is an unbiased sample of such estimates: as noted by Card (1990), both the stopping rules for specification search (Leamer, 1978) and publication bias (Berlin et al., 1989) may favor positive and statistically significant results.[12] The wide range of data sources and empirical techniques employed, plus the fact that profit sharing was not the primary focus of several of the studies, reduces the likelihood that the positive results are purely an artifact of stopping rules and publication bias.

While indicating a positive association, these studies provide very little information on possible mechanisms through which profit sharing may affect productivity. The idea that the productivity effects are labor-embodied is

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[10] The two significant negative coefficients, in Carstensen et al. (1992), use profit share divided by profits in predicting value-added. The authors note that this measure is contaminated by the influence of productivity on the denominator of the measure, and the opposite result is obtained (with significant positive coefficients) when profit sharing is measured as profit share per employee.

[11] Of the eight studies reporting interactions, six indicate that profit sharing is associated with higher productivity at mean values of the interacted variables. Bradley and Smith (1991) report positive effects only for small firms, while Jones and Kato (1992b) indicate positive effects only when combined with employee ownership.

[12] Of the 26 studies, 16 had been or are being published.

supported by Shepard (1986). Positive effects on worker behavior are reported by Wilson and Peel (1991), who find that profit sharing is associated with significantly lower absenteeism and quits. The idea that worker participation in decisions may increase the positive effects of profit sharing is supported by Cable and Fitzroy (1980) (who find a positive, significant coefficient on profit sharing only in "high-participation" firms) but not by Jones and Pliskin (1991) (who find no positive interactions between profit sharing and worker membership on boards of directors). The idea that it may be most productive in small companies is supported by Bradley and Smith (1991).[13]

Therefore prior research indicates a good likelihood that profit sharing is positively related to productivity, but the causality has not been well disentangled (most employ cross-sectional but not longitudinal comparisons). In addition, these studies provide very little evidence on the mechanisms by which this may happen. This study will build upon this research by intensively analyzing the effects of profit-sharing adoption and presence, and the role played by different plan types, formulas, firm sizes, and information-sharing and personnel policies.

D. Dataset

For this study, 500 companies were surveyed to collect information for testing profit sharing theories.[14] The survey was limited to those with publicly-traded stock, to ensure that longitudinal information on company

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[13] Additional evidence comes from Smith (1992), who examines financial performance of Italian cooperatives and finds it to be higher among firms which stress production knowledge of employees, high quality products, and specialized corporate alliances.

[14] The survey form is reproduced in Kruse (1993: 179-186).

performance would be available. Firms with profit sharing were oversampled, in order that they would constitute one-half of the final sample. An attempt was made to pair each firm surveyed in the initial sample with a firm of the opposite profit sharing status in the same (2-digit SIC) industry. For example, for each profit-sharing food processor, an attempt was made to find a non-profit-sharing food processor to act as a paired control. This could be done for 410 of the surveyed firms (creating 205 pairs). Comparison of characteristics between the within-industry pairs will automatically control for any industry effects on those characteristics.

Each company was asked "Does your company have a profit sharing plan for employees other than top management?" If the response was positive, the company was treated as a profit-sharing company, and a series of questions elicited information on the features and coverage of the plan.[15] The resulting sample of profit-sharing companies may be over-inclusive, since it includes whatever type of plan is viewed by the employer as profit sharing (even if there is little or no de facto relationship to profits). The advantage is that it allows analysis of what goes under the name of profit sharing in the U.S., with additional data to distinguish plans by profit sharing formulas and features. The lack of a strict definition matches the practice of the Profit Sharing Council of America, a non-profit association representing U.S. companies practicing profit sharing.[16]

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[15] For respondents who inquired about the definition, a profit-sharing plan was defined as one in which employer contributions to the plan are based at least in part on the financial performance of the company (profits or some other company-wide indicator such as total revenues).

[16] The Council promotes plans that give employees "a direct stake in profits," but notes that "profit sharing is an extremely adaptable and flexible invention" and "there are many variations among

Companies were surveyed by telephone, with a follow-up written survey to collect additional information from profit-sharing companies. The sample frame was those companies on the 1990 CompuStat tapes that reported at least eight years of employment data in the 1980-89 period. These were ordered by industry, and a systematic sample was drawn to ensure a representative distribution across industries. At least one attempt was made to contact 906 companies. After excluding firms which could not serve as a paired control (n=55), were out of business (n=3), or had disconnected numbers (n=36), interviews were completed with 500, for a response rate among contacted firms of 61.6%.[17]

The initial sample (prior to the attempt at pairing[18]) contained 275 firms, of which 112 (or 40.7%) reported having a profit sharing plan for employees other than top management. As shown in Table 1, these 275 firms collectively employed slightly over 6 million employees in 1990, among which there were an estimated 2.3 million profit-sharing participants. The industry distribution shows the highest concentration of participants in durable manufacturing (47.7%) and the lowest in utilities (6.3%). The overall numbers match other survey data on the prevalence of profit sharing in public companies (Mitchell, Lewin, and Lawler, 1990; Smith, 1988; Bradley and Smith, 1992).

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individual plans as to how company contributions are determined, credited to participants' accounts, [and] distributed" (PSCA, 1984: 8, 10, 16). The PSCA membership exhibits this diversity in plan types and formulas (PSCA, 1989).

[17] Unsuccessful contacts included 115 refusals and 197 cases where repeated attempts to locate and talk to the appropriate person were ultimately unsuccessful. Analysis of sample selection based on 1989 and 1990 financial variables revealed no strong predictors of response likelihood (available on request). Inverse Mill's ratios based on survey response were included with all reported results.

[18] Including the contacts during the attempts at pairing would induce a bias in the representativeness of the firms, due to the stopping rules for pairing.

Insert Table 1

The survey results are summarized in Table 2, including the mean values and t-statistics for within-industry paired differences (representing the profit-sharing firm's value minus the non-profit-sharing firm's value). The average percent of employees covered was 78.5% (with 40% covering all employees). The likelihood of having a union is slightly lower among profit-sharing companies, and 45% of unionized profit-sharing companies include a majority of union members in the plan. The personnel policies which may compete or interact with profit sharing (defined in Table 6) have similar prevalence in profit-sharing and non-profit-sharing companies--the exception being a slightly higher likelihood of job enrichment programs in profit-sharing companies. Over half of the profit-sharing plans were started in the past 20 years. There are no strong differences in size (measured as employment or sales).

Insert Table 2

E. Estimating the Productivity Effects of Profit Sharing

This study uses a translog production function to model the determinants of productivity, with variables added to capture the potential effects of profit sharing, other company programs or policies, and industry time trend effects. Two measures of productivity are employed: sales per employee, and value-added

added per employee.[19] Two ways in which profit sharing may affect productivity are examined. First, profit sharing may have an simple effect on the productivity level, implying an upward or downward jump in productivity when profit sharing is adopted. Second, profit sharing may have an effect on productivity growth after adoption--possibly a positive effect if employees gradually learn how better to cooperate and improve performance, and possibly a negative effect if workers' initial optimism is unfulfilled and they gradually return to pre-adoption levels of performance.

The potential effects of several other firm characteristics are included in all specifications. Employee Stock Ownership Plans (ESOPs), defined benefit pensions, and unions may all have independent effects on productivity, and their omission could lead to biased estimates of the effect of profit sharing.[20]

The estimating equation is based upon the first terms of a translogarithmic

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19 Adjusting sales for inventory change was found to produce no difference in results (the unadjusted data are used due to missing data on inventories). Value-added was calculated as Sales - (cost of goods sold - labor costs - rental expense). Labor cost data are not reported by most publicly-held companies. Where labor cost data were not available, the value was imputed using a regression of ln(labor costs) on natural logarithms in t and t-1 of industry compensation per employee (from the National Income and Product Accounts), sales, and employment levels, plus eight industry dummies. Predictions from the regression (which had an R-squared of .982) were inserted into the above equation for firms that did not report labor expenses.

20 For research on the productivity effects of ESOPs see Conte and Svejnar (1990), of pensions see Clark (1987) and Gustman and Mitchell (1991), and of unions see Hirsch (1991).

All specifications account for the adoption and subsequent trend effects of defined benefit pensions and ESOP's, and the trend effects of unions. The variables representing defined benefit plans and ESOPs were constructed from the 1988 Form 5500 pension tapes, which includes both the beginning year and the number of participants in these plans. Companies were only asked about union status at the survey date; the gains from identifying changes in union status were felt to be very small.

production function, augmented to include profit sharing, defined benefit pension, and ESOP variables (alone and interacted with time trends), union and year dummies, and industry time trends. Ln(L) was subtracted from both sides, so that the dependent variable is the natural logarithm of output per worker.[21] To remove the effects of any unobserved variables that may be in a firm-specific fixed effect, the specification is first-differenced so that all measured values represent the difference between t and t-1. This results in the estimated equation, where δ is the first-difference operator and individual company subscripts have been suppressed:

$$
\begin{aligned}
(1)\quad \delta Ln(Q/L) = {} & (\beta_1-1)*\delta Ln(L) + \beta_k*\delta Ln(K) + \beta_{ll}*\delta[Ln(L)*Ln(L)] + \\
& \beta_{kk}*\delta[Ln(K)*Ln(K)] + \beta_{kl}*\delta[Ln(L)*Ln(K)] + \\
& \beta_p*\delta PS + \beta_{pt}*PS_t + \beta_d*\delta DB + \beta_{dt}*DB_t + \\
& \beta_e*\delta ESOP + \beta_{et}*ESOP_t + \beta_u*Union + \\
& \beta_i*I + \beta_y*Y + e
\end{aligned}
$$

where Q = output, alternatively measured as sales and as value-added
L = total employees
K = capital stock
δPS = adoption of profit-sharing plan between t-1 and t
PS_t = presence of profit-sharing plan in t
δDB = adoption of defined benefit pension plan between t-1 and t
DB_t = presence of defined benefit pension plan in t
$\delta ESOP$ = adoption of ESOP between t-1 and t
$ESOP_t$ = presence of ESOP in t
Union = Union presence
I = vector of industry dummies
Y = vector of year dummies
e = error term

The key parameters of interest for this study are β_p and β_{pt}, which can

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21 While measurement error in ln(L) will bias coefficients on the independent variables using ln(L), the results for profit sharing were found to be nearly identical when ln(L) was not subtracted from both sides.

be interpreted equivalently as measures of profit sharing presence and trend effects on productivity levels, or as measures of profit sharing adoption and profit sharing presence on productivity growth. The reported results have had the upper 1% and lower 1% of productivity changes trimmed, to remove any undue influence that these outliers may have upon the results.[22]

Several alternatives to the above specification were tested. A random effects model, in which the firm-specific effect is treated as a random variable, was tested but rejected (Hsiao, 1986: 32-47).[23] There may be lagged effects of changes in capital and labor terms, but a number of experiments with alternative lag structures on these terms produced very minor differences in the profit-sharing coefficients. Autocorrelation of the error term was tested and rejected.

Adoption of profit sharing may be accompanied by accounting changes, company mergers, or acquisitions, any of which could impart a bias to the estimated profit-sharing effects. Both events were less common in adoption years than in the sample as a whole, and the results were not noticeably influenced

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22 The basic results in Table 3 are not substantially affected by inclusion of the outliers, or by use of a robust regression technique that gives smaller weight to outliers (Rousseeuw and Leroy, 1987). When all observations are included in the specifications reported in Table 3, the estimated effects of profit sharing adoption with equally-weighted observations are slightly larger (between .034 and .055), and with robust regressions are slightly smaller (between .032 and .037), and all are significant at $p<.05$ or $p<.01$.

23 Consistency of results depends on orthogonality between the random effects and other regressors, which was strongly rejected by the data. When using random effects specifications, the results indicated much larger effects of profit-sharing adoption (e.g., using sales per employee as the dependent variable on the full sample, the coefficient on profit sharing adoption was .112 with a t-statistic of 6.29).

by these events.[24]

Estimation of the effects of profit sharing in non-experimental data is clearly subject to selection bias in the adoption decision (see, e.g., Heckman, 1976, 1979, 1990; Maddala, 1983; Heckman and Robb, 1985; Manski, 1989; and Heckman and Hotz, 1989). Four broad types of selection bias will be described here. First, the simplest and clearest form of selection bias is when companies with pre-existing high productivity are more likely to select profit sharing. Second, the companies selecting profit sharing may have been on an upward growth path in productivity, and profit sharing may have played no role in stimulating the higher growth. These two forms of selection bias are controlled by comparing multiple observations on pre-adoption and post-adoption productivity levels and trends, as is done here with the panel data.

Third, profit sharing adoption may reflect other changes at the time of adoption, and these other changes may be responsible for any observed productivity changes. This potential bias is partially addressed by asking the firms about the existence and duration of other policies that may affect productivity, and by analyzing responses to an open-ended question about any significant changes in other policies that accompanied profit sharing adoption. It is nonetheless possible that, at the time of profit sharing adoption, the company was undergoing other changes in financial and organizational structure that were responsible for any changes in productivity.

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[24] For the sample used in regression 1 of Table 2, an accounting change was reported in 2.4% of the adoption years compared to 2.5% of all observations, while a merger or acquisition was reported in 6.1% of adoption years compared to 12.4% of all observations. Tests were made alternatively excluding these observations, and including them with variables representing the events, and the results were nearly identical to those reported in Table 2.

While these three forms of selection bias address ways in which profit sharing may mistakenly be concluded to have a true effect on productivity, a fourth form addressed here posits that profit sharing may in fact have a true effect on productivity, but this effect varies across firms. The incentive to adopt profit sharing is clearly strongest where it is expected to have the most impact--reflecting, perhaps, a particular organizational structure, culture, or history into which profit sharing meshes well. This implies that, even though profit sharing may have helped fuel a productivity increase in some companies, this result cannot be generalized (since it would be much smaller or nonexistent in other companies). If this were the case, it would nonetheless be of interest that profit sharing helped productivity in some companies, and investigation of the circumstances that created this effect would be valuable to study.

These latter two forms of potential selection bias were addressed in a variety of ways, including instrumental variables, the addition of selection terms to the equation, and other techniques. These tests, discussed in the appendix, had no substantial differences in conclusions. The reported results include an inverse Mill's ratio based on factors predicting adoption, restricting the sample to the years 1977 to 1991.[25] A secondary reason for such a restriction is concern about the accuracy of data on adoptions reported this long ago (in particular, there are sharp upward spikes in reported ages of "15" or "20" years, which are likely to represent convenient targets for those who are not certain).[26]

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[25] The coefficients on this term, which were never significantly different from zero, are not reported but are available.

[26] Results employing the entire 1970-91 panel, without the selection term, were similar to those reported but indicated slightly lower effects of profit-sharing adoption (as would be expected if measurement error is greater for the adoption dates of these earlier

F. Do Profit Sharing Adoption and Presence Affect Productivity?

Results of the basic specification are presented in Table 3. To provide a picture of the productivity path before and after adoption, the dummy variable for the year of profit sharing adoption is accompanied by three dummies for the years preceding adoption and three dummies for the years following adoption. Focusing first on the year of adoption (line 4), the first column indicates that the adoption of profit sharing was accompanied by an estimated 4.2% increase in sales per employee (significant at $p<.01$). The comparison of within-industry pairs in column 2 is almost identical for this productivity measure (4.6% increase significant at $p<.05$). Columns 3 and 4 measure productivity as value-added per employee, where it can be seen that the unpaired results show an estimated 5.1% increase ($p<.01$) and the paired results an estimated 4.7% increase ($p<.05$), for profit-sharing adoption.

Insert Table 3

The productivity changes in the three years following adoption (lines 5 to 7) are close to zero and not significantly different from zero, indicating a plateau effect in which productivity levels are maintained after the upward jump. The pattern prior to adoption, however, indicates several statistically significant changes. Each of the regressions indicates a decrease in productivity two years prior to adoption (significant at $p<.05$ only in column 2), and each indicates an increase in the year preceding adoption (significant at $p<.05$ in columns 3 and 4).

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plans).

The productivity path of adopters is illustrated in Figure 1.[27]

Insert Figure 1

There are two things to note about the productivity path prior to adoption. First, it does not indicate that the adopters had generally faster growth in productivity. Second, the decrease in productivity in the second year preceding adoption raise the question of a statistical regression threat to validity--the subsequent increases may simply represent "rebounding" from poor performance. This appears unlikely, however, given that the subsequent increases put productivity at higher levels than in the pre-adoption period (after accounting for the effects of all other variables in the model).

Does every adopter of profit sharing experience a productivity increase? No. While the average productivity increase in the year of adoption is about 4%, between one-fourth and one-third of the adopters had no productivity increase beyond that predicted by the other factors in the equation, and the dispersion of outcomes was just as large for the adopters as for the non-adopters.[28]

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[27] The same pattern was evident when regressions were run without the profit-sharing variables, and mean and median residuals were examined around the time of adoption. This technique has the advantage of providing a conservative estimate of the effect of profit sharing, since any collinearity between profit sharing and other variables is attributed to the other variables. The mean residuals for profit-sharing adopters in their year of adoption were: 3.9%, 4.0%, 4.0%, and 3.4%.

[28] Regressions were run without profit-sharing variables, as described in the previous footnote, and residuals were analyzed for years in which profit sharing was adopted. In the four specifications, the percentages of profit-sharing adopters with positive residuals were, respectively: 69.5%, 72.7%, 60.0%, and 68.2%. Of the adopters, the lower quartile of residuals at the time of adoption ranged from -1.1% to -3.7%, while the upper quartile ranged from 10.2% to 12.2%. The dispersion of the residual was equivalent between the entire

Adoption of defined benefit pensions and ESOPs are both associated with small productivity increases (about 0.9% to 2.9% for defined benefit pensions, and 0.2% to 1.3% for ESOPs), but these estimates are not significantly different from zero. Union presence is estimated to decrease growth in sales per employee by about 0.1% to 0.8% per year, but this effect is also not significantly different from zero.[29] The capital and labor terms of the production function are strong predictors of productivity changes.[30]

It is notable that the estimated increase in productivity when profit sharing is adopted--an average of 4.5% across the four estimates--is remarkably close to the median estimate of effect sizes from other studies. The 16 studies surveyed in Weitzman and Kruse (1990) were analyzed for the estimated productivity differentials associated with profit sharing--the median estimate was 4.4% (with a mean of 7.4%, and lower and upper quartiles of 2.5% and 11.0%). As noted there, "Such estimates strike us as reasonable--they are neither so small as to be negligible, nor so large as to be implausible when adjustment

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sample and the observations representing profit-sharing adoption. For regression 1, the standard deviation of the residual for the entire sample was .101, and the inter-quartile range was .103 (from -.051 to .052), compared to figures of, respectively, .115 and .126 for the profit-sharing adoption observations.

29 Hirsch (1991) finds that slower growth in productivity among unionized firms in the 1970's and 1980's is mostly due to industry differences; he concludes that "we cannot reject the hypothesis that unions, on average, have little direct effect on productivity and productivity growth" (1991: 111).

30 See Jones and Pliskin (1991) for estimation of profit sharing effects in a translog production function. In the results presented here, coefficients on the terms including labor will be biased if there is measurement error in employment levels, since employment also appears in the denominator in the dependent variable. This does not, however, bias the profit sharing coefficients; results for the variables of interest were equivalent when employment levels were not in the denominator of the dependent variable.

costs are considered" (1990: 138-9).

G. Do Cash and Deferred Plans Have Different Effects?

It is often theorized that cash plans will be more effective motivators for employees, since they provide more immediate rewards. Within this sample, when asked about motives for maintaining profit sharing, the average expressed importance of "motivating existing employees" was higher for firms maintaining any cash plans than for firms maintaining only deferred plans.

This theory is supported by the results in rows 1 to 4 of Table 4, where profit sharing is separated into cash plans and deferred plans.[31] The adoption of cash profit sharing is predicted to increase sales per employee by 3.5% and 6.5% in the first two regressions (line 1), both effects being significant at the 95% level. The estimated adoption effects are similar in size (3.6% and 4.3%) when productivity is measured as value-added/employees, but the latter result is not significantly different from zero. The post-adoption trend effects are not significant.

Insert Table 4 here

None of the coefficients on adoption of deferred plans (line 3) indicate a statistically significant change in productivity. The first three columns indicate positive effects of 0.9% to 1.8% from adopting deferred profit sharing, while the fourth column indicates a small decrease. The trend effects are all

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[31] Combination plans are included with cash plans since they both contain cash elements which provide immediate rewards to employees. The reported regressions include separate inverse Mill's selection terms for cash and deferred plans.

positive, and one is significantly different from zero.[32]

H. Does the Profit Sharing Formula Matter?

There is no set formula among profit sharing plans for how the company's profit sharing contribution should be tied to profits. Several common formulas follow, along with the percentage of respondents using these formulas from the Profit Sharing Council of America (PSCA, 1989), and the percentage of participants in deferred plans that use these formulas (BLS, 1990):

	PSCA	BLS
Specific percentage of profits	17%	10%
Specific percentage of profits in excess of amount reserved for return on stockholder equity	11%	
Sliding percentage based on profits, sales, or return on assets		18%
Percentage of participants' pay	12%	
Specific percentage of profits plus a discretionary amount	7%	
Discretionary amount	46%	40%

Tying the formula to a specific percentage of profits is clearly the most straightforward way to link employee rewards to the performance of the firm, and should therefore have the greatest effect on employees. The absence of a formula--where the employer can simply determine a discretionary amount--is popular, and is not straightforward to analyze. There is no guarantee that higher profits will result in higher profit sharing payments, so that the

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32 These magnitudes are lower than those from my previous analysis of deferred plans using administrative data and similar specifications (Kruse, 1992), in which the estimated effects of plan adoption were in the range of .025 to .028. The results presented here are based on a smaller sample size, and are more prone to a downward bias from measurement error.

incentive effect would appear very weak. In any given period, a firm maximizing short-run profits for investors would clearly have an incentive to provide no profit-sharing payment to employees. The fact that these plans are maintained, however, clearly indicates that firms see them as useful and do make contributions to them. There may be a strong relationship between profits and contributions to these plans, so that these may clearly be de facto profit sharing plans even if there is no formula tying payments to profits.

The formula that appears least consistent with profit sharing is making profit sharing payments a fixed percentage of participants' pay. Taken literally, this implies that "profit sharing" payments have the same relationship to profits as do fixed wages, so that there is nothing distinctive about them as a form of compensation.[33] Presumably these are called "profit sharing" payments so that they may be cut more easily than wages when the company is undergoing financial difficulties. This implies, however, only a very weak relationship to profits. Any productivity effect would therefore be expected to be much weaker or nonexistent.

Profit sharing firms in the survey being analyzed here were asked for the method by which profit sharing payments were determined. The breakdown of methods (for 163 plans in 124 companies reporting) was the following:

1. Specific percentage of profits	19.6%
2. Specific percentage of profits in excess of amount reserved for dividends or retained earnings	3.7%
3. Fully discretionary	22.1%
4. Specific percentage of profits plus	

[33] While there is no direct contingency between fixed wages and profitability, fixed wages may have an element of profit sharing by being affected by company profitability (as posited by rent-sharing theories). For a review and some evidence, see Blanchflower et al. (1992).

discretionary amount	4.3%
5. Specific percentage of participants' pay	30.1%
6. Other	34.4%

(Total exceeds 100% because more than one method could be listed for each plan)

These responses were classified into four categories so that the relationship to productivity could be analyzed: a) payments linked to specific percentage of profits (1, 2, and 4 from above); b) payments that are fully discretionary (3 from above); c) payments that are a specific percentage of pay (5 from above); and d) payments determined by "other" method (the variety prevented any neat classification).

Of the profit-sharing firms, 90 provided data on yearly profit-sharing contributions as a percentage of participants' pay, with a mean of 7.4% and median of 4.0%. The correlation between year-to-year changes in contributions and changes in profits per employee was -.017 when a percent-of-pay plan was in place, and .101 when a percent-of-profits plan was in place ($r=.101$); somewhat unexpectedly, the correlation was highest for discretionary plans ($r=.220$).[34] Therefore discretionary plans may operate as de facto profit-sharing plans.

The results of estimating separate productivity effects for different formulas are summarized in rows 5 to 12 of Table 5, based on: 30 companies that maintained percent-of-profit plans (15 adopted in sample period), 20 companies

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[34] The sample sizes are, respectively, 120, 93, and 152. If contributions were closely tied only to profits/employees, the correlation should be close to 1.0. The existence of other factors in the formula, and the use of other measures of profitability (including thresholds that must be met before contributions are made), account for the low correlations. When profit margin rather than profits/employees is used, the correlation for percent-of-profits plans is .124, for discretionary plans is .096, and for percent-of-pay plans is .061.

that maintained discretionary plans (11 adopted in sample period), 23 companies that maintained percent-of-pay plans (12 adopted in sample period), and 46 companies that maintained plans based on other formulas (27 adopted in sample period). Clearly the small number of plan adoptions in the sample period limits the ability to obtain consistent estimates.

Plan adoption is positively related to productivity for all four methods, (rows 5, 7, 9, and 11), with the only negative estimate appearing for percent-of-pay plans (in row 9, column 3). However, most estimates are not significantly diifferent from zero. The most favorable results appear for discretionary plans: in three of the regressions, the adoption of discretionary plans is associated with significant increases in productivity (of 7.8% to 10.5%). The only other statistically significant estimate is for the adoption of percent-of-profits plans (an estimate of 7.9%). Adoption of plans with percent-of-pay or other formulas is never associated with significant productivity changes. The estimates for the post-adoption trends are never estimated as significantly different from zero at the 95% level.

The pattern of results suggests that percent-of-pay plans do not have positive effects on productivity, since there is one negative estimate and no significant positive estimates. This is consistent with theory on a positive motivational role for profit sharing, since a fixed percent-of-pay has little or no relationship to profits. There are stronger indications that adoptions of percent-of-profit plans and discretionary plans have positive productivity effects--these coefficients are always positive and are statistically significant in several cases. The results are most favorable, somewhat surprisingly, for discretionary plans. The lack of a specific formula may seem to represent a strong drawback, since it leaves open the possibility that firms will share very

little with employees even when employees may have contributed to high profits. It is nonetheless possible that the employer's discretion may be used to more accurately reward employee efforts, in an atmosphere of high trust. As argued by Baker, Gibbons, and Murphy (1993), almost every objective performance measure is subject to contamination from influences other than the performance it is designed to measure. In the case of profit sharing, company profits are clearly influenced by a large variety of factors other than employee performance, such as capital investment, imports, managerial decisions, and regulations. Baker et al. note argue that an "implicit contract based on subjective performance assessments may augment or replace an explicit contract based on objective performance measurements" when the subjective assessment may provide a better measure of employee contribution to firm value (1993: 2). Noting that "trust between workers and supervisors is essential if subjective performance assessment systems are to be successful," Baker et al. show how an implicit contract based on subjective assessments can be enforced by the firm's concern about labor market reputation. This suggests the possibility that companies with high employee trust may be able to use discretionary payments to encourage and maintain high employee effort and commitment (which would be threatened if the employer, for example, paid very little in a year when employees have contributed to higher profits). Whether this is a realistic possibility for the results presented here cannot be addressed, due to lack of information on employee trust.

I. Does Company Size Matter?

The effect of a group incentive system such as profit sharing is strongly predicted to be dependent upon the size of the group. As described earlier, such systems have a 1/N problem (with N representing group size), in which the direct

individual reward from better individual performance becomes more diluted as the work group grows larger. This implies that profit sharing has more potential to be an effective incentive in a small firm, in which any one employee is more likely to have personal contact with top managers, and with a greater proportion of the workforce. Personnel policies may be more quickly established and adapted to maintain employee identification with co-workers and the company.

To the extent that personnel policies and information-sharing have large fixed costs, however, the establishment and maintenance of such policies may be done more easily, with a lower cost per employee, in a large company. In addition, larger companies may have more experienced employee relations staffs who are better able to coordinate profit sharing with other personnel policies. Finally, to the extent that worker behavior is affected not by the size of the performance-pay link, but instead by the existence of such a link, company size may not be a crucial variable, and large size may not be a strong disadvantage.

To examine the relationship of profit sharing and work group size, the sample of profit-sharing adopters was split into five groups.[35] These groups were defined by employment size at the time of profit-sharing adoption, for which the lowest decile, lower quartile, median, and upper quartile were, respectively, 775, 1681, 4599, and 17,600. These four cut-offs were used to create five groups, and the adoption and presence of profit sharing were interacted with group membership. In addition, the terms of the production function were interacted with group membership, to allow different production functions by group size. Because there were very few cases in which paired firms fell into

[35] Experiments were also made with squared and cubed terms for employment size, but results were sensitive to extreme values; the size classes are presented as a more a straightforward picture of different effects by size.

the same employment size class, reliable results for the paired regressions could not be obtained.

The employment size class results are in Table 5. In the smallest size class, the productivity effect of profit-sharing adoption is large and highly significant (11.1% and 17.2%, both significantly different from zero at the 99% level). The presence of profit sharing, however, is not estimated to have any significant effect on productivity growth. The second and fourth size classes show no significant coefficients on profit sharing adoption or subsequent trend, while the third size class shows a weakly significant ($p<.10$) estimate of a 4.2% increase in sales per employee when profit sharing is adopted, and a 2.2% trend in value-added per employee. The fifth and largest size class shows significant effects of profit-sharing adoption, of 6.9% and 5.8%.

Insert Table 5 here

The result that profit-sharing adoption is estimated to have the strongest productivity effects in the smallest size class is consistent with the above considerations about the 1/N problem and the relative ease of establishing a cooperative solution in a small work group. The result that smaller, but still highly significant, productivity effects are estimated in the largest size class is not consistent with these considerations. It may be that, as noted above, there are fixed costs in establishing and maintaining personnel policies that are conducive to a positive effect of profit sharing; therefore large companies may be more likely to have these in place or be able to adopt them along with profit sharing. In addition, the larger companies may have more experienced employee relations staffs. Finally, as discussed above, the existence of profit

sharing may create a psychological stake in the company apart from the direct financial stake, so that increased employer size may not be a strong liability. Therefore it is possible that these productivity jumps may be influenced by profit sharing adoption. Nonetheless, given the minute contingency between employee effort and profit share in large companies, and the small proportion of fellow workers with whom an employee would interact, it is difficult to believe that profit sharing adoption could help increase productivity by over 6% in such very large firms.

J. Does Size of the Profit Share Matter?

The size of the profit share in relation to other employee compensation should clearly be an important factor in the impact of profit sharing upon workplace relations and performance. A profit share that, for example, averages less than 1% of employee compensation is unlikely to be taken seriously by employees as an incentive for increased effort, monitoring, and cooperation with co-workers. What size is necessary to improve employee performance is an open question. For this study, profit-sharing firms were asked to provide the size of the employer's profit-sharing contribution as a percentage of participant payroll for the years 1975-90. Of respondents, 71 firms provided three or more years' worth of data, used to construct a within-firm average. These within-firm averages had a mean of 4.95, median of 3.63, and upper and lower quartiles of 1.98 and 7.35.

Entering the yearly bonus size as an independent variable would be strongly plagued by a simultaneity bias: an increase in productivity will clearly lead to larger bonuses in a given year, whether or not the bonus size has any direct effect on productivity. What is desired is a measure of company policy regarding

size of contributions--does the company intend profit shares to be a large chunk of employee compensation? To minimize the simultaneity bias, profit-sharing firms were divided into two groups: those with "high" and "low" average contributions (as percentages of payroll). The cut-off between these two groups was defined as the median average contribution of 3.63%. By not focusing on each year's bonus size and by using separate selection terms for the two groups, the simultaneity bias is minimized, and the membership in high- or low-contribution groups comes closer to a measure of company policy on size of profit shares in relation to compensation.[35]

If profit sharing does positively affect productivity, the effect is clearly expected to be larger where employees expect it to be a higher percentage of pay. The results (not presented in a table here) are consistent with this expectation. The adoption of a low-contribution plan is never estimated to have a significant association with productivity change, while the adoption of a high-contribution plan is estimated to have significant associations with 7% to 13% increases in productivity (with three of the four estimates in this small sample significant at $p<.10$).

K. Is Profit Sharing A Proxy for Other Company Policies?

A serious problem with non-experimental data is that the variable of interest may be strongly correlated with, and may act as a proxy for, other variables that affect the observed outcome. Firms that adopt profit sharing may also adopt a variety of other policies designed to improve company performance.

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[35] As noted in the appendix, the simultaneity bias can also be addressed through instrumental variables. As before, however, instrumental variables estimates produced implausibly large estimates of profit-sharing's effect.

If these do affect performance and are not measured in the equation, the profit-sharing coefficient may be unduly high due to omitted variable bias. In addition, profit sharing may be associated with differences in managerial quality, representing another possible omitted variable. This potential bias is a standard criticism of positive results for profit sharing in past research.

This section addresses whether profit sharing is simply reflecting other company policies or management changes that may in fact be the important influences on productivity, while the following section addresses whether such policies interact with profit sharing to influence performance.

The use of panel data to analyze yearly changes in productivity levels controls for the effects of any company characteristics, such as constant high-quality management, that affect productivity levels but do not change over time. The obvious case in which managerial quality may not be constant is where there is a significant change in management personnel. Profit-sharing firms in this study were asked "Was the profit-sharing plan adopted following a change in management personnel?" Of the 122 respondents, only four (3.3%) answered affirmatively, making it highly unlikely that the profit-sharing adoption variable is measuring significant changes in managerial quality.

The policies identified here as being particularly likely to compete or interact with profit sharing are those that seek to increase involvement of the employee in the company by tapping employee ideas, opinions, and decision-making skills. There has been substantial experimentation with such policies over the 1970's and 1980's (see, e.g., Lawler, Ledford, and Mohrman, 1989; Eaton and Voos, 1992). Such policies may improve company performance both directly--through making use of employee information and skills--and indirectly--by increasing employee identification with the company, which may reduce turnover and improve

both quality and quantity of work.

Survey respondents were asked about the presence, age, and coverage of seven company policies. Two policies that solicit employee ideas and opinions are employee surveys and suggestion systems. Three policies that seek to change the structure of work are job enrichment, self-managed work teams, and employee involvement programs such as quality circles.[37] Gainsharing plans represent an alternative group incentive system, typically increasing employee involvement in production decisions, and tying employee bonuses not to overall company performance but to more narrowly-defined group performance.[38] Finally, a formal policy of employment security attempts to increase employee identification with the company and willingness to share information.[39] The definitions provided to survey respondents of these seven policies were largely taken from the General Accounting Office's 1987 survey of employee involvement efforts in Fortune 1000 firms. These are presented in Table 6, with the percentages of profit-sharing and non-profit-sharing firms who maintain these policies in Table 2.[40]

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[37] For reviews of theory and research on worker participation experiments, see Gershenfeld (1987), and Levine and Tyson (1990). For their relationship to unions see Eaton (1992) and Eaton and Voos (1992). For research on on higher-level participation in the form of workers' councils, see Freeman and Rogers (forthcoming) and Addison et al. (forthcoming).

[38] For studies of gainsharing see the meta-analysis in Bullock and Tubbs (1990), as well as Schuster (1983, 1984), Robertson and Osuorah (1991), Markham et al. (1992), Masternak (1991/92), and Masternak and Ross (1992).

[39] For discussion of the relationship between employment security and firm performance, see Osterman (1987) and Ichniowski (1992).

[40] The percentages in Table 2 exclude "don't know" responses. Those who responded "don't know" for the existence of the policies were: 2.4% for attitude survey feedback, 5.6% for suggestion system, 5.2% for job enrichment, 3.8% for employee involvement groups, 4.0% for self-managed workteams, 2.0% for employment security, and 4.2% for productivity-related group bonuses. Also, the percentages of those

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Insert Table 6 here

Tests were made of the effects of the adoption and presence of these policies, alternatively using dummy variables and proportion covered for each of the policies.[41] The results are not presented in a table because they are so easily summarized in text: the profit-sharing estimates change negligibly with the addition of the other policy variables.[42] Estimates on the personnel policies are of interest in themselves. Across eight regressions, there is only one personnel policy coefficient significantly different from zero ($p<.05$, for a negative coefficient on job enrichment adoption in the paired value-added regression); given that 5% of coefficients are expected to be randomly "significant," no importance is attached to this. These results provide no clear evidence of productivity effects for these individual policies.[43] There is,

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responding that they had the policy but did not know its age were, respectively, 3.6%, 6.6%, 4.0%, 4.4%, 3.0%, 1.2%, and 5.4%.

41 While the rates of response on the individual policy questions were high (see previous note), a substantial number of the respondents answered "don't know" on the existence or age of at least one of the policy questions. Excluding these respondents greatly diminishes the sample size for the regressions. To maintain the sample size for comparability with previous results without providing bias to the reported coefficients, the "don't know" responses were coded as separate dummy variables. The coefficients on the "don't know" variables were uniformly small and statistically insignificant.

42 F-tests reveal that there were no significant changes in profit sharing coefficients from the results presented in Table 3.

43 These results cast doubt on the idea that any one of these policies in isolation can be expected to have an impact on productivity. However, it remains possible that some combination of these with other human resource policies may have consequences for firm performance. For evidence that such a combination may improve company performance, see Ichniowski (1990) and Huselid (1992). For discussion of how human resource policies can interact for better

however, clearly a problem of downward bias from measurement error here; respondents may have included very different programs under these categories.[44]

L. Does Information-Sharing Enhance Profit Sharing Effects?

While sharing sensitive business information with employees may have positive or negative consequences for the firm (see, e.g., Kleiner and Bouillon, 1988, 1991), it is commonly believed that profit-sharing plans have more positive effects when the companies make extra efforts to share information with employees. Such information-sharing is a plausible part of establishing and maintaining worker norms in the cooperative solution to the problem of dilution of individual incentives.

Survey respondents were asked, "About how many corporation employees, excluding top management, are routinely provided with: a. Information about the company's overall operating results; b. Information on business plans and goals; and c. Information on competitors' relative performance?"[45] From this the approximate proportions of employees provided with such information were constructed.[46] Mean comparisons (reported in Table 2) revealed that profit-

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labor-management relations and higher performance, see Ichniowski (1992).

[44] Knowledge of these policies may greatly differ by respondent position. The estimates were similar, though, when only Vice-Presidents of Human Resources, or other top corporate positions, were used.

[45] These questions were taken directly from the GAO survey of employee involvement in Fortune 1000 firms.

[46] The answer options were "none" (0%), "some" (1-40%), "about half" (41-60%), "most" (61-99%) or "all" (100%). The proportions assigned to each of the five categories were, respectively, 0, .20, .50, .80, and 1.0. While the use of categories produces some measurement error, this should not be systematic error. Following the GAO

sharing companies provided this information to, on average, a slightly higher percentage of employees, but none of the within-industry paired differences are statistically significant.

This section examines whether information sharing interacts with profit sharing in affecting company performance.[47] The three information-sharing variables are interacted with profit sharing and added to the standard productivity specifications. The results, in Table 7, include profit-sharing adoption and presence without the interactions; therefore the interaction coefficients represent productivity effects on top of the main (non-interacted) effect.[48]

Insert Table 7

Interactions of the first two types of information-sharing with profit sharing have no significant associations with productivity growth. The third type of information-sharing--on competitors' performance--has an intriguing interaction with profit sharing adoption in significantly increasing sales per employee, but no significant relationship with value-added per employee. This

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survey, categories rather than "exact" percentages were used to encourage a higher response rate.

[47] On the question of whether information-sharing itself affects company performance, Kleiner and Bouillon (1991) find that sharing of sensitive information is associated with lower profitability. The information-sharing measures in this study had no significant direct relationship with level or growth of either productivity measure.

[48] Including all interactions produces high multicollinearity among these variables, raising standard errors and making estimates less precise. To reduce the multicollinearity bias, each information-sharing interaction was entered separately in regressions, with similar results.

is the type of information that is least likely to be shared with employees by any firms, and with which there is the largest association with profit sharing (the within-industry paired difference from Table 2, while not significant, is that the percentage of employees provided with this information is 4.6% higher for profit-sharing). There is greater dispersion on this variable than on the first two types of information-sharing: of the firms that adopted profit sharing in the sample period, 96% shared each of the first two types of information with at least some employees, while only 70% shared information on competitors' performance with at least some employees. The results here provide some weak evidence that the productivity increases are greater for the profit-sharing adopters that share information with employees on competitors' performance. Given that this result is only strongly significant in one of the four regressions, and that the estimated effect sizes vary considerably, it is only suggestive.[49]

The lack of strong evidence that sharing these three types of information enhances the effects of profit sharing can be interpreted in several ways. First, and most obviously, it may be that information sharing does not interact with profit sharing to enhance performance. Second, it is possible that the information measured here is superfluous: the size of the profit share is an important signal of company performance, and there are many informal ways in which employees gain company performance information in their daily work (through news reports, union negotiations, existence and severity of layoffs, etc.).

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[49] When the interaction terms for the first two types of information were removed, the coefficients for the competitors' performance interaction term were .054, .150, .033, and .065, with the second of these being significant only at $p<.10$. Reducing multicollinearity therefore weakens the case that sharing this type of information has strong interaction effects with profit sharing.

Third, it is clearly possible that more detailed measures of information sharing--including not only different types of information but also different mechanisms for its distribution--would produce different results.

M. Does Profit Sharing Interact with Other Personnel Policies?

Profit sharing may need to be combined with other personnel policies to create group cooperation for improved company performance. Theory suggests the need for other policies to counteract individual disincentives in a group incentive plan, and case study material often emphasizes the importance of combining profit sharing with such policies (see, e.g., Doherty et al., 1989, for gainsharing case studies; more generally, see Huselid, 1992, and Ichniowski, 1992, on synergy amoung human resource policies). In general, the prescribed policies seek to tap the ideas and skills of employees, thereby increasing the involvement and identification of the employee in the workplace and company. The results of Fitzroy and Kraft (1987) support the idea that worker participation in decisions may enhance the productivity effects of profit sharing, while Quarrey and Rosen (1986), U.S. GAO (1987), and Rooney (1991) suggest that such participation may enhance the performance of ESOP companies.

Two types of data are used here to address the possibility of interactions between profit sharing and other policies. First, the seven personnel policies that were earlier analyzed as potential "omitted variables" in the productivity equations are tested for interactions with profit sharing in affecting performance. Second, profit-sharing companies were asked what other changes in personnel policies and compensation were made when profit sharing was adopted.

Profit-sharing companies were asked, for each of the seven personnel policies, what approximate percentage of the profit-sharing participants were

covered by this policy. The mean percentages covered (including zeros for those without the policy) are presented in Table 2 (e.g., among profit-sharing companies, an unweighted average of 21.6% of profit-sharing participants are covered by employee surveys). The proportion covered was interacted with the presence of both profit sharing and the personnel policy for each company in each year, and this was used to create variables for both the adoption and trend effects of combining profit sharing with a particular policy.[50] For example, the adoption of the interaction between employee surveys and profit sharing indicates that both were present in the given year, while at least one was not present in the preceding year. In addition to these interactions, the simple profit-sharing adoption and presence variables were included in the specifications.[51]

The results on personnel policy interactions with the profit-sharing variables are presented in Table 8. There is little support for the idea that these policies interact with profit sharing in affecting company performance. The simple (non-interacted) profit-sharing adoption coefficients are strongly

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[50] The interaction was first-differenced, so that the "adoption" of this interaction may signify either the adoption of profit sharing when the policy is present, or the adoption of the policy when profit sharing is present (separate tests on these situations produced no noteworthy differences in results). The trend effect of the interaction simply indicates that both profit sharing and the policy were in effect in that year. Note that the personnel policy variable is defined as the proportion of profit-sharing participants covered by this policy at the time of the survey--the technique employed here extrapolates this proportion back through the time that both profit sharing and the policy were in effect. The measurement error thereby created will bias the coefficients toward zero. Concerns about data quality and response rate precluded asking for detail on personnel policy coverage of profit-sharing participants in earlier years.

[51] In addition, tests were made using separate inverse Mill's ratios for the presence of each interaction in each year, but these provided consistently negligible coefficients and were dropped in the final specifications.

significant, and the majority of estimates do not indicate that these policies add to, or subtract from, the main effect. Employee involvement is the only policy that may interact positively with profit sharing, since it shows one weakly significant estimate ($p<.10$, in column 2) and the other estimates are all positive (unlike the pattern for all other interactions). Positive effects of such an interaction is consistent with case study material and prescriptive material emphasizing the importance of involving workers in decision-making, but the results here must be regarded as weak. There are two negative estimates of adopting profit sharing with an employment security policy, perhaps indicating that these policies were adopted when the firms were undergoing financial stress.

Insert Table 8

A finding reported earlier is that the positive adoption effects of profit sharing are concentrated among the very smallest and very largest firms. What personnel policies were in effect in these firms at the time of adoption? A comparison revealed no strong differences among the different size classes, casting further doubt on the idea that these policies (as measured here) have important interactions with profit sharing.

The presence of measurement error in these interactions will, as noted, bias the estimates toward zero. If there were a "true" positive effect of the interaction of profit sharing with a particular policy, though, it is likely that the pattern of estimates would remain positive. This pattern remains positive only for the employee involvement estimates; none of the others are uniformly positive across all four regressions, suggesting that it is unlikely a true

positive effect is being mismeasured.[52]

The second method for testing interactions between profit sharing and personnel policies relies on the survey question to profit-sharing respondents:

> When the profit-sharing plan was established, were any significant changes made in personnel policies or other compensation? (If yes: Please describe these changes.)

One-sixth (17.3%) of the profit-sharing respondents replied yes, one-fourth (26.0%) could not answer, and the remainder (56.7%) replied no.

The profit-sharing adoption and presence variables were interacted with two dummy variables indicating "yes" and "no" responses to the above question (excluding those who could not answer). The resulting variables were used in the productivity specifications in place of the standard profit-sharing variables. Estimated productivity growth is higher for profit-sharing adoption when significant changes had been made in personnel policies or other compensation. When such changes were made, the initial productivity effect of profit sharing is estimated as 6.1% to 7.5% (all significantly different from zero), while the corresponding estimates when such changes were not made were 0.8% to 3.7% (only two of which are significantly different from zero). All estimates for post-adoption trends in productivity were estimated as positive for both groups, though none were strongly significant.

The productivity increase appears to be higher when profit-sharing adoption is accompanied by other significant changes. What is the nature of these other changes? The 37 open-ended answers that were solicited from the respondents were coded in the following categories:

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[52] The multicollinearity of these variables will increase the standard errors of the coefficients. To reduce multicollinearity, the interactions were entered individually in the specifications, and the results were very similar.

Change in incentive plans:		
1.	Replaced a different incentive plan	7
2.	Added another incentive plan	2
3.	Combined or extended existing incentive plans	6
Changes in wages or benefits:		
4.	Replaced pension plan	2
5.	Established in lieu of wage increase	2
6.	Part of effort to reduce fixed costs	3
7.	Improvement in other benefit	1
8.	Technical changes in other benefits	6
9.	Part of labor negotiations	3
Other:		
10.	Part of new training program	1
11.	Part of new "working smarter" philosophy	1
12.	Company went public	1
13.	Company recovering from bankruptcy	1
14.	Part of a merger	1

This distribution of responses provides no clear pattern concerning the types of changes that may enhance the effectiveness of profit sharing. Changes in existing incentive plans were reported by 15 of the respondents (categories 1, 2, and 3 above). Changes in wages or benefits were reported by 17, with four of these changes representing unambiguous sacrifices by employees (categories 4 and 5). The combination of profit sharing with changes in non-compensation policies is clear only for the two companies in categories 10 and 11. While these responses provide a useful portrait of the circumstances under which profit sharing is adopted, there is no clear answer to the question of what types of policies may enhance the performance of profit sharing.

N. Summary and conclusions

Does profit sharing improve company performance? For over a century there have been claims that it does, by encouraging workers to cooperate with each other and management, share ideas and information, and monitor co-workers. This

theory has received new attention in the past two decades, partly due to the slowdown in U.S. productivity growth (which averaged only 1.2% per year in the 1970's and 1980's, after almost 3.0% per year between World War II and 1970).[53]

Research in the past 15 years has provided some support for the idea that profit sharing can improve corporate performance. Across 26 econometric studies, a majority of estimated coefficients (57.4%) between profit sharing and productivity measures have been positive and significantly different from zero. The majority of these studies, though, have not compared companies before and after the adoption of profit sharing, leaving open the question of causality.

This study used a new 500-company dataset--half with profit-sharing and half without, with same-industry pairs for 410 of the firms. A variety of specifications and variables was employed in attempting to gauge the relationship between productivity and profit sharing adoption and presence. The availability of panel data over the 1970-91 period made it possible to compare pre- and post-adoption performance on the adopters, and remove the influence of any constant factors that make one firm more productive than another (such as market placement or managerial quality). Regressions were run on all firms, and on paired differences between firms in the same industry, using two productivity measures, and a translog production terms with controls for union presence and the adoption and presence of ESOPs and defined benefit pension plans.

The adoption of a profit-sharing plan within the sample period was associated with a 4 to 5% increase in productivity, with no consistent estimate of an upward or downward productivity trend after adoption. The estimated effect sizes are very much in line with the productivity differentials estimated from

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[53] Economic Report of the President (Washington: U.S. Government Printing Office, 1992), Table B-44.

other studies. There was no automatic productivity increase, though, associated with profit-sharing adoption: across various estimates, between one-fourth and one-third of the adopters had no productivity increase beyond that predicted by other variables in the equation (in fact, outcomes were just as dispersed for adopters as for non-adopters, but were on average shifted in a more positive direction for the adopters).

A variety of factors are commonly believed to influence the potential impact of profit sharing. First, adoption of cash plans (which are generally seen as better motivators than deferred plans) is associated with larger productivity increases in all estimates. Second, plans that explicitly tie contributions to profits--as opposed to a percentage of pay, a discretionary amount, or another method--are believed to be better motivators. The inferiority of percent-of-pay plans is generally confirmed by the productivity regressions, although the results were more favorable for adoption of discretionary plans than for percent-of-profits plans. The correlation between changes in profits and profit-sharing contributions is actually slightly higher for discretionary plans than for percent-of-profit plans (while the correlation for percent-of-pay plans is close to zero).

Company size is strongly expected to be a factor in the effect of profit sharing on performance, since individual incentives should grow weaker as the number of employees who share in profits grows larger. Analysis of profit-sharing effects in five size classes gives anomalous results. The productivity effects of profit-sharing adoption are in fact largest, and most statistically significant, in the smallest size class (less than 775 employees). However, the other size class that attracts strongly significant, though smaller, coefficients is the largest (more than 17,600 employees). This is hard to reconcile with

considerations of individual incentives, though it may indicate that the presence of profit sharing is as important as the size of the performance-pay link, and large companies may be able to develop a "corporate culture" in which profit sharing is most effective.

The size of the profit share in relation to employee compensation is also commonly believed to be an important factor in its motivational potential. To attempt a measure of company policy regarding contributions, the profit-sharing sample was split into "high-contribution" and "low-contribution" groups based on the average contribution as a percentage of payroll. The estimates indicated more positive effects for adoption and presence of high-contribution plans.

Finally, this study addressed the questions of whether profit sharing may simply be a proxy for other personnel policies, and of whether profit sharing interacts with information sharing and other policies designed to make better use of employee ideas and skills. When the adoption and presence of seven other personnel policies were included in the productivity regressions, the profit-sharing coefficients were virtually unchanged, indicating that profit sharing is unlikely to be a proxy for these other policies. When profit-sharing adoption and presence were interacted with three types of information-sharing, and with coverage of profit-sharing participants by these seven personnel policies, there were no clear results indicating that these policies enhance or detract from the effect of profit sharing. The two possible exceptions were the provision of information on competitors' results, and inclusion of profit-sharing participants in employee involvement plans, both of which had patterns of positive interactions and had some weakly significant coefficients.

To more fully explore this question of interactions with other policies, profit-sharing companies were also asked whether the adoption of profit sharing

was accompanied by significant changes in other compensation or policies. One-sixth replied in the affirmative, and these companies had generally higher increases in productivity in the year of adoption. Examination of open-ended responses about the type of changes, though, gives no clear indication of what policies may interact with profit sharing: nearly half said that other incentive plans had been revised or dropped, and nearly half said there had been other changes in wages or benefits. Only one company reported a change in a policy other than compensation (a new training program).

What is the verdict on whether profit sharing improves performance? Different conclusions may reasonably be drawn from this array of data.

On the positive side, arguments in favor of profit sharing may be marshalled as follows: Adoption of profit sharing is statistically associated with significant average productivity increases, with no negative post-adoption trend. The productivity differentials are very much in line with results from previous studies. In line with expectations about the effect of profit sharing, these increases are found to be largest for cash plans, for small companies, and for plans with high average contributions, and nonexistent for percent-of-pay plans where the relationship to profits is the weakest. The positive results for discretionary plans may indicate that such plans can work in implicit contracts that better employee performance will be rewarded, enforced by the firm's labor market reputation. In addition, the positive results remain when controlling for other policies to solicit employee ideas, decision-making skills, and commitment, so prior results on profit sharing do not appear to be simply reflecting such policies. A variety of techniques to control for company self-selection into profit sharing did not weaken results.

On the negative side, skeptics of profit sharing may make the following

arguments: It is difficult to believe that profit sharing causes a single immediate upward jump in productivity, before employees have had a chance to become familiar with it. It takes time for people to learn how to work together cooperatively to improve performance, implying that the productivity effects should be more gradual. The existence of significant upward jumps in productivity even in the largest size class is very suspicious: it strains credulity to think that more than 17,600 employees can establish a cooperative solution to the 1/N problem in only one year. Discretionary plans should not be good motivators for employees, and the favorable results for them casts further doubt on the results. There is little clue as to what makes profit sharing "work": there were no apparent patterns of interactions between profit sharing, information sharing, and personnel policies. Finally, if profit sharing really caused upward jumps in productivity, it would be more widespread by now.

Much as it is tempting to offer a verdict on profit sharing and productivity, no definite one is possible. It is clear that, on average, companies adopting profit sharing have an upward jump in productivity relative to their peers, but it is not clear why. This study has employed more detailed data surrounding the adoption and presence of profit sharing than have past studies, and has identified several features of plans that are associated with higher productivity, but has not identified company characteristics that help profit sharing "work". The wide dispersion in results for adopters makes it clear that there is no automatic productivity increase. If profit sharing does in fact affect productivity, it may be that it has no simple direct effect on the quality and quantity of employee work; rather, it may interact (possibly in subtle ways) with the myriad of other influences on productivity to shift the overall results slightly in a positive direction (e.g., profit sharing may cause

less employee resistance to productivity-enhancing technological change). The conditions that determine how employees receive and respond to profit sharing (e.g., "corporate culture", trust in management, and history of employee relations) may be highly specific to each workplace.[54]

[54] For discussion of implications for companies, unions, and public policy, see Kruse (1993: 162-169).

Appendix

As discussed in the paper, the estimating framework may be tainted by selection bias. There may be factors that predict profit sharing status and, through correlation between profit sharing status and the distribution of the error term, violate standard assumptions about the error term in equation (1).

While self-selection may create a bias, it does not necessarily do so. Heckman and Robb (1985: 216-223) review several models using panel data in which a bias does not exist under certain decision rules and error processes.

In the presence of selection bias, there are two standard procedures for removing the correlation between the variable of interest and the error term: instrumental variables to predict profit sharing variables that are uncorrelated with the error term, and the addition of a selection term to correct for the distribution of the error.

Instrumental variable estimates were attempted using both linear probability and probit techniques to predict both profit-sharing adoption and profit-sharing maintenance. The presumed exogenous variables included those used to predict profit-sharng adoption in Kruse (1993)(variance of change in ln(sales) over t-5 to t-1, and the changes between t-2 and t-1 in ln(sales), debt/equity, interest payments/sales, ln(capital/labor), and profit margin). Linear probability techniques produced estimates for $ß_p$ and $ß_{pt}$ of 2.226 and .209 when the dependent variable is δLn(sales/employees), and 3.367 and .217 when the dependent variable is δLn(value-added/employees). These coefficients, which are all highly statistically significant (at $p<.01$), imply productivity increases of more than eight-fold when profit sharing is adopted, and more than 20% each year it is in place. When probits are used to predict δP and P_t, the estimated coefficients for $ß_p$ and $ß_{px}$ are .329 and .468 when Ln(sales/employees) is used,

and .785 and .534 when Ln(value-added/employees) is used. These are again highly statistically significant, and imply adoption effects of 40-120% and trend effects of 60-70% per year. A variety of other instrumental variable techniques produced results which were similarly not credible; such results argue for the use of other techniques for the correction of selection bias.

Selection bias may also be corrected by the inclusion of a selection correction term. The inverse Mill's ratio (based on Heckman, 1979) takes the value $f(\tau Z_i)/F(\tau Z_i)$ when the profit-sharing status equals one, and $-f(\tau Z_i)/(1-F(\tau Z_i))$ when it equals zero (with exogenous variables Z_i and coefficients τ, where f() and F() respectively represent the normal density function and cumulative density function). A second method allowing different coefficients between the profit-sharing and non-profit-sharing samples uses, in addition to the common explanatory variables, the values of these variables multiplied by $F(\tau Z_i)$, as well as $f(\tau Z_i)$ as an independent regressor (Maddala, 1983: 227). A third method tested here is to predict what the expected outcome would be if the non-profit-sharing firms decided to adopt profit sharing, by using the coefficients on the non-profit-sharing sample with the additional selection term $f(\tau Z_i)/F(\tau Z_i)$, and comparing the predicted productivity change with the actual productivity change for the profit sharing firms (Maddala, 1983: 261).

In addition, two alternative methods, developed to assess the effect of training programs on worker earnings, were tested to correct for selection bias. The first is based on a control function developed by Heckman and Robb (1985: 224-5) that removes the correlation between the error term and program participation. This control function relies on prediction of program participation using preprogram error terms. For this study, the prediction was done using an unrestricted process for the four error terms prior to profit

sharing adoption. A second method employed is based on Bassi (1984), who uses a transformation of the equation designed to purge the correlation between program participation and the error terms.

The tests on these alternative sample selection correction techniques did not produce noteworthy differences in the results. For example, analysis of the profit-sharing adoption coefficient in the full sample with ln(sales/employee) as the dependent variable (comparable to column 1 of Table 3) gave the following results. Estimation of the model assuming different coefficients between profit-sharing and non-profit-sharing firms (Maddala, 1983: 227) gives a coefficient of .040 (t=3.58). Estimation of the model which predicts the outcome if non-profit-sharing firms were to adopt profit sharing (Maddala, 1983: 261) produces a coefficient of .042 (t=3.29). Use of the control function based on preprogram error terms (Heckman and Robb, 1985: 224-5) produces a coefficient of .045 (t=3.49) when all firms are included, and .066 (t=3.42) when only adopters are included. Finally, use of Bassi's technique produces an average coefficient of .044 over the first three post-adoption years.

Two variables that predicted profit sharing adoption and raised a strong possibility of selection bias were the change in the stock price, and change in the profit margin, from t-2 to t-1. To examine the influence of these variables, the profit-sharing adopters were divided into two groups--those that had positive and negative values on these variables (relative to industry means for that year)--and separate productivity effects were calculated for comparison with columns 1 to 4 of Table 3. The coefficients on profit-sharing adoption were of similar magnitude between the two groups, and neither group had consistently larger or smaller coefficients.

Since these techniques did not produce noteworthy differences, only the

results from the first method are presented here (with common production parameters across the entire sample). Specifically, because the productivity regressions primarily indicate a profit sharing adoption effect, and the selection bias is likely to be strongest among adopters, the selection term used a specification to predict profit sharing adoption (including union status, variance of change in ln(sales), and the changes between t-2 and t-1 in ln(sales), debt/equity, interest payments/sales, ln(capital/labor), and profit margin). Once the adoption had been made, the adopters maintained the selection term from the time of adoption. Old profit-sharing companies, that had no pre-adoption values, were simply assigned the mean post-adoption selection term from the adopters. Separate selection terms were created for cash and deferred plans, type of formula, and size of employer contribution. The coefficients on the selection terms are not presented here since they were never distinguishable from zero, and had no pattern of positive and negative coefficients. Experiments with a number of other specifications of the selection term (including prediction of profit sharing presence as well as adoption) failed to produce any consistent patterns or substantial effects on the results. This indicates that sample selection is unlikely to be an important factor in the productivity effects.

In constructing sample selection terms, variables were re-weighted to reflect the choice-based sampling (Manski and Lerman, 1977). For these estimates, the re-weighting caused very minor changes in the results, largely due to the high incidence of profit sharing (40.7%) in the random sample, which did not vary greatly by broad industry. For the fixed-effects estimates, choice-based sampling does not produce a bias (Heckman and Robb, 1985: 219).

A separate form of selection bias may be present with missing observations on incomplete panel data (see, e.g., Hausman and Wise, 1979; Ridder, 1990;

Verbeek, 1990). The selection rule on when observations are reported may be related to the variable of interest. There was, however, no discernible relationship between the pattern of profit-sharing adoption and missing observations in the panel. The possibility of bias was checked and discounted with the variable addition test and comparison of random effects estimators from the balanced and unbalanced panels (Verbeek and Nijman, 1992).

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FIGURE 1:

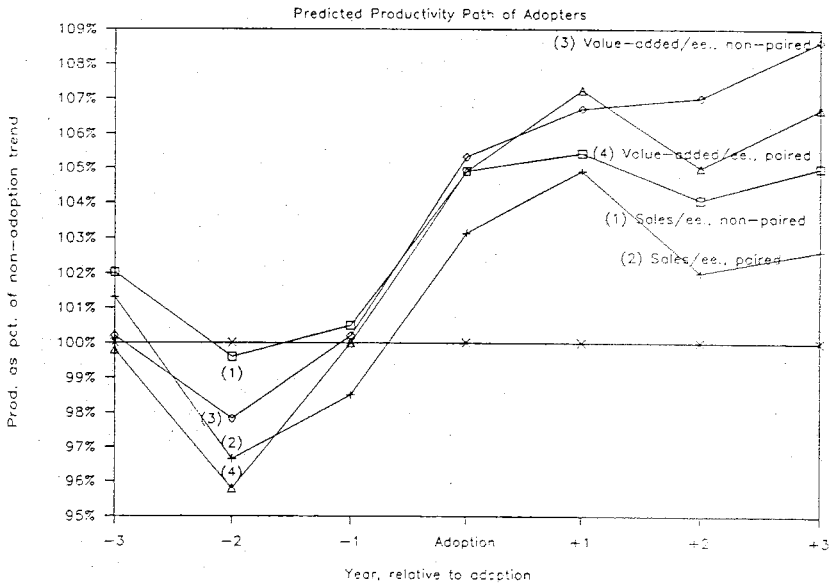
Predicted Productivity Path of Adopters
Prod. as pct. of non-adoption trend
109%
108%
107%
106%
105%
104%
103%
102%
101%
100%
99%
98%
97%
96%
95%
(3) Value-added/ee., non-paired
(4) Value-added/ee., paired
(1) Sales/ee., non-paired
(2) Sales/ee., paired
(1)
(3)
(2)
(4)
-3
-2
-1
Adoption
+1
+2
+3
Year, relative to adoption

TABLE 1: Prevalence of Profit Sharing in Sample *

PS = profit sharing

	Distribution of companies			Distribution of employees (1990 Sum, in 000's)		
	All cos.	PS cos.	PS as % of all	All employees	PS participants	PS parts. as % of all
	(1)	(2)	(3)	(4)	(5)	(6)
Mining/construction	12	4	33.3%	21.9	2.7	12.4%
Non-durable manufacturing	86	35	40.7%	1393.1	345.5	24.8%
Durable manufacturing	86	40	46.5%	3153.4	1503.2	47.7%
Communications	11	5	45.5%	279.0	44.5	16.0%
Utilities	37	6	16.2%	172.2	10.9	6.3%
Wholesale	9	4	44.4%	71.1	13.0	18.2%
Retail	15	8	53.3%	635.8	187.6	29.5%
Finance, insurance, real estate	13	6	46.2%	210.2	131.3	62.5%
Service	6	4	66.7%	85.9	60.2	70.0%
Total	275	112	40.7%	6022.6	2298.9	38.2%

* These numbers consider only the responses from the primary sample, which was based on a systematic sample of all firms with at least 8 years of employment data over the 1980-89 period. Companies contacted to provide matched pairs are excluded, due to bias from selection rule for pairing.

Table 2: Descriptive Statistics on Profit Sharing Dataset

(PS=profit-sharing; NPS=non-profit-sharing; U=union)

	PS	NPS	Within-industry paired difference (PS minus NPS) mean	t-stat.	Percent of PS ees	Percent of U ees
	(1)	(2)	(3)	(4)	(5)	(6)
n	253	247	205			
% ee's in PS	78.5%					
% of cos. w/ unions	65.9%	75.9%	-7.1% *	-1.77		
% of ee's in union, if unionized	38.6%	35.8%	3.2%	0.97		
majority of U workers are in PS, if unionized	44.7%					
% cos. with personnel policy^:						
surveys	38.0%	35.4%	0.5%	0.11		
suggestion system	57.1%	51.7%	6.1%	1.22		
job enrichment	35.1%	25.0%	11.4% **	2.63		
ee. involvement	60.7%	58.2%	1.6%	0.33		
autonomous workteams	26.1%	22.5%	3.7%	0.91		
employment security	16.1%	13.6%	5.1%	1.52		
gainsharing	45.3%	39.0%	1.1%	0.22		
% ee's covered by personnel policy^:						
surveys	23.3%	22.3%	0.3%	0.08	21.6%	13.5%
suggestion system	19.1%	17.5%	2.5%	0.90	15.1%	12.3%
job enrichment	14.5%	10.8%	4.3% *	1.67	11.2%	5.7%
ee. involvement	25.6%	24.5%	1.6%	0.47	21.8%	19.4%
autonomous workteams	9.5%	7.8%	1.9%	0.99	8.2%	6.1%
employment security	9.5%	7.6%	3.1%	1.15	8.3%	7.9%
gainsharing	19.8%	16.0%	1.3%	0.40	17.3%	13.1%
% ee's provided w/ info on:						
overall co. perf.	85.3%	83.4%	0.8%	0.29		
bus. plans & goals	61.8%	57.5%	3.6%	0.97		
competitors' perf.	30.4%	24.6%	4.6%	1.24		

	PS	NPS	Within-industry paired difference (PS minus NPS) mean	t-stat.
	(7)	(8)	(9)	(10)
Occ. mix:				
% production/service	49.5%	51.2%	-3.7%	-1.31
% clerical/technical	24.7%	21.8%	1.8%	0.72
% prof./admin.	26.6%	26.9%	2.4%	0.98
% ee's covered by PS:				
% production/service	75.8%			
% clerical/technical	86.5%			
% prof./admin.	87.6%			
Type of PS				
cash	37.7%			
deferred	50.8%			
combination	8.5%			
More than one PS plan	24.7%			
Age of oldest PS plan				
1-5	21.7%			
6-10	17.7%			
11-20	22.1%			
20+	29.9%			
NA	8.7%			
Change in other personnel policies when PS adopted				
Yes	17.3%			
No	56.7%			
NA	26.0%			
1990 employment (000's):				
Mean	21.52	18.08	1.275	0.21
Median	5.60	5.40		
Mean of ln(employment)	1.71	1.63	-0.048	-0.29
1990 sales (000,000's):				
Mean	3823.40	3494.06	583.9	0.52
Median	876.55	935.27		
Mean of ln(sales)	6.76	6.81	-0.039	-0.23

* Statistically significant difference at p<.10 ** p<.05

^ Personnel policy definitions in Table 6.

Note: Except where "NA" (not answered) is used, reported percentages exclude "don't know" responses.

TABLE 3: Productivity Growth and Profit Sharing (PS) Adoption and Presence

Dependent variable:	dLn(Sales/L)		dLn(Value-added/L)		Means (s.d.)				
	(1) Unpaired	(2) Paired	(3) Unpaired	(4) Paired	(1a)	(2a)	(3a)	(4a)	Brief definitions
PS adoption:									
1. Three years until	0.030 **	0.013	0.001	-0.001	0.014	0.032	0.014	0.028	Three years until PS adoption (dummy)
	(0.012)	(0.019)	(0.013)	(0.022)	(0.119)	(0.176)	(0.118)	(0.164)	
2. Two years until	-0.014	-0.047 **	-0.016	-0.040 *	0.014	0.031	0.014	0.028	Two years until PS adoption (dummy)
	(0.013)	(0.020)	(0.013)	(0.021)	(0.119)	(0.173)	(0.116)	(0.166)	
3. One year until	0.020	0.019	0.032 **	0.044 **	0.014	0.032	0.013	0.028	One year until PS adoption (dummy)
	(0.013)	(0.020)	(0.013)	(0.022)	(0.116)	(0.175)	(0.114)	(0.164)	
4. Year of adoption	0.041 ***	0.045 **	0.050 ***	0.046 **	0.015	0.033	0.014	0.029	PS plan adopted in current year (dummy)
	(0.013)	(0.021)	(0.014)	(0.023)	(0.120)	(0.179)	(0.118)	(0.168)	
5. One year ago	0.004	0.016	0.012	0.020	0.016	0.037	0.016	0.034	PS plan adopted last year (dummy)
	(0.012)	(0.019)	(0.013)	(0.020)	(0.126)	(0.189)	(0.127)	(0.182)	
6. Two years ago	-0.014	-0.029	0.003	-0.022	0.016	0.035	0.016	0.032	PS plan adopted two years ago (dummy)
	(0.012)	(0.019)	(0.013)	(0.021)	(0.125)	(0.185)	(0.124)	(0.175)	
7. Three years ago	0.008	0.005	0.015	0.015	0.014	0.030	0.014	0.028	PS plan adopted three years ago (dummy)
	(0.013)	(0.020)	(0.013)	(0.022)	(0.116)	(0.172)	(0.116)	(0.166)	
8. Old PS trend	0.000	0.007	0.009	0.013	0.230	0.511	0.261	0.558	PS plan adopted before sample period
	(0.010)	(0.020)	(0.010)	(0.012)	(0.421)	(0.500)	(0.439)	(0.497)	
9. DB adoption	0.012	0.027	0.009	0.029	0.004	-0.001	0.005	-0.002	Defined benefit plan adopted between t-1 and t
	(0.021)	(0.037)	(0.020)	(0.034)	(0.066)	(0.088)	(0.070)	(0.100)	
10. DB trend	-0.001	-0.004	-0.006 *	-0.009	0.752	-0.020	0.742	-0.025	Presence of defined benefit plan in t
	(0.003)	(0.005)	(0.004)	(0.006)	(0.432)	(0.632)	(0.437)	(0.632)	
11. ESOP adoption	0.013	0.002	0.008	0.010	0.016	0.003	0.017	0.006	ESOP adopted between t-1 and t
	(0.011)	(0.018)	(0.011)	(0.019)	(0.127)	(0.181)	(0.130)	(0.184)	
12. ESOP trend	-0.001	0.001	0.000	-0.001	0.426	0.069	0.386	0.100	Presence of ESOP in t
	(0.003)	(0.005)	(0.003)	(0.005)	(0.495)	(0.696)	(0.487)	(0.705)	
13. Union trend	-0.004	-0.008	0.001	0.000	0.753	-0.068	0.723	-0.066	Union presence in t
	(0.004)	(0.006)	(0.004)	(0.006)	(0.431)	(0.537)	(0.448)	(0.546)	
14. dLn(L)	-0.389 ***	-0.388 ***	-0.395 ***	-0.327 ***	0.008	0.011	0.008	0.014	Change in Ln(employees), t-1 to t
	(0.027)	(0.048)	(0.027)	(0.048)	(0.142)	(0.192)	(0.150)	(0.197)	
15. dLn(K)	0.057 **	0.093 **	0.025	0.000	0.085	0.011	0.089	0.015	Change in Ln(net assets), t-1 to t
	(0.024)	(0.043)	(0.024)	(0.043)	(0.177)	(0.239)	(0.195)	(0.264)	
16. dLn(L)*Ln(L)	-0.019 ***	-0.031 ***	-0.009	-0.004	0.022	0.003	0.022	0.012	Change in Ln(employees) squared, t-1 to t
	(0.005)	(0.009)	(0.006)	(0.010)	(0.573)	(0.760)	(0.627)	(0.838)	
17. dLn(K)*Ln(K)	0.006 **	0.001	0.010 ***	0.016 ***	0.898	0.001	0.899	0.037	Change in Ln(net assets) squared, t-1 to t
	(0.003)	(0.006)	(0.003)	(0.006)	(1.802)	(2.474)	(1.939)	(2.656)	
18. dLn(L)*Ln(K)	0.008	0.017	0.001	-0.015	0.188	0.014	0.197	0.032	Change in Ln(net assets)*Ln(employees), t-1 to t
	(0.007)	(0.013)	(0.008)	(0.014)	(0.976)	(1.288)	(1.033)	(1.361)	
Dependent variables					0.067	-0.007	0.064	-0.005	dLn(Sales/L): Change in Ln(total sales/employees)
Year dummies and 25 industry dummies	Yes		Yes		(0.116)	(0.150)	(0.111)	(0.145)	dLn(Sales/L): Change in Ln(value-added/employees)
R-squared	0.248	0.185	0.261	0.211					
N	5652	1807	4673	1510	5652	1807	4673	1510	

* Statistically significant at p<.10 ** p<.05 *** p<.01

TABLE 4: Profit Sharing Plan Types, Formulas, and Productivity Growth

Dependent variable:	Regression coefficients (s.e.) dLn(Sales/L) (1)	(2)	dLn(Value-added/L) (3)	(4)	Descriptive Statistics Mean (s.d.)			
PLAN TYPE REGRESSIONS	Unpaired	Paired	Unpaired	Paired	(1a)	(2a)	(3a)	(4a)
1. Cash PS adoption	0.034 **	0.063 **	0.035 **	0.042	0.008	0.020	0.008	0.019
	(0.016)	(0.029)	(0.017)	(0.032)	(0.089)	(0.140)	(0.089)	(0.136)
2. Subsequent trend	0.005	0.008	-0.003 **	0.008	0.116	0.281	0.132	0.316
	(0.008)	(0.017)	(0.008)	(0.018)	(0.320)	(0.450)	(0.338)	(0.465)
3. Deferred PS adoption	0.018	0.009	0.014	-0.011	0.006	0.021	0.006	0.019
	(0.018)	(0.030)	(0.020)	(0.035)	(0.078)	(0.145)	(0.075)	(0.136)
4. Subsequent trend	0.002	0.025	0.035 ***	0.027	0.173	0.269	0.184	0.248
	(0.011)	(0.015)	(0.011)	(0.019)	(0.378)	(0.443)	(0.388)	(0.432)
R-squared	0.247	0.214	0.257	0.216				
N	5608	1443	4638	1160	5608	1443	4638	1160
PLAN FORMULA REGRESSIONS								
%-of-profits formula:								
5. Plan adoption	0.047	0.022	0.076 **	0.014	0.003	0.009	0.003	0.009
	(0.030)	(0.046)	(0.035)	(0.047)	(0.051)	(0.096)	(0.052)	(0.094)
6. Subsequent trend	-0.002	0.036	-0.025	0.005	0.047	0.136	0.054	0.145
	(0.012)	(0.057)	(0.023)	(0.060)	(0.211)	(0.343)	(0.225)	(0.352)
Discretionary:								
7. Plan adoption	0.074 **	0.037	0.088 **	0.100 **	0.002	0.007	0.002	0.008
	(0.037)	(0.051)	(0.038)	(0.050)	(0.042)	(0.086)	(0.043)	(0.088)
8. Subsequent trend	-0.004	0.034	0.021	0.049 *	0.036	0.096	0.041	0.102
	(0.012)	(0.026)	(0.012)	(0.026)	(0.186)	(0.294)	(0.198)	(0.302)
%-of-pay formula:								
9. Plan adoption	0.022	0.032	-0.016	0.043	0.002	0.007	0.002	0.006
	(0.033)	(0.051)	(0.037)	(0.058)	(0.047)	(0.086)	(0.043)	(0.075)
10. Subsequent trend	-0.017	0.024	-0.028	-0.052 *	0.044	0.154	0.046	0.151
	(0.017)	(0.026)	(0.018)	(0.030)	(0.206)	(0.361)	(0.210)	(0.358)
Other formula:								
11. Plan adoption	0.016	0.029	0.007	0.016	0.005	0.017	0.005	0.016
	(0.023)	(0.034)	(0.023)	(0.035)	(0.068)	(0.128)	(0.069)	(0.124)
12. Subsequent trend	-0.001	-0.009	-0.004	-0.012	0.087	0.258	0.099	0.275
	(0.018)	(0.021)	(0.020)	(0.022)	(0.282)	(0.438)	(0.299)	(0.447)
Dependent variable					0.068	-0.004	0.064	-0.007
					(0.115)	(0.150)	(0.112)	(0.146)
R-squared	0.247	0.173	0.278	0.334				
N	4565	1077	3711	959	4587	1077	3711	896

* Statistically significant at p<.10 ** p<.05 *** p<.01

Cash plan: co. contribution has cash element (includes combo plans)
Deferred plan: co. contribution put wholly into pension trust
%-of-profits plan: co. contribution based on fixed percent of profits (may also include discretionary component)
Discretionary plan: company contribution wholly discretionary
%-of-pay plan: company contribution based on fixed percent of participants' pay
Other formula: company contribution based on formula other than above three

All regressions include variables listed in Table 3 (except for PS adoption and presence), plus separate inverse Mill's selection terms for each plan type and formula.

TABLE 5: Profit Sharing and Productivity, by Employment Size Class

Analysis of profit sharing effects by five size classes, representing the smallest 10%, 10-25%, 25-50%, 50-75%, and 75-100% classes of employment size at time profit sharing was adopted.

	Dependent variable:	dLn(Sales/L)	dLn(Value-added/L	Mean (s.d.)	
		(1)	(2)	(1a)	(2a)
Size class					
(1)	Empl. < 775:				
	PS adoption	0.105 ***	0.159 ***	0.001	0.001
		(0.037)	(0.040)	(0.038)	(0.036)
	PS trend	-0.007	0.001	0.027	0.029
		(0.014)	(0.014)	(0.161)	(0.167)
(2)	775 <= Empl. <1681:				
	PS adoption	-0.015	0.060	0.002	0.001
		(0.029)	(0.037)	(0.048)	(0.039)
	PS trend	-0.003	0.011	0.043	0.047
		(0.013)	(0.013)	(0.202)	(0.211)
(3)	1681 <= Empl. < 4599:				
	PS adoption	0.041 *	-0.034	0.004	0.003
		(0.024)	(0.026)	(0.059)	(0.057)
	PS trend	0.002	0.022 *	0.071	0.077
		(0.011)	(0.011)	(0.257)	(0.267)
(4)	4599 <= Empl. < 17,600:				
	PS adoption	0.022	0.029	0.003	0.003
		(0.024)	(0.025)	(0.058)	(0.058)
	PS trend	0.001	0.012	0.090	0.095
		(0.011)	(0.011)	(0.286)	(0.294)
(5)	Empl. >= 17,600:				
	PS adoption	0.067 ***	0.056 ***	0.004	0.005
		(0.022)	(0.021)	(0.062)	(0.069)
	PS trend	0.001	0.008	0.094	0.108
		(0.011)	(0.011)	(0.292)	(0.310)
	R-squared	0.251	0.269		
	N	5652	4672	5652	4672

Note: The regressions include variables from regressions 1 and 3 of Table 2 (translog terms, year dummies, 25 industry dummies, and DB, ESOP, and union terms). Translog production terms have been fully interacted with the five size classes.

* Statistically significant at p<.10
** Statistically significant at p<.05
*** Statistically significant at p<.01

Table 6: Definitions of Personnel Policies

The term in capital letters is the one used in the Tables presented here, followed by the term presented to survey respondents, and the definition made available to respondents. (Definitions are based largely upon the 1987 General Accounting Office survey of employee involvement in Fortune 1000 companies.)

SURVEY: Attitude survey feedback. Use of employee attitude survey results, not simply as an employee opinion poll, but rather as part of a larger problem-solving process in which survey data are used to encourage, structure, and measure the effectiveness of employee participation.

JOB ENRICHMENT: Job enrichment and redesign. Design of work that is intended to increase worker performance and job satisfaction by increasing skill variety, autonomy, significance and identity of the task, and performance feedback.

EMPLOYEE INVOLVEMENT: Employee involvement groups, such as Quality Circles or other formal committees. Structured type of employee participation groups in which groups of volunteers from a particular work area meet regularly to identify and suggest improvements to work-related problems. The goals of are improved quality and performance: there is no direct reward, group problem-solving training is provided, and the groups' only power is to suggest changes to management.

AUTO. WORKTEAM: Self-managed work teams. Also termed autonomous work groups, semi-autonomous work groups, self-regulating work teams, or simply work teams. The work group (in some cases acting without a supervisor) is responsible for the whole product or service, and makes decisions about task assignments and work methods. The team may be responsible for its own support services such as maintenance, purchasing, and quality control, and may perform certain personnel functions such as hiring and firing team members and determining pay increases.

EMPLOYMENT SECURITY: Company policy designed to prevent layoffs.

SUGGESTION SYSTEM: Company system of soliciting employee suggestions for improved performance.

GAINSHARING: Productivity-related Group Bonuses. Plans based on a formula that shares some portion of gains in productivity, quality, cost effectiveness, or other performance indicators, The gains are shared in the form of bonuses with all employees in an organization (such as a plant). It typically includes a system of employee suggestion committees. It differs from profit sharing or an ESOP in that the basis of the formula is some set of local performance measures, not company profits. Examples include the Scanlon Plan, the Improshare Plan, the Rucker Plan, and various custom-designed plans.

For each policy, survey respondents were asked about its presence and age, as well as percentage of corporate employees and (for profit-sharing companies) of profit sharing participants who participate. The percentage figures were categorized as None (0%), Some (1-40%), About half (41-60%), Most (61-99%), or All (100%). "Proportion covered" for Tables 2 and 8 was computed from these five categories as, respectively, .00, .20, .50, .80, and 1.0.

TABLE 7: Profit Sharing and Information-Sharing

Dependent variable:	dLn(Sales/L)		dLn(Value-added/L)		Means (s.d.)			
	(1) Unpaired	(2) Paired	(3) Unpaired	(4) Paired	(1a)	(2a)	(3a)	(4a)
PS adoption	0.060 *	0.049	0.016	0.032	0.014	0.035	0.014	0.031
	(0.033)	(0.038)	(0.033)	(0.037)	(0.119)	(0.183)	(0.118)	(0.173)
PS presence	0.003	0.002	0.006	-0.006	0.313	0.679	0.348	0.706
	(0.014)	(0.024)	(0.014)	(0.026)	(0.464)	(0.467)	(0.476)	(0.456)
Info-sharing on company results interacted with								
PS adoption	0.006	-0.017	0.023	-0.021	0.012	0.025	0.011	0.019
	(0.049)	(0.054)	(0.048)	(0.055)	(0.104)	(0.155)	(0.101)	(0.138)
PS presence	0.004	-0.010	0.008	-0.005	0.282	0.485	0.310	0.477
	(0.011)	(0.012)	(0.011)	(0.013)	(0.434)	(0.500)	(0.444)	(0.500)
Info-sharing on business plans interacted with								
PS adoption	-0.062	-0.060	0.010	-0.014	0.009	0.015	0.008	0.010
	(0.043)	(0.051)	(0.045)	(0.060)	(0.086)	(0.120)	(0.081)	(0.098)
PS presence	-0.005	0.012	0.002	0.019	0.200	0.278	0.219	0.288
	(0.008)	(0.012)	(0.008)	(0.013)	(0.360)	(0.448)	(0.372)	(0.453)
Info-sharing on competitors' performance interacted with								
PS adoption	0.080 *	0.200 **	0.014	0.090	0.004	0.002	0.003	0.002
	(0.045)	(0.088)	(0.052)	(0.104)	(0.045)	(0.047)	(0.043)	(0.042)
PS presence	0.002	-0.018	0.000	-0.030	0.090	0.074	0.097	0.073
	(0.010)	(0.015)	(0.010)	(0.016)	(0.217)	(0.262)	(0.219)	(0.260)
Dependent variable					0.068	-0.009	0.064	-0.007
					(0.116)	(0.152)	(0.112)	(0.148)
R-squared	0.245	0.189	0.264	0.233				
N	4970	1377	4073	1129	4970	1377	4073	1129

* Statistically significant at p<.10 ** p<.05 *** p<.01
Note: All regressions include variables from Table 3.

Definitions of information-sharing variables (based on 1987 GAO survey):
Respondents were asked: "About how many corporation employees, excluding top management, are routinely provided with:
a. Information about the company's overall operating results?
b. Information on business plans and goals?
c. Information on competitors' relative performance?"
The proportion of employees provided with such information was interacted with PS adoption and presence.
See Table 2 for mean comparisons of information-sharing in profit-sharing and non-profit-sharing companies.

TABLE 8: Productivity Growth and Interaction of Profit Sharing with Personnel Policies

Dependent variable:	dLn(Sales/L) (1) Unpaired	(2) Paired	dLn(Value-added/L) (3) Unpaired	(4) Paired	Means (s.d.) (1a)	(2a)	(3a)	(4a)
PS adoption	0.042 ***	0.033	0.053 ***	0.041 *	0.015	0.033	0.014	0.029
	(0.016)	(0.022)	(0.016)	(0.023)	(0.120)	(0.179)	(0.118)	(0.168)
PS trend	0.000	0.008	0.009	0.018	0.310	0.719	0.341	0.748
	(0.010)	(0.020)	(0.010)	(0.022)	(0.462)	(0.449)	(0.474)	(0.434)
Personnel policy interactions:								
Survey * PS adoption	0.014	0.006	0.001	-0.013	0.004	0.010	0.004	0.008
	(0.025)	(0.039)	(0.027)	(0.043)	(0.060)	(0.091)	(0.059)	(0.084)
trend	0.000	-0.005	0.003	0.007	0.036	0.092	0.039	0.097
	(0.010)	(0.015)	(0.010)	(0.016)	(0.170)	(0.263)	(0.178)	(0.271)
Job enrichment * PS adoption	0.009	0.022	-0.011	0.003	0.002	0.005	0.002	0.005
	(0.040)	(0.062)	(0.040)	(0.063)	(0.037)	(0.057)	(0.039)	(0.060)
trend	0.003	0.001	-0.008	-0.017	0.032	0.060	0.025	0.058
	(0.013)	(0.020)	(0.013)	(0.020)	(0.134)	(0.191)	(0.129)	(0.189)
Auto. workteam * PS adoption	0.056	0.000	0.046	-0.092	0.002	0.002	0.002	0.003
	(0.047)	(0.108)	(0.046)	(0.102)	(0.032)	(0.031)	(0.035)	(0.034)
trend	0.009	0.007	-0.007	-0.010	0.028	0.045	0.021	0.046
	(0.014)	(0.021)	(0.012)	(0.022)	(0.132)	(0.180)	(0.123)	(0.181)
Empl. inv. * PS adoption	0.042	0.092 *	0.016	0.066	0.004	0.008	0.004	0.008
	(0.031)	(0.052)	(0.032)	(0.053)	(0.051)	(0.068)	(0.051)	(0.069)
trend	0.001	0.006	0.008	0.015	0.024	0.064	0.031	0.067
	(0.012)	(0.019)	(0.013)	(0.020)	(0.126)	(0.191)	(0.134)	(0.191)
Empl. security * PS adoption	-0.103 **	-0.080	-0.113 **	-0.099	0.001	0.003	0.001	0.002
	(0.044)	(0.066)	(0.049)	(0.078)	(0.034)	(0.055)	(0.031)	(0.048)
trend	0.003	0.000	0.003	0.013	0.019	0.052	0.024	0.057
	(0.011)	(0.018)	(0.011)	(0.018)	(0.119)	(0.208)	(0.145)	(0.219)
Suggest * PS adoption	-0.012	0.064	-0.017	0.025	0.003	0.007	0.003	0.005
	(0.036)	(0.062)	(0.036)	(0.066)	(0.043)	(0.059)	(0.044)	(0.056)
trend	-0.005	0.015	-0.007	-0.008	0.021	0.065	0.035	0.066
	(0.012)	(0.021)	(0.012)	(0.021)	(0.136)	(0.181)	(0.143)	(0.186)
Gainsharing * PS adoption	0.015	-0.032	0.027	-0.023	0.003	0.007	0.003	0.007
	(0.031)	(0.048)	(0.032)	(0.052)	(0.048)	(0.072)	(0.048)	(0.070)
trend	-0.001	0.007	0.002	0.011	0.033	0.068	0.038	0.076
	(0.010)	(0.017)	(0.010)	(0.016)	(0.152)	(0.221)	(0.162)	(0.231)
R-squared	0.246	0.183	0.259	0.218				
N	5652	1807	4673	1510	5652	1807	4673	1510

* Statistically significant at p<.10 ** p<.05 *** p<.01

Note: All regressions include variables from Table 3. See Tables 2 and 6 for personnel policy basic numbers and definitions. The proportion of PS participants covered by a policy was interacted with the existence of PS and the policy in each year. "Adoption" refers to adoption of this interaction.