The Productivity Effects of Participatory Employment Practices: Evidence from New Japanese Panel Data

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We report the first results for Japanese firms on the effects of clusters of participatory employment practices (or participation/employee involvement at the top level as well as at the grassroots level, and financial participation) by estimating production functions using new panel data. We find that the introduction of a group of complementary practices will lead to a significant 8–9 percent increase in productivity. However, the full productivity effect is felt only after a long developmental period.

Introduction

In many countries, management systems are changing away from the traditional system characterized by often adversarial collective bargaining

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and a fixed wage contractual payment basis. Prominent among these changes is the explosion in the use and interest in participatory employment practices, or human resource management practices (HRMPs), which are designed to promote employee participation/involvement and financial participation of employees.[1] Because of the limited nature of the available data, however, the econometric evidence on the economic effects of changing management systems for major corporations is generally quite thin and mixed although we are presently witnessing an impressive growth of such evidence in the United States.[2]

We contribute to this important yet relatively new literature of econometric analysis of the economic effects of participatory employment practices by providing the first rigorous econometric evidence for Japanese firms in manufacturing on the productivity effects of groups of HRMPs that are aimed at promoting employee participation/involvement and financial participation.

A closer look at the postwar Japanese experience of employee participation and labor-management cooperation in the 1960s, 1970s, and 1980s and their effects on workplace productivity and, thus, competitiveness appears to be of particular public policy interest for many countries considering participatory employment practices as a way to improve their productivity performance and thus competitiveness.

First, as Levine and Tyson (1990) suggest, relatively higher job security (often ensured by intrafirm transfers of employees and transfers to related firms) and strong group cohesiveness (supported by compression of wage and status differentials) of Japanese workers in large manufacturing firms in

[1]See, for instance, Commission on the Future of Worker-Management Relations (1994) and Levine (1995).

[2]See, for example, in the economics literature, Ichniowski, Shaw, and Prennushi (1997), Freeman, Kleiner, and Ostroff (2000), Black and Lynch (1997), Susan Helper (1998), Freeman and Kleiner (2000), Bartel (2000), and articles featured in a special issue of *Industrial Relations* (Vol. 35, July 1996). In addition to the economics literature, there is a wealth of relevant literature in the field of management (see, for example, Lawler, Mohrman, and Ledford 1995; Becker and Huselid 1998). Many of these recent studies in the United States use plant-level panel data within a narrowly defined industry. The benefits of using such data are probably less dramatic for Japan than for the United States since Japanese firms are generally substantially smaller (see, for instance, Kato and Rockel's 1992 comparative study of the 1,000 most valuable corporations between the two nations), and their management appears to be less decentralized than U.S. firms. Based on our interviews with managers in human resource at the corporate level and top managers in marketing/sales and accounting/finance at the business-unit level of Japanese and U.S. corporations, the power of the human resource department at the corporate level relative to top management at the business-unit level appears to be much stronger in Japan than in the United States. In addition, as Jones and Kato (1995) and this study show, there are substantial lags (up to seven years) in the productivity effects of HRMPs in Japan. Plant-level data seldom provide long-term longitudinal data and thus may not be as useful in the context of the postwar Japanese experience as in the context of the current U.S. experimentation.

the postwar period point to an industrial relations system favorable to successful employee participation. Moreover, relatively more rapid and stable growth over the sample period, lower unemployment, and stable financial corporate grouping (banks and institutional shareholders as stable, long-term suppliers of capital) point to an external environment favorable to successful employee participation.

Probably as a result of these favorable environments in the postwar Japanese economy, in particular in manufacturing, participatory employment practices spread widely and were established firmly, as we document in the next section. Indeed, these practices became the hallmark of "Japanese management," which has been inspiring (or necessitating, in some instances) many U.S. corporations to experiment with employee involvement and labor-management cooperation in recent years (see, for instance, Levine 1995:5). In short, the postwar Japanese economy (especially in manufacturing) clearly represents one of the most important examples of experimentation with HRMPs.[3]

In spite of the importance of the postwar Japanese experience with HRMPs, there is not much systematic investigation of the economic effects of HRMPs in Japan, especially employee participation/involvement mechanisms, such as joint labor-management committees (JLMCs) and shop-floor committees (SFCs), financial participation schemes, such as employee stock ownership plans (ESOPs), and profit-sharing plans (PSPs). For financial participation, the Japanese bonus payment system has attracted considerable attention and controversy, in particular the claim that it is a form of PSP. Earlier studies focused on the effects on employment of the Japanese bonus payment system. Freeman and Weitzman (1987) use industry-level aggregate data to show the statistically significant positive correlations between bonuses and employment level. However, Brunello (1991) uses firm-level micro data and finds *no* statistically significant positive correlations between bonuses and employment level for the electric machinery, car, and steel industries.[4] More recent studies turned to the issue of the productivity effects of the Japanese bonus payment system. Jones and Kato (1995) use firm-level panel data to find that there is a modest productivity gain from the bonus system. Ohkusa and Ohtake (1997) find that firms with a statistically significant positive correlation between their wages and per capita profit are 9 percent more productive

[3]The economic slowdown in the 1990s and a rapidly aging workforce in Japan have allegedly been eroding the aforementioned participation-friendly environments. However, according to Kato (2000), participatory employment practices have been surviving in general in recent years.

[4]He does find, however, the statistically significant positive correlations between bonuses and employment level for the textiles industry.

than firms without such a correlation. For ESOPs, Jones and Kato (1995) use firm-level panel data to find that the introduction of an ESOP will lead to a 4–5 percent increase in productivity and that this productivity payoff does not appear immediately.

For employee participation/involvement, Morishima (1991a, 1991b) uses firm-level micro data to find the statistically significant positive correlations between the extent of employee participation/involvement through JLMCs and productivity, and the statistically significant correlations between stronger JLMCs and shorter and smoother wage negotiation. More recently, Tsuru and Morishima (1999) use two unique data sets, one from a survey of firms and the other from a survey of employees, and find evidence for positive correlations between the presence of JLMCs and the strength of "employee voice."

Unfortunately, for Japanese firms, there is no micro data, especially panel data providing information on *groups* of HRMPs such as JLMCs, SFCs, ESOPs, and PSPs. The lack of such data has severely limited the ability of prior studies to study the effects of financial participation schemes and employee participation/involvement practices of Japanese firms simultaneously.[5] This weakness in the available empirical evidence is especially troublesome in light of several authors recently developing and investigating hypotheses that some HRMPs may be more effective when used in combination with other HRMPs.[6] Furthermore, no study has been able to distinguish employee participation/involvement at the grassroots level

[5]The lack of such data resulted in some researchers resorting to an indirect approach to identify the presence of information sharing by estimating for each firm the correlations between the profit level and the bargaining period. Thus, Ohkusa and Ohtake (1997) assume that the absence of a statistically significant correlation between the profit level and the bargaining period is an indication of the presence of information sharing, and proceed to estimate the productivity differences between firms with and without such correlations. Unfortunately, the highly indirect nature of their approach to identify the presence of information sharing sometimes makes it difficult to interpret their findings (for example, the productivity of firms with both information sharing and financial participation was estimated to be nearly 50 percent higher than other firms). Moreover, since their indirect approach required them to assume that the presence of profit sharing and information sharing are time invariant, they were thus prevented from using standard fixed-effects models to account for a well-known problem of firm heterogeneity. The collection of a new panel data, which contains information on the presence of information sharing mechanisms and financial participation schemes allows us to measure their presence directly and use standard fixed-effects model to account for the issue of firm heterogeneity. In addition, our data allow us to differentiate between employee participation/involvement at the top level and at the grassroots level, which proves to be important.

[6]See, for instance, Fitzroy and Kraft (1987), Weitzman and Kruse (1990), Levine and Tyson (1990), Jones and Pliskin (1991), Ben-Ner and Jones (1995), Kandel and Lazear (1992), Kruse (1993), Holmstrom and Milgrom (1994), Baker, Gibbons, and Murphy (1994), Milgrom and Roberts (1995), Ichniowski, Shaw, and Prennushi (1997), Black and Lynch (1997), Helper (1998), and articles featured in a special issue of *Industrial Relations* (Vol. 35, July 1996).

(SFCs) from employee participation/involvement at the top level (JLMCs), which we will argue and prove to be important.

It was against this backdrop of limited data that we conceived the idea of a survey of Japanese firms, the HRM Survey of Japanese Firms, from which such panel data can be assembled. The survey was administered at Keio University's Keio Economic Observatory during the summer of 1993. The sample universe of the HRM Survey of Japanese firms was the Toyo Keizai Kaisha Shiki Ho that provides a list of all firms in Japan's three major stock exchanges, Tokyo, Osaka, and Nagoya. In 1993 there were 2,127 firms listed in those three exchanges.[7]

The survey itself was preceded by a pilot phase in which an earlier version of the instrument was tested on human resource managers of several firms as well as on researchers at the Japan Institute of Labor, the Japan Productivity Center, and the Japan Securities Research Institute which conducted similar yet smaller surveys separately in the past. On the basis of what we learned from this, the questionnaire was revised. The final version of the questionnaires were mailed to Director of HR/Personnel (Jinji Bucho) of all 2,127 firms using a list of addresses from the Toyo Keizai Kaisha Shiki Ho in August 1993.

We received usable responses from 371 firms (a response rate of 17 percent). Among those, there were 226 firms in manufacturing (a response rate of 20 percent for manufacturing alone). The response rate of 17 percent (20 percent for manufacturing) is comparable to most prior surveys of similar nature in Japan.[8] We did attempt to prompt the nonrespondents by phone but our effort was largely unsuccessful.

To study the representativeness of our sample, we try to compare the proportion of firms that have each HRMP in our sample and in the population. Such comparison is usually not feasible due to the absence of the data on the population. Fortunately, however, insofar as ESOPs are concerned, *all* firms listed on Japan's stock exchange markets respond to the Survey of Stock Distribution (*Kabushiki Bunpu Jyokyo Chosa*), which has been conducted annually since 1973 by the National Conference Board of Securities Exchanges (*Zenkoku Shoken Torihikijyo Kyogikai*). Using the

[7]Our sample universe is virtually all listed firms in Japan. The only listed firms not included in the sample universe are a very small number of firms listed only in other local stock exchanges.

[8]For instance, in June 1991, the Rengo Sogo Seikatsu Kaihatsu Kenkyu Jo (Rengo Research Institute of General Life Development) mailed its questionnaire asking questions on labor conditions and employee participation/involvement to 6,800 firms (including both public and private firms in Japan) and received usable responses from 689 firms (a response rate of 10 percent). In June 1989, the Japan Productivity Center mailed its questionnaire asking questions on HRMPs to 1,030 firms in Japan and received usable responses from 203 firms (a response rate of 19.7 percent).

Survey of Stock Distribution, we computed that 95 percent of all listed firms had ESOPs in 1992. Reassuringly, the corresponding figure from our sample is 96 percent. Moreover, we also found that the rate of participation of employees in ESOPs in 1992 was about 50 percent both in our sample and in the population.

With regard to JLMCs, SFCs, and PSPs, the pertinent information on the population is not available and thus strict comparison between our sample and the population is not possible. Nevertheless, we did find that about 17 percent of firms in our sample had a PSP in 1985 and this figure is comparable to that reported by a large governmental survey called the General Survey of Wages and Hours Worked System (*Chingin Rodojikan Seido to Sogo Chosa*) conducted that same year. Finally, about 78 percent of firms in our sample were found to have a standing JLMC in 1988, the figure quite similar to the one reported by a larger governmental survey by the Ministry of Labour (the Survey of Labor-Management Communications, *Roshi Komyunikeishon Chosa*) in the same year.[9]

In this article, we merge data from this new survey with corporate proxy statement data to create for the first time a panel data set for Japanese manufacturing firms that provides information on JLMCs, SFCs, ESOPs, and PSPs. The data are then used to estimate production functions augmented by variables to capture the effects of these HRMPs.

We find evidence for the importance of introducing groups of HRMPs in the following three areas: (1) employee participation/involvement at the top level; (2) employee participation/involvement at the grassroots level; and (3) financial participation of employees. Specifically, moving from the traditional system of no HRMPs to a highly participatory system with HRMPs in all three areas leading to a significant 8–9 percent increase in productivity. The full productivity effect is, however, felt only after a fairly long developmental phase (seven years). At the same time, we find no evidence for significant productivity gains from changing the industrial relations system from the traditional system to any intermediate systems that lack HRMPs in any one of the three key areas.

The article is organized as follows: In the next section, we provide institutional information on JLMCs, SFCs, ESOPs, and PSPs. The third section offers theoretical arguments for the productivity effects of these practices, while the fourth provides the basic empirical strategy. Next, we

[9]Since the Ministry of Labour Survey is an establishment-level survey and includes many small private firms that are not included in our sample universe, the results are not strictly comparable to our survey results. However, the survey reports the proportion of establishments with JLMCs for establishments of unionized firms, which are probably closest to our sample universe. The Ministry reports that the figure for those establishments was 77.8 percent.

present our main empirical results, followed by a section providing preliminary evidence on the adoption of HRMPs, and end with our conclusions.

Institutions

Joint Labor-Management Committees (JLMCs). One of the core mechanisms for labor-management relations within a large Japanese firm is the joint labor-management committee (JLMC). Established at the top level (corporate and/or establishment level) and involving both management and union representatives, JLMCs serve as a mechanism for employee participation/involvement at the top level, covering a large variety of issues, from basic business policies to working conditions.

Unlike German works councils, the establishment of JLMCs is not obligatory under Japanese law. When there is a union, labor-side representatives are almost always union representatives. In the absence of a union, the majority of labor-side JLMC members are elected by employee vote (about 70 percent, Koike 1978). Thus, labor-side JLMC members are usually legitimate representatives of the firm's workforce.

According to Shimada (1992), JLMCs were one of the many labor-management institutions proposed at the beginning of 1950s by the Japan Productivity Center. After a decade of tumultuous labor-management relations (1945 through 1955), Japanese unions and management, with endorsement from the central government, began to implement a number of well-known human resource management techniques, including JLMCs and semi-annual bonus payments to all employees. According to our survey, as shown in Table 1, in 1960 about 38 percent of all firms, both manufacturing and nonmanufacturing (close to 50 percent for manufacturing), had standing JLMCs.[10] During the next decade, the institution diffused rapidly. Thus, by 1970 the figure had risen to close to 60 percent (70 percent for manufacturing). For the next two decades the institution continued to gain ground and, as of 1992, fully 80 percent of all firms (nearly 90 percent for manufacturing) report having standing JLMCs.

[10]We asked each firm with a JLMC in which year the JLMC was adopted. Our sample consists of well-established publicly traded firms, which is fortunate because our interviews with human resource managers of several of these firms as well as with researchers of the Japan Productivity Center who have done extensive field work on Japanese JLMCs suggest that HR/personnel departments of such well-established publicly traded firms should be able to answer this question quite accurately. Likewise, we are reasonably confident of our respondents' ability to answer this question for other HRMPs.

TABLE 1
PROPORTION OF FIRMS WITH HRMPS FROM 1960 TO 1992

	JLMCs[a]		SFCs[b]		ESOPs[c]		PSPs[d]	
Year	All	Manu-facturing	All	Manu-facturing	All	Manu-facturing	All	Manu-facturing
1960	38.20%	48.47%	11.38%	15.42%	4.42%	4.25%	5.00%	6.19%
1961	39.13%	50.00%	11.38%	15.42%	4.72%	4.25%	5.00%	6.19%
1962	39.75%	51.02%	11.38%	15.42%	5.01%	4.72%	5.00%	6.19%
1963	41.30%	52.55%	12.00%	16.42%	5.60%	4.72%	5.29%	6.19%
1964	43.17%	53.57%	13.23%	17.91%	6.49%	4.72%	5.59%	6.67%
1965	46.89%	57.14%	15.08%	18.91%	7.67%	6.13%	6.76%	8.10%
1966	48.45%	59.69%	15.38%	18.91%	7.96%	6.60%	6.76%	8.10%
1967	50.31%	61.73%	15.38%	18.91%	8.55%	7.08%	6.76%	8.10%
1968	53.42%	65.31%	16.62%	20.40%	10.62%	8.96%	7.06%	8.57%
1969	54.35%	65.31%	17.23%	21.39%	20.06%	20.28%	7.06%	8.57%
1970	58.07%	68.88%	23.69%	29.35%	26.25%	26.42%	9.12%	10.00%
1971	59.63%	70.92%	24.62%	30.35%	33.92%	35.38%	9.41%	10.00%
1972	61.49%	72.96%	25.23%	31.34%	38.64%	41.04%	9.41%	10.00%
1973	63.04%	74.49%	26.15%	32.84%	48.97%	50.94%	10.00%	10.48%
1974	63.66%	74.49%	26.77%	32.84%	51.92%	53.77%	10.29%	10.95%
1975	66.46%	77.04%	27.69%	33.83%	54.57%	55.66%	11.18%	12.38%
1976	68.01%	78.57%	28.00%	33.83%	56.64%	58.96%	11.18%	12.38%
1977	69.57%	79.59%	29.54%	35.82%	60.18%	63.21%	11.47%	12.86%
1978	69.88%	79.59%	30.46%	36.32%	61.95%	65.57%	12.06%	13.81%
1979	70.50%	80.10%	31.08%	36.82%	64.01%	67.45%	12.06%	13.81%
1980	72.67%	82.65%	34.15%	39.80%	68.14%	72.17%	14.12%	15.24%
1981	73.60%	83.67%	34.77%	39.80%	70.80%	75.47%	14.12%	15.24%
1982	73.60%	83.67%	34.77%	39.80%	73.75%	78.30%	14.12%	15.24%
1983	73.60%	83.67%	35.69%	39.80%	76.70%	81.13%	15.29%	16.19%
1984	73.91%	83.67%	35.69%	39.80%	78.76%	83.49%	15.59%	16.19%
1985	76.09%	85.20%	37.54%	42.29%	84.37%	89.15%	16.76%	17.62%
1986	76.71%	85.71%	37.54%	42.29%	87.02%	90.09%	17.06%	17.62%
1987	77.33%	86.22%	37.85%	42.79%	88.50%	91.04%	17.06%	17.62%
1988	78.26%	87.24%	39.08%	43.78%	91.15%	92.45%	18.53%	19.05%
1989	78.88%	87.76%	39.08%	43.78%	92.63%	94.81%	19.71%	20.00%
1990	79.19%	88.27%	40.00%	44.28%	94.10%	95.28%	20.88%	20.95%
1991	80.12%	89.29%	40.31%	44.78%	95.58%	96.23%	21.76%	21.43%
1992	80.12%	89.29%	40.92%	45.27%	95.87%	96.23%	22.65%	21.90%

SOURCES: *Human Resource Management Survey of Japanese Firms*.
[a]Based on 322 firms (196 firms in manufacturing) that provided information on their use of JLMCs.
[b]Based on 325 firms (201 firms in manufacturing) that provided information on their use SFCs.
[c]Based on 339 firms (212 firms in manufacturing) that provided information on their use of ESOPs.
[d]Based on 340 firms (210 firms in manufacturing) that provided information on their use of PSPs.

Many observers attribute the peaceful firm-level labor relations observed in Japanese firms to the establishment of JLMCs (Shimada 1992; Inagami 1988). Within JLMCs, which meet almost once a month (an average of 11 times a year according to our survey), a number of

issues are discussed, from basic business policies to social and athletic activities sponsored by the firm. According to a survey conducted by the Ministry of Labour in 1985 on the types of issues discussed in JLMCs and the degree of employee participation in each issue (quoted in Inagami 1988), firms use JLMCs on a wide variety of issues. In particular, more than 60 percent of the firms use JLMCs for information sharing for basic management decisions such as business strategies and production and sales plans. However, in many cases, the degree of employee influence with regard to these issues is small, with almost 79 percent of the firms sharing information, but not going any further. In contrast, when the issues more directly relate to employment conditions (such as working hours and holidays, wages and bonuses, and layoffs and employment adjustment), a large proportion of firms use JLMCs to consult with labor and even allow employee representatives to participate in joint decision making. For example, out of the firms that discuss wage and employment security issues, more than 87 percent of the firms at least consult with labor representatives prior to making these plans. Thus, for direct labor issues, JLMCs appear to go beyond simple information sharing and serve a function of labor-management consultation and, occasionally, joint decision making.

The quality of the information shared during JLMC meetings appears to be quite high. According to field research conducted at a variety of Japanese firms, labor representatives to JLMCs believe that some of the information they receive from top management can be considered ''insider information'' (see Kato 2000 for details).

Shop-Floor Committees (SFCs). Aside from JLMCs and formal trade unions, many Japanese corporations have shop-floor committees (SFCs) in which supervisors and employees discuss issues such as shop-floor operations and shop-floor environments. Although the potentially important role of SFCs in the Japanese industrial relations system has been suggested (see, for instance, Koike 1978), the nature and scope of these SFCs have not been studied extensively, largely due to the absence of reliable data. Our survey is one of the first to provide firm-level data on SFCs. According to our HRM Survey of Japanese Firms, the average SFC meets about nine times a year (slightly less frequently than JLMCs). The survey also shows that information shared during the SFC meetings tends to go beyond standard shop-floor issues, such as safety and health, fringe benefits, training and development, and grievances, and includes business and strategic plans. As such, SFCs are aimed at employee participation/involvement at the grassroots level.

The HRM Survey of Japanese Firms also reveals for the first time the diffusion of SFCs among Japanese firms in the postwar era. In 1960, as shown in Table 1, a little over 10 percent of all firms, both manufacturing and nonmanufacturing firms (15 percent for manufacturing), had a standing SFC. Since then, the institution has become more popular; in 1992 more than 40 percent of all firms reported having standing SFCs (45 percent for manufacturing firms).

The field research illustrates vividly how SFCs work (Kato 2000). At Firm A (a large manufacturing firm with sales of over three trillion yen, nearly half of which is export sales, and employment of close to 40,000 workers in 1998), SFCs have two functions: (1) resolving shop-floor-level work condition issues, such as airconditioning, smoking/nonsmoking environment, bathrooms, paid vacations, and the cafeteria menu; and (2) explaining shop-floor production plans and related staffing issues, which is done by a manager in charge of the shop floor. The link between JLMCs and SFCs is strong. First, what is not resolved at SFCs goes up to JLMCs. For example, labor representatives requested the introduction of airconditioners for the shop floor during SFC meetings. However, the manager in charge of the shop floor did not have the budget to pay for them. The issue was discussed at the next JLMCs meeting and management decided to purchase several spot airconditioners for the shop floor. Second, SFCs discuss shop-floor production plans, which are derived from production plans discussed during JLMCs meetings.

Employee Stock Ownership Plans (ESOPs).[11] Japanese ESOPs are perhaps best understood by comparing their main features with the better-known U.S. ESOPs. Unlike U.S. ESOPs, Japanese corporations establishing an ESOP (*mochikabukai*) do not receive tax incentives for doing so. To induce individual employees to participate in the ESOP, companies offer modest subsidies. Typically, the firm matches each employee's contribution by giving 5 to 10 percent of the contribution as well as bearing administrative costs. Whereas ESOPs elsewhere frequently are structured so as to encourage strong participation by top management, in Japan, executives (as well as part-time and temporary employees) are normally ineligible for membership. As is the norm elsewhere, individual participants' shares (and dividends) in the ESOP are held in trust. Unusually, however, each participant has a right to withdraw his or her shares and shares so withdrawn are privately owned. Withdrawals are permitted only in 1,000-share units.

[11] For institutional information on Japanese ESOPs, we draw heavily on Jones and Kato (1993, 1995).

Although members may freely exit completely from the ESOP, reentry is restricted. Exiting employees receive their shares in 1,000-share lots and must sell the remaining shares to the trust at the prevailing market price. Upon retirement, model rules adopted by most ESOPs require retiring workers to exit completely from the ESOP. Finally, the general director (*rijicho*) represents stockholders in the ESOP. The general director is chosen by other participants on a one-participant, one-vote basis. At the general meeting of shareholders, the general director votes the stock held by the plan, deciding independently, rather than by tabulating votes of employee participants. The general director must be a participant in the ESOP and thus is not an executive.

Our survey shows that ESOPs are a relatively new and the most rapidly growing innovation among various Japanese HRMPs. Thus, as shown in Table 1, in 1960, only 4 percent of firms had an ESOP. The proportion grew rapidly during the next decade, reaching 26 percent by 1970. In 1967, a special government committee on foreign capital advocated employee ownership as a way of preventing foreign takeovers of domestic firms. The government, using informal channels, encouraged firms to set up new ESOP trusts to accommodate employee investments in their stock. Although the fear of foreign takeovers diminished in the 1970s, the idea of employee ownership took root. Perhaps partly due to this government initiative of 1967, the 1970s were characterized by an astonishing pace of diffusion of the institution, and over two-thirds of firms came to have ESOPs by 1980. This growth continued, and in 1992, ESOPs became an almost universal phenomenon (96 percent of firms reported having an ESOP that year, with no significant difference between manufacturing and nonmanufacturing firms).

Our survey also shows that in 1992, almost 50 percent of the labor force in firms with ESOPs participated in ESOPs. Furthermore, concerning employee stakes, Jones and Kato (1995) report that, in 1988, ESOPs owned stock worth 4.1 trillion yen (about $32 billion); this amounts to 1.7 million yen (about $14,000) per participant.

However, according to Jones and Kato (1995), these plans do not own large percentages of company stock. For listed companies, the average proportion of stock owned by ESOPs has varied between 0.66 percent and 1.42 percent from 1973 to 1988. In 1988, the average was lower than 1 percent and holdings over 5 percent were rare.

Profit-Sharing Plans (PSPs). PSPs are a pay system in which the total amount of bonuses are linked to a measure of firm performance, such as profit. The Japanese bonus-payment system has attracted considerable

attention and controversy, particularly over the claim (e.g., Freeman and Weitzman 1987) that it is a form of a PSP. In light of the ongoing debate between those who stress the profit-sharing aspect of the Japanese bonus system (e.g., Freeman and Weitzman 1987) and those who downplay it (e.g., Ohashi 1989; Brunello 1991), we consider only the least controversial (with respect to the profit-sharing aspect of the bonus-payment system) type of bonus-payment system, i.e., the bonus-payment system with a formal contract stipulating the presence of the profit-sharing plan.

According to our survey, as shown in Table 1, close to 23 percent of firms had a PSP in 1992 (with no appreciable difference between manufacturing and nonmanufacturing firms). The proportion of firms with a PSP was only 5 percent in 1960, but grew steadily to 14 percent by 1980. A significant diffusion occurred during 1980s, however, with the proportion of firms with PSPs growing to over 20 percent by 1990.

Our survey also reveals that PSPs are more prevalent in smaller firms. For instance, only 11 percent of firms with 5,000 or more employees have a PSP. The large majority (70 percent) of firms with a PSP reported separate profit-sharing plans for officers and nonofficers. However, Japanese PSPs do not normally distinguish between union and nonunion members (only one-third of firms with PSPs reported separate PSPs for union and nonunion members). PSPs are mostly companywide with only 12 percent of firms having them reporting separate plans for different divisions and occupations. Moreover, nearly all Japanese PSPs are cash plans (98 percent), which is in sharp contrast to the United States, where deferred plans are more popular (see Kruse 1993:16–17). Because they are nearly always cash plans, Japanese PSPs have no tax advantage.

The majority of Japanese PSPs (55 percent) do not have a set formula (or are fully discretionary) for how the contribution should be tied to profits, which is also in contrast to PSPs in the United States, where only 22 percent of such plans are fully discretionary (Kruse 1993:75).

Productivity Effects of HRMPs: Hypotheses

In general, formal economic theory is ambiguous as to the expected effect of participatory employment practices on productivity. (For reviews, see the essays in Blinder 1990; Gibbons and Waldman 1999). Focusing on individual motivation and performance, however, several hypotheses predict positive productivity effects, of which two—goal-alignment effects and human-capital effects—are perhaps most important. In addition, there are a few hypotheses concerning the complementarities among HRMPs.

Goal-Alignment Effects of HRMPs. We consider financial participation first as this is the easiest way of understanding how the goal-alignment effects arise. PSPs help align the interest of the firm with the interest of its employees by linking pay for employees to firm performance. Likewise, the most direct positive effects of ESOPs result from enterprise success being reflected in a higher price of its equity, and thus higher wealth for employees who own stock in the ESOP. In these cases, the firm's interest is more aligned with the employees' interest.

These interest-alignment effects of financial participation can be expected to be more significant in Japan than in the United States for several reasons. First, for both PSPs and ESOPs, Japanese firms do not receive any tax incentive to establish financial participation. In this sense, the intent of Japanese firms in introducing financial participation can be interpreted by their employees as more "genuinely participatory" than is the case in the United States. Second, concerning ESOPs, executives are normally ineligible for membership in Japanese ESOPs whereas ESOPs in the United States often are structured to encourage strong participation by top management (Jones and Kato 1995). U.S. ESOPs frequently are designed to prevent participation by groups of nonexecutive employees, especially union members (Blasi 1988). In Japan, typically all full-time nonexecutive employees are eligible for membership and, based on our interviews with managers of several Japanese manufacturing corporations, it appears that blue-collar workers actively participate in ESOPs. Third, with regard to PSPs, as Kruse (1993) shows, cash plans tend to have a greater productivity effect than deferred plans, and plans without a set formula (and therefore based on trust) tend to do better than other plans. As discussed above, almost all Japanese PSPs are cash plans and a substantially higher proportion of Japanese PSPs do not have a formula than is the case in U.S. PSPs. Lastly, in Japan, the average ESOP participant owns a substantial amount of stock, worth $14,000 on average.

The goal-alignment effects of employee participation/involvement via JLMCs and SFCs are more subtle, but not necessarily weaker. First, JLMCs and SFCs are expected to reduce information asymmetry between labor and management and, consequently, avoid the development of adversarial labor-management relations. In labor-management relations, employers are believed to have more information about the status of the firm and business strategies. Workers, under usual collective-bargaining arrangements, have no means of obtaining such information except to resort to hard bargaining, often coupled with the threat of strikes (Tracy 1992). Such behavior on the part of the unions and employees may lead to adversarial labor relations, which may, in turn, have negative consequences

for productivity. Voluntary information sharing by management, via such mechanism as JLMCs and SFCs, is likely to reduce the cost of such information asymmetry and have positive effects on productivity.

Second, employers may voluntarily share information to enhance worker loyalty (Kleiner and Bouillon 1991). Worker cooperation also may be achieved through higher commitment and loyalty on the part of the workers. Enhanced worker loyalty and cooperative behavior are all predicted to have positive effects on productivity. In economic terms, sharing information that previously was restricted to owners and top management is likely to lead to goal alignment and trust between labor and management. Better informed via JLMCs and SFCs, workers, although still striving for their own benefit, may be more likely to be convinced that it is in their interest to cooperate with management and improve productivity and firm performance. They may see more clearly the connection between their own behavior and an increase in benefits due to firm prosperity.

Also, information sharing is likely to curtail management's opportunistic behavior and increase the level of trust that labor has for management. In a repeated game situation where the interdependence between labor and management is likely to continue in the future, provision of private business information is likely to enable labor to detect management's deception and curtail opportunistic behavior. Moreover, labor is more likely to develop trust in a management that voluntarily shares information. Overall, by avoiding the negative consequences of management's moral hazard and increasing the positive effects of labor's cooperative behavior, employee participation/involvement is likely to have favorable effects on productivity.

These goal-alignment effects of employee participation/involvement are expected to be quite significant in Japan. The field research suggests that employee involvement both at the top level and at the grassroots level are indeed substantial in Japan (see Kato 2000 for details). For example, the field research demonstrates vividly that both management and labor take their JLMCs seriously, spending much time and effort preparing for JLMC meetings, and that the quality of information shared via JLMCs appears to be high. Moreover, field research confirms that both labor and management clearly recognize the benefit of SFCs and anticipate the increasing role of SFCs in the future.

Human-Capital Effects of HRMPs. JLMCs and SFCs may play an important role of providing employees with a voice in the firm and thus reduce the costs of exit from the firm, saving specific human capital.[12] In the

[12]In the context of trade unions, this argument was first developed by Freeman (1976).

absence of unions, these arrangements may provide the sole voice mechanism; when there is a union, these mechanisms may supplement the direct voice of the union. Also, in order to own shares privately, the average employee participant in a Japanese ESOP must stay with the firm for a significant number of years (Jones and Kato 1995). This vesting feature would be expected to discourage employee turnover and promote the formation of more firm-specific human capital.

Complementary Effects of HRMPs. Employee participation/involvement and financial participation are likely to have complementary effects on productivity through goal-alignment processes, with financial participation directly aligning employees' and management's goals, and employee participation/involvement indirectly aligning the two parties' goals by modifying employee perceptions and expectations regarding management's behavior. Three specific mechanisms may be proposed. First, as Levine and Tyson (1990:209) argue, successful employee participation/involvement will require financial participation schemes that assure financial rewards for continued participation. Employee participation/involvement, which induces employees' cooperative behavior is not likely to be effective over the long haul in the absence of tangible rewards because employees may lose interest in being cooperative and become less loyal.

Second, successful financial participation may also require employee participation/involvement, in part due to the role that employee participation/involvement plays in reducing management's moral hazard. One of the important preconditions for a successful financial participation scheme is that employees believe that management is honest in reporting the status of the firm to both employees and outside markets. Voluntary information sharing, often involving private information not yet available to outside investors, allows employees to monitor employer behavior more effectively. Management that voluntarily shares financial and other business information knowing that such information may be used to discipline its own behavior is not likely to engage in deceptive and opportunistic behavior regarding financial participation schemes.

Third, Weitzman and Kruse (1990:100) argue that profit sharing works only when the free-rider problem is effectively solved. Arguably, the free-rider problem will be alleviated when workers develop a strong long-term commitment to the company so that workers face a repeated game, as discussed above, or when workers engage in active peer monitoring. Employee participation/involvement can be a mechanism that facilitates the development of a long-term commitment to the firm by its workers.

Discussion on the complementarities among HRMPs often neglects potentially important complementarities between participation at the top level and participation at the grassroots level. It is quite possible that employee participation/involvement at the top level without employee participation/involvement at the grassroots level results in a significant gap between labor representatives (often union officials) and the rank-and-file in terms of their sense of goal alignment with management. The gap may not only reduce the overall goal alignment between labor and management but create a complex coordination problem of three distinct constituencies: management, labor leaders, and the rank-and-file. Apathy and a sense of alienation, and hence reduced morale, of the rank-and-file may result.

In addition, as Koike (1978:196) suggests, employee participation/involvement at the grassroots level may complement employee participation/involvement at the top level by providing a forum for information shared at the top level to be disseminated to the rank-and-file. For instance, as previously discussed, SFCs facilitate sharing information concerning not only standard shop-floor issues but also information on business and corporate strategic plans that are discussed during the JLMC meetings.

Basic Empirical Strategy and the Data

In estimating the impact of HRMPs on productive efficiency, our basic empirical strategy is to use a production-function framework.[13] Specifically we estimate equations of the general form:

$$Q = F(K, L, H, Z) \tag{1}$$

where Q denotes a measure of output, K and L are measures of total capital stock and total employment, H is a vector of variables representing the effects of HRMPs on productivity, and Z is a vector of control variables, such as managerial ability.

We estimate various specifications of equation (1) by using an important new 20-year panel containing 126 firms over the 1973–1992 accounting year period. All observations are for manufacturing firms listed in Japan's three major stock exchanges, Tokyo, Osaka, and Nagoya. This panel data set was

[13]Our framework is similar to the one adopted by recent studies on the productivity effect of HRMPs in the United States, the United Kingdom, and Japan. See, for instance, Cable and Wilson (1989, 1990), Wadhwani and Wall (1990), Kruse (1993), Jones and Kato (1995), Ichniowski, Shaw, and Prennushi (1997), and Freeman, Kleiner, and Ostroff (2000).

assembled by merging two databases. The data on JLMCs, SFCs, ESOPs, and PSPs were from our HRM Survey of Japanese Firms. The data on Q, K, and L were compiled from the Nikkei financial data tapes, *Nikkei NEEDS*.[14] In converting nominal variables into real variables, we used the Wholesale Price Indices (WPI) published by the Bank of Japan to deflate all nominal variables.

An obvious yet often unfeasible specification would be to run a single large regression that includes all available HRMP variables and a full set of interaction terms among these variables. This approach is, however, confronted by severe collinearity among HRMPs and their interaction terms, and the lack of sufficient numbers of degrees of freedom.[15] No available data on HRMPs (including ours) is large and rich enough to overcome these problems directly and hence make the approach feasible.

An alternative and more feasible approach is to create a number of dummy variables that indicate the presence of certain clusters of HRMPs, and run regressions with these dummy variables.[16] For both theoretical and empirical considerations, we group all possible combinations of these four HRMPs into four types of clusters, or four levels of participation systems. System 4 is the lowest level of participation with no HRMPs. System 3 contains either at least one form of employee participation/involvement (JLMCs and/or SFCs) or at least one form of financial participation (ESOPs and/or PSPs) but not both. As such, System 3 does not exploit the potential complementarity between employee participation/involvement and financial participation. All other combinations of these four HRMPs have at least one form of employee participation/involvement and at least one form of financial participation. Since our theoretical discussion above pointed to an important distinction between employee participation/

[14]We decided the starting year of our panel to be 1973 since any earlier starting year was found to result in a substantial loss of observations. We compared the incidence of HRMPs between the original sample of manufacturing firms who responded to our Survey (226 firms) and a subset of these firms who provided complete information for our econometric analysis (126 firms), and found very little difference.

[15]Hong and McMillan (1994) and Ichniowski, Shaw, and Prennushi (1997) recognized these problems and propose and apply solutions to their data.

[16]Ichniowski, Shaw, and Prennushi (1997) applied a similar approach to their data on steel finishing lines and estimated the productivity effects of clusters of HRMPs. This approach requires us to use only those firms that provide complete information on all four HRMPs and thus reduces the number of usable observations. An alternative, more parsimonious yet less complete approach is to run a set of six pairwise regressions, each of which considers two HRMPs at a time, and try to identify any indication of complementarities among HRMPs (Hong and McMillan (1994) applied a similar approach to their data on Chinese firms and found evidence for complementarities among a number of managerial incentive mechanisms). This alternative approach allows us to maintain 2,740 (137 firms) to 3,040 (152 firms) usable observations whereas the first approach reduces the number of usable observations to 2,520 (126 firms). See Kato and Morishima (1998) for the results from this alternative approach.

involvement at the top level and at the grassroots level, we further divide these latter combinations into two groups. System 2 lacks either employee participation/involvement at the top level or at the grassroots level. In other words, these firms have both employee participation/involvement and financial participation but their employee participation/involvement is not complete. System 1 contains all three ingredients of successful participation: employee participation/involvement at the top level (JLMCs), employee participation/involvement at the grassroots level (SFCs), and financial participation (ESOPs and/or PSPs).

We ignore the distinction between two forms of financial participation (ESOPs and PSPs) because a closer look at our survey data revealed that PSPs are a recent and relatively unpopular practice in Japan and that firms rarely adopt PSPs prior to ESOPs. Distinguishing PSPs from ESOPs in Japanese financial participation does not seem to make sense empirically and there does not appear to be a particularly strong theoretical ground for such an distinction. Thus, for the sake of degree of freedom, we decided to ignore the distinction between ESOPs and PSPs in the subsequent analysis.

Specifications and Results

Specifically, we begin with a simple Cobb-Douglas production function augmented by three dummy variables:

$$\begin{aligned} \ln Q_{it} = {} & \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 SYSTEM1_{it-j} + \beta_2 SYSTEM2_{it-j} \\ & + \beta_3 SYSTEM3_{it-j} + (\text{firm specific fixed effects}) \\ & + (\text{year effects}) + (\text{industry time trends}) + u_{it} \end{aligned} \tag{2}$$

where Q_{it} is output of firm i in year t, K_{it} is the capital stock, L_{it} is labor, and $SYSTEM1_{it-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial participation schemes (ESOPs and PSPs) have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{it-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs (but not both) and at least one of the financial participation schemes have been in existence for j and more years and the value of 0 otherwise. $SYSTEM3_{it-j}$ is a dummy variable that takes the value of 1 if either employee participation/involvement or financial participation (but not both) has been in existence for j and more years, the value of 0 otherwise. $SYSTEM4_{it-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise and this dummy variable is omitted from the right-hand side as a

reference. βs are slope coefficients. For the disturbance term, u_{it}, we assume $u_{it} \sim \text{NID}(0, \sigma^2)$.

The coefficient on SYSTEM1_{-j} (for the sake of exposition, from now on, we omit subscripts i and t) can be interpreted as indicating the productivity difference between firms that have all three ingredients of successful participation and firms with no HRMPs. Analogous interpretations can be given to the coefficients on SYSTEM2_{-j} and SYSTEM3_{-j}.

We allow for significant lags (up to 10 years, or $j = 1, 2, \ldots, 10$) in the productivity effects of HRMPs for several reasons. First, it is highly unlikely that instituting a HRMP will instantly create significant interest alignment between labor and management and/or the labor force with more firm-specific human capital. It takes time for a HRMP to generate an industrial-relations climate conducive to positive productivity effects.[17]

Second, a newly established HRMP tends to go through a significant amount of learning by doing in its early developmental (often turbulent) years. For instance, for the first decade of the JLMC of Ajinomoto, a leading food processing firm with close to 6,000 employees, both management and unions viewed their JLMC largely as a preliminary round for formal collective bargaining that was at times adversarial. In other words, the early JLMC was intended mostly to facilitate formal collective bargaining. It was only after the first decade that the JLMC was given a status clearly separate from collective bargaining and a focus on the issues concerning productivity enhancement. It appears that through a decade of development, both management and labor learned the potentially important productivity gains from employee participation/involvement via JLMCs and thereby redesigned the JLMC to capture these potentially beneficial productivity effects.

Isetan, a department store chain with 6,000 employees, introduced various special subcommittees after a decade of development of their JLMC. These special subcommittees were considered quite successful. The JLMC of Honda was held irregularly in its early years; since 1979 these meetings have been held regularly six times a year. For Panasonic, the founder, Konosuke Matsushita, proposed a JLMC to its newly formed union in July 1946. Starting at that time, JLMC meetings were held once a month and Mr. Matsushita always attended. From 1955 to 1973, however, the JLMC was given a secondary role as a forum for preliminary rounds for formal collective bargaining, and its potentially important participatory effects on worker incentives and productivity were largely ignored. It was only after 1973 that these potentially important productivity gains from the JLMC

[17]For similar arguments, see Pil and MacDuffie (1996) and Ichniowski and Shaw (1995).

were recognized and that the Panasonic's JLMC was substantially expanded in its role and refined in its structure to capture these productivity gains.[18]

Third, Japan Productivity Center (1990:15) and Kato (2000) stress the importance of the ability of labor representatives to fully understand information provided by management and study it and come up with valuable advice to management. It is highly improbable that labor representatives develop this ability overnight.

Fourth, in investigating the productivity effects of HRMPs, ideally we want to use the presence of HRMPs (a *de jure* measure) as well as the extent of HRMPs (a *de facto* measure), such as the quantity and quality of information shared during JLMC meetings. Unfortunately, no panel data on such *de facto* measures are available for Japanese firms.[19] We can, however, measure the extent of HRMPs indirectly by allowing for lags in the productivity effects of HRMPs in so far as the extent of HRMPs is positively correlated with the length of time HRMPs have been in place (see Freeman and Kleiner (2000) for such positive correlations).

In sum, we assume that it will take at least j years ($j = 1, 2, \ldots, 10$) for a newly introduced HRMP to mature and hence realize its full potential of creating either significant interest alignment between labor and management and/or the labor force with more firm-specific human capital. We will use our regression analysis to pin down the actual lag time.

We include firm-specific fixed effects to capture the time-invariant unobserved heterogeneity of our firms. In particular, firm-specific fixed effects will attempt to control for differences among firms in managerial abilities and worker quality. As Wadhwani and Wall (1990) argue in the case of profit sharing, an innovative HRMP might be adopted in firms that are better managed. If so, the coefficients on HRMP variables might indicate the effects of superior management in general as well as the actual effects of HRMPs. If managerial differences across firms are largely time-invariant, firm-specific fixed effects will help separate the two effects. Moreover, as Conte and Svejnar (1990) argue in the case of ESOPs, firms with innovative HRMPs might have more productive and more qualified workers than do conventional firms. To the extent that they are time-invariant, firm-specific fixed effects will also capture these quality differences.[20]

[18]These case histories were drawn from Japan Productivity Center (1990).

[19]However, Morishima (1991a) provides evidence that Japanese workers are more likely to view information shared through JLMCs as genuinely "confidential" than do U.S. workers. In this sense, JLMCs are more likely to be "real" in Japan than in the United States, and the gap between the *de jure* and *de facto* measures can be considered narrower in Japan than in the United States.

[20]A similar argument is made for the case of profit sharing by Nakamura and Nakamura (1989) and Ehrenberg (1990).

In addition, we include year effects to capture technological change and other shocks that are common to all firms. Industry time trends are also included to capture industry-specific time trends common to all firms in each of 13 industries.

Table 2 provides summary statistics for the estimations of equation (2). Output is measured by value added deflated by the WPI for manufacturing products at the two-digit industry level (published by the Bank of Japan) for each accounting year.[21] The capital stock is proxied by the fixed assets of the firm deflated by the WPI for capital goods (published by the Bank of Japan). Labor is measured by the number of workers (executives and temporary workers excluded). We show data for the whole sample and also for those with $\text{SYSTEM1}_{-j} = 1$, $\text{SYSTEM2}_{-j} = 1$, $\text{SYSTEM3}_{-j} = 1$, and $\text{SYSTEM4}_{-j} = 1$ (for $j = 1$, 4, 7, and 10).[22]

Table 3 provides the OLS estimates of equation (2). The sums of estimated β_K and β_L are similar to those obtained by Jones and Kato (1995). First, as expected, when we allow for only one year of maturing of HRMPs, we find no statistically significant productivity effects of any participation system. However, when we allow for seven years of maturing of HRMPs, the estimated coefficient on SYSTEM1_{-j} is positive and statistically significant at the 1 percent level. It follows that moving from the traditional system of no participation to a highly participatory system with employee participation/involvement at the top level and at the grassroots level and financial participation will lead to a 9 percent increase in productivity (using a simple formulae, $\{\exp(\beta_1) - 1\}*100$) and that this productivity payoff takes seven years.[23] To see if the productivity payoff disappears after seven years of developmental phase, we further consider $j = 10$. Although somewhat smaller, we still find a statistically significant productivity difference between the highly participatory system (SYSTEM1) and the traditional system of no participation (SYSTEM4). The productivity gain from SYSTEM1 appears to be rather enduring.

[21]The data on value added as a proxy for Q were created by adding labor costs and depreciation to operational profit. A similar procedure was used to calculate value added for earlier years by the Oriental Economist (*Toyokeizai Shinpo Sha*) whose value-added data were widely used by both scholars and practitioners Kato and Jones (1995) used these value-added data for their study of Japanese ESOPs during earlier years). Most prior studies use sales to proxy output. We believe our use of the (theoretically preferable) value added instead of sales is a strength of the article.

[22]For the rest of the article, we present the results only for $j = 1$, 4, 7, and 10 since our main conclusions are drawn sufficiently from the results from those four lags ($j = 1$, 4, 7, and 10) and presenting the results from the remaining six lags ($j = 2$, 3, 5, 6, 8, and 9) does not add much. The results for $j = 2$, 3, 5, 6, 8, and 9 as well as other unreported results are available upon request from the authors.

[23]According to the OLS estimates of equation (2) for $j = 6$, we find no significant effect of any participation system. Thus, it appears that six years of maturing is not sufficient for the significant productivity payoff from SYSTEM1.

TABLE 2

SUMMARY STATISTICS: MEANS (STANDARD DEVIATIONS)

	Value added in billions of 1980 yen ($Q \times 10^{-9}$)	Capital stock in billions of 1980 yen ($K \times 10^{-9}$)	Employment in thousands of workers ($L \times 10^{-3}$)	Number of observations
All	16.924	17.474	4.039	2520
	(56.030)	(35.368)	(9.375)	
$SYSTEM1_{-1} = 1$	14.705	19.544	3.610	925
	(32.729)	(35.554)	(6.948)	
$SYSTEM2_{-1} = 1$	26.334	22.008	5.742	953
	(83.854)	(43.256)	(13.078)	
$SYSTEM3_{-1} = 1$	5.469	7.916	1.949	564
	(8.361)	(13.344)	(3.250)	
$SYSTEM4_{-1} = 1$	11.110	6.634	3.429	78
	(15.865)	(14.941)	(5.785)	
$SYSTEM1_{-4} = 1$	15.293	20.025	3.466	778
	(34.846)	(36.609)	(6.420)	
$SYSTEM2_{-4} = 1$	27.875	22.986	5.601	837
	(88.425)	(45.150)	(12.709)	
$SYSTEM3_{-4} = 1$	7.776	10.428	2.937	776
	(16.732)	(19.047)	(7.591)	
$SYSTEM4_{-4} = 1$	10.739	8.713	3.990	129
	(17.359)	(18.822)	(7.088)	
$SYSTEM1_{-7} = 1$	16.044	20.599	3.290	618
	(37.563)	(37.939)	(5.828)	
$SYSTEM2_{-7} = 1$	30.324	24.770	5.567	696
	(95.304)	(48.554)	(12.654)	
$SYSTEM3_{-7} = 1$	9.559	11.890	3.345	987
	(21.761)	(20.489)	(8.260)	
$SYSTEM4_{-7} = 1$	10.019	10.634	4.421	219
	(17.726)	(24.079)	(9.427)	
$SYSTEM1_{-10} = 1$	16.440	21.005	3.061	467
	(40.759)	(38.990)	(5.119)	
$SYSTEM2_{-10} = 1$	33.121	26.878	5.557	556
	(103.778)	(53.175)	(12.760)	
$SYSTEM3_{-10} = 1$	11.296	13.236	3.542	1158
	(26.870)	(21.859)	(8.286)	
$SYSTEM4_{-10} = 1$	10.252	11.663	4.594	339
	(19.120)	(26.266)	(10.496)	

SOURCES: *Human Resource Management Survey of Japanese Firms*; *Nikkei NEEDS*.

[a]$SYSTEM1_{-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial-participation schemes (ESOPs and PSPs), have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs and at least one of the financial-participation schemes have been in existence for j and more years, the value of 0 otherwise; $SYSTEM3_{-j}$ is a dummy variable that takes the value of 1 if at least one HRMP has been in existence for j and more years but an information-sharing mechanism and a financial-participation scheme have not been in coexistence for j and more years, the value of 0 otherwise; and $SYSTEM4_{-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise.

TABLE 3

OLS ESTIMATES OF COBB-DOUGLAS PRODUCTION FUNCTIONS, AUGMENTED BY SYSTEM1, SYSTEM2, AND SYSTEM3 (DEPENDENT VARIABLE = ln Q)

	j = 1	j = 4	j = 7	j = 10
lnK	0.230***	0.231***	0.233***	0.230***
	(11.126)	(11.128)	(11.279)	(11.118)
lnL	0.628***	0.633***	0.625***	0.630***
	(18.438)	(18.550)	(18.478)	(18.594)
$SYSTEM1_{-j}$	−0.025	−0.041	0.090***	0.085***
	(−0.462)	(−1.000)	(2.641)	(2.693)
$SYSTEM2_{-j}$	0.003	−0.050	0.037	0.034
	(0.064)	(−1.241)	(1.110)	(1.160)
$SYSTEM3_{-j}$	−0.007	−0.066*	0.013	0.026
	(−0.140)	(−1.923)	(0.500)	(1.141)
R^2	0.967	0.967	0.967	0.967

SOURCES: *Human Resource Management Survey of Japanese Firms*; *Nikkei NEEDS*.

[a]$SYSTEM1_{-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial-participation schemes (ESOPs and PSPs), have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs and at least one of the financial-participation schemes have been in existence for j and more years, the value of 0 otherwise; $SYSTEM3_{-j}$ is a dummy variable that takes the value of 1 if at least one HRMP has been in existence for j and more years but an information-sharing mechanism and a financial-participation scheme have not been in coexistence for j and more years, the value of 0 otherwise; and $SYSTEM4_{-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise.

[b]For all regressions, there were 2,520 observations on 126 firms over the 1973—1992 time period, and values of t statistics are in parentheses. All models include firm-specific fixed effects, year effects, and industry time trends.

*significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

On the other hand, we find no statistically significant productivity payoff from moving from the traditional system of no participation to the other two intermediate systems of participation (SYSTEM2 and SYSTEM3).[24] Even allowing for 10 years of maturing, we still find no such statistically significant effect. In fact, for j = 4, the estimated coefficient on $SYSTEM3_{-j}$ is negative and statistically significant at the 10 percent level. It follows that four years after the introduction of SYSTEM3, a participation system with no opportunity for synergy among HRMPs, the firm will experience a productivity loss. However, this productivity loss will dissipate over time since for j = 7 and 10, the estimated coefficients on $SYSTEM3_{-j}$ are no longer negative.

Table 4 provides an account of whether, and by how much the simple OLS results change when we use instrumental variables (IV) to correct for the possible endogeneity of labor and the capital stock. In addition to the predetermined variables included in the model, we use as instruments the

[24]To see if moving from either one of those intermediate systems to SYSTEM1 (a highly participatory system) is found to be associated with a statistically significant productivity increase, we reestimated equation (2), omitting $SYSTEM1_{-7}$ instead of $SYSTEM4_{-7}$. Such moves were indeed found to result in statistically significant productivity increases.

TABLE 4

ESTIMATES OF COBB-DOUGLAS PRODUCTION FUNCTIONS, AUGMENTED BY IV SYSTEM1, SYSTEM2 AND SYSTEM3 (DEPENDENT VARIABLE = ln Q)

	j = 1	j = 4	j = 7	j = 10
ln K	0.227***	0.229***	0.237***	0.231***
	(7.526)	(7.531)	(7.867)	(7.648)
ln L	0.560***	0.567***	0.550***	0.559***
	(11.786)	(11.879)	(11.680)	(11.856)
$SYSTEM1_{-j}$	−0.006	−0.030	0.096***	0.087***
	(−0.115)	(−0.735)	(2.802)	(2.750)
$SYSTEM2_{-j}$	0.026	−0.036	0.046	0.039
	(0.471)	(−0.889)	(1.389)	(1.328)
$SYSTEM3_{-j}$	0.010	−0.057*	0.019	0.032
	(0.211)	(−1.639)	(0.709)	(1.362)

SOURCES: *Human Resource Management Survey of Japanese Firms*; *Nikkei NEEDS*.

[a]$SYSTEM1_{-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial-participation schemes (ESOPs and PSPs), have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs and at least one of the financial-participation schemes have been in existence for j and more years, the value of 0 otherwise; $SYSTEM3_{-j}$ is a dummy variable that takes the value of 1 if at least one HRMP has been in existence for j and more years but an information-sharing mechanism and a financial-participation scheme have not been in coexistence for j and more years, the value of 0 otherwise; and $SYSTEM4_{-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise.

[b]For all regressions, there were 2,520 observations on 126 firms over the 1973—1992 time period, and values of asymptotic t statistics are in parentheses. All models include firm-specific fixed effects, year effects, and industry time trends. The variables lnK and lnL are instrumented by using, in addition to the predetermined variables included in the model, the second lags of the following variables: lnK; lnL; total labor costs per employee measured in 1980 yen; log of sales in 1980 yen; profit margin; and return on asset.

*significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

second lags of the following variables: $\ln K$; $\ln L$; total labor costs per employee measured in 1980 yen; log of sales in 1980 yen; profit margin; and return on assets.[25] As shown in the table, the results do not change in the IV estimates.

Tables 5 and 6 repeat the same analysis using the translog specification rather than the Cobb-Douglas. That is,

$$\begin{aligned} \ln Q_{it} = {} & \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_{KK}(\ln K_{it})^2 + \beta_{LL}(\ln L_{it})^2 \\ & + \beta_{KL}(\ln K_{it}) * (\ln L_{it}) + \beta_1 SYSTEM1_{it-j} \\ & + \beta_2 SYSTEM2_{it-j} + \beta_3 SYSTEM3_{it-j} \\ & + (\text{firm-specific fixed effects}) \\ & + (\text{year effects}) + (\text{industry time trends}) + u_{it} \end{aligned} \tag{3}$$

[25]These instruments are similar to those used in the relevant literature (e.g., Wadhwani and Wall 1990; Jones and Kato 1995).

TABLE 5

OLS ESTIMATES OF TRANSLOG PRODUCTION FUNCTIONS, AUGMENTED BY SYSTEM1, SYSTEM2, AND SYSTEM3 (DEPENDENT VARIABLE = ln Q)

	j = 1	j = 4	j = 7	j = 10
lnK	−0.556	−0.490	−0.463	−0.505
	(−1.580)	(−1.394)	(−1.316)	(−1.439)
lnL	1.265***	1.260***	1.171***	1.196***
	(3.460)	(3.443)	(3.201)	(3.268)
$(lnK)^2$	0.018*	0.016	0.016	0.017
	(1.655)	(1.467)	(1.448)	(1.547)
$(lnL)^2$	−0.033*	−0.038**	−0.030*	−0.030*
	(−1.891)	(−2.168)	(−1.726)	(−1.715)
(lnK)*(lnL)	−0.006	−0.002	−0.004	−0.005
	(−0.248)	(−0.086)	(−0.160)	(−0.206)
$SYSTEM1_{-j}$	−0.038	−0.063	0.074**	0.069**
	(−0.703)	(−1.548)	(2.160)	(2.154)
$SYSTEM2_{-j}$	−0.003	−0.071*	0.021	0.018
	(−0.049)	(−1.743)	(0.636)	(0.594)
$SYSTEM3_{-j}$	−0.019	−0.082**	0.008	0.020
	(−0.384)	(−2.366)	(0.284)	(0.886)
R^2:	0.967	0.967	0.967	0.967

SOURCES: *Human Resource Management Survey of Japanese Firms*; *Nikkei NEEDS*.

[a]$SYSTEM1_{-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial-participation schemes (ESOPs and PSPs), have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs and at least one of the financial-participation schemes have been in existence for j and more years, the value of 0 otherwise; $SYSTEM3_{-j}$ is a dummy variable that takes the value of 1 if at least one HRMP has been in existence for j and more years but an information-sharing mechanism and a financial-participation scheme have not been in coexistence for j and more years, the value of 0 otherwise; and $SYSTEM4_{-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise.

[b]For all regressions, there were 2,520 observations on 126 firms over the 1973—1992 time period, and values of t statistics are in parentheses. All models include firm-specific fixed effects, year effects, and industry time trends.

*significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

To see whether the translog production functions are well behaved, we calculated the elasticity of output with respect to capital and labor. Always we find positive elasticities and elasticities that are fairly close to those obtained earlier from the Cobb-Douglas specification.[26] As such, the translog production functions appear to be well behaved. In addition, F tests indicate that the translog is the preferred specification. Most importantly,

[26]Substituting the estimates of β_K, β_{KK}, and β_{KL} and lnK = 22.577 (the mean value for lnK), lnL = 7.467 (the mean values for lnL) into $\beta_K + 2\beta_{KK}$ lnK + β_{KL} lnL yields the output elasticity of capital. The output elasticity of labor can be calculated likewise. The output elasticities of capital calculated from j = 1, 4, 7, and 10 of Table 4 are 0.234, 0.233, 0.238, and 0.235, respectively. The analogous output elasticities of labor are 0.635, 0.641, 0.632, and 0.636. Using the IV estimates of Table 5, we calculate the output elasticities of capital as 0.224, 0.223, 0.234, and 0.228, respectively; the associated output elasticities of labor are 0.565, 0.573, 0.557, and 0.564.

TABLE 6

ESTIMATES OF TRANSLOG PRODUCTION FUNCTIONS, AUGMENTED BY IV SYSTEM1, SYSTEM2, AND SYSTEM3 (DEPENDENT VARIABLE = ln Q)

	j = 1	j = 4	j = 7	j = 10
lnK	−1.048**	−0.939**	−0.893**	−0.979**
	(−2.304)	(−2.071)	(−1.965)	(−2.162)
lnL	1.678***	1.668***	1.542***	1.603***
	(3.692)	(3.669)	(3.388)	(3.523)
$(\ln K)^2$	0.036***	0.033**	0.032**	0.034**
	(2.469)	(2.240)	(2.204)	(2.368)
$(\ln L)^2$	−0.003	−0.011	−0.0004	0.0003
	(−0.112)	(−0.457)	(−0.019)	(0.012)
(lnK)*(lnL)	−0.048	−0.041	−0.043	−0.046
	(−1.572)	(−1.372)	(−1.433)	(−1.529)
$SYSTEM1_{-j}$	−0.010	−0.049	0.085**	0.074**
	(−0.186)	(−1.165)	(2.436)	(2.323)
$SYSTEM2_{-j}$	0.030	−0.050	0.037	0.029
	(0.543)	(−1.218)	(1.108)	(0.946)
$SYSTEM3_{-j}$	0.008	−0.067	0.018	0.028
	(0.163)	(−1.901)*	(0.649)	(1.214)

SOURCES: *Human Resource Management Survey of Japanese Firms*; *Nikkei NEEDS*.

[a]$SYSTEM1_{-j}$ is a dummy variable that takes the value of 1 if both JLMCs and SFCs, and at least one of the financial-participation schemes (ESOPs and PSPs), have been in existence for j and more years, and the value of 0 otherwise. Likewise, $SYSTEM2_{-j}$ is a dummy variable that takes the value of 1 if either JLMCs or SFCs and at least one of the financial-participation schemes have been in existence for j and more years, the value of 0 otherwise; $SYSTEM3_{-j}$ is a dummy variable that takes the value of 1 if at least one HRMP has been in existence for j and more years but an information-sharing mechanism and a financial-participation scheme have not been in coexistence for j and more years, the value of 0 otherwise; and $SYSTEM4_{-j}$ is a dummy variable that takes the value of 1 if no HRMP has been in existence for j and more years, the value of 0 otherwise.

[b]For all regressions, there were 2,520 observations on 126 firms over the 1973–1992 time period, and values of asymptotic t statistics are in parentheses. All models include firm-specific fixed effects, year effects, and industry time trends. The variables ln K, ln L, $(\ln K)^2$, $(\ln L)^2$, and (lnK)*(lnL) are instrumented by using, in addition to the predetermined variables included in the model, the second lags of the following variables: ln K; ln L; $(\ln K)^2$; $(\ln L)^2$; (lnK)*(lnL); total labor costs per employee measured in 1980 yen; log of sales in 1980 yen; profit margin; and return on asset.

*significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

comparisons of Table 5 to Table 3 and Table 6 to Table 4 point to the robustness of our results on the productivity effect of HRMPs. The finding of a positive productivity effect for firms that have had SYSTEM1 for at least seven years and at least 10 years is independent of the particular specification of production technology, although the size of estimated productivity payoff tends to fall somewhat with the translog specification. For example, with the OLS estimates of the Cobb-Douglas specification, moving from SYSTEM4 to matured SYSTEM1 is estimated to lead to a 9 percent productivity increase, whereas with the OLS estimates of the translog specification, such a move is estimated to lead to an 8 percent productivity increase.

Adoption of HRMPs

Though the main focus of this article is on the effects of HRMPs and our data are best suited to address the effects of HRMPs, we provide some preliminary evidence on the adoption of HRMPs in this section as such evidence may provide useful insights on the interpretation of the observed effects of HRMPs. Specifically, if HRMP adoption occurs for reasons unrelated to the marginal return to HRMPs in a particular firm (or in the random adoption world), we can make the strongest case for interpreting the productivity results causally (see, e.g., Athey and Stern 1998).[27]

As previously discussed, qualitative evidence suggests that public policy has been an important factor for adoption of some of HRMPs. First, in 1967, a special government committee on foreign capital promoted employee ownership as a way to help prevent takeovers of domestic companies by foreign capital. The government, using informal channels, encouraged firms to adopt ESOPs. While the fear of foreign takeovers of domestic firms lessened in the 1970s, ESOPs took root. Perhaps partly due to this government initiative of 1967, the 1970s were characterized by an amazing pace of diffusion of ESOPs (see Table 1).

Second, JLMCs were one of the many industrial relations institutions proposed at the beginning of 1950s by the Japan Productivity Center. After a decade of tumultuous industrial relations between 1945 and 1955, Japanese unions and management, with backing from the central government, began to adopt a number of well-known HRMPs, including JLMCs and semi-annual bonus payments to all employees. To the extent that such public policy changes are exogenous, the above qualitative evidence is consistent with the random adoption view of HRMPs.

Qualitative evidence also points to the significant role that the leadership quality of management and unions sometimes plays in HRMP adoption. For example, Panasonic adopted JLMC before most other Japanese firms, in part due to the creative and progressive mind of its founder Konosuke Matsushita. The second example concerns a union leader of firm A where JLMC existed at least in 1955. Initially JLMC was functioning as a mechanism for management to explain their

[27]Alternatively, for example, if poorly performing companies are likely to adopt HRMPs and their productivity rises, one might argue that HRMP adoption is evidence that they are engaging in restructuring of a more general sort. Conversely, if better-performing firms tend to adopt HRMPs, HRMPs might be viewed as a nonpecuniary device for allowing employees to share in the returns to company. We designed our survey instruments to study the effects of HRMPs. Thus, to address the issue of HRMP adoption fully, we will need to gather additional detailed information about adoption that could differentiate between these alternative theories. We are currently embarking on such an endeavor.

decision *ex post* to union representatives. However, due in part to a charismatic and aggressive union leader, by 1985, JLMC had changed its role from information sharing to joint decision making. For example, during JLMC meetings, union representatives tried to veto a management decision to open a new plant overseas. Following the resignation of the union leader in 1985, the joint decision-making aspect of JLMC was significantly reduced. Finally, Firm C is a medium-size manufacturing firm with sales of 150 billion yen and more than 2,000 workers in 1997. JLMC began in 1970. However, until 1978, JLMC held informal meetings three or four times a year in which labor and management exchanged ideas with no specific agenda. With a strong initiative of a compelling and progressive union leader, JLMC was formalized in 1978, with specific agenda set for each meeting, which lasts four hours (Kato 2000). Again, to the extent that these personal factors are exogenous, the above qualitative evidence is not inconsistent with the random adoption view of HRMPs.

Figure 1 and Table 7 provide some preliminary quantitative evidence on the adoption of HRMPs. In Figure 1, we graph Adoptions (the number of any of JLMCs, SFCs, ESOPs, and PSPs adopted each year), ROA, CROA (change in ROA from the previous year), and Unemployment (national

FIGURE 1
ADOPTIONS OF HRMPS

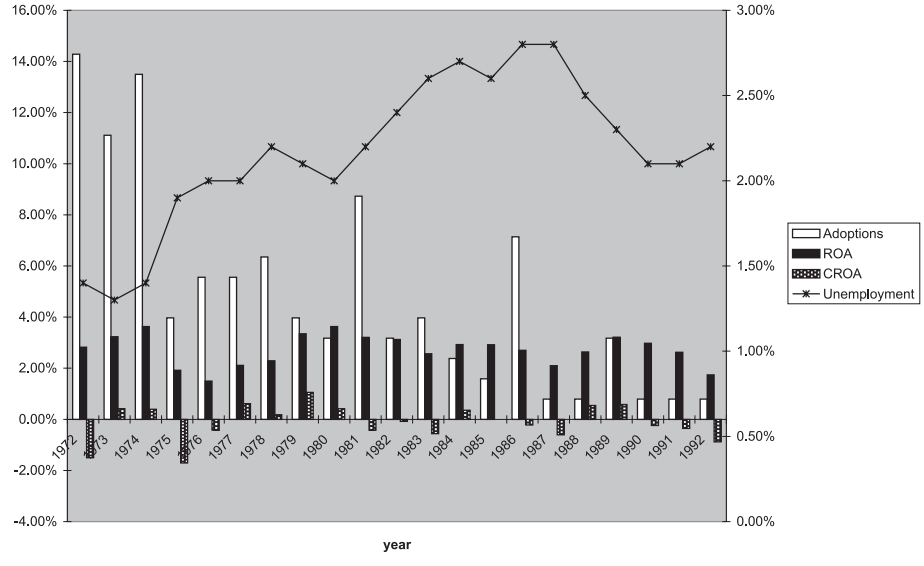

TABLE 7
PROBIT ESTIMATES OF THE ADOPTION OF HRMPS (DEPENDENT VARIABLE: HRMP)

Independent variable	Coefficient	Asymptotic SE	Coefficient	Asymptotic SE
Constant	−1.55*	0.87	−0.43***	0.17
ROA	1.66	4.25	3.37	4.07
CROA	7.27	14.24	2.92	13.94
IROA	22.73	16.34		
ICROA	−34.82*	19.81		
IGEMP	−0.56	6.45	3.92	6.05
Sample size	126		126	
Mean of dependent variable	0.37		0.37	
Log of the likelihood function	−79.89		−82.21	
Model χ^2	5.60		0.97	
Constant	−0.42	0.71	−0.39**	0.17
MARG	2.15	4.01	2.61	3.84
CMARG	14.62	16.84	10.02	16.45
IMARG	1.03	15.55		
ICMAR	−44.50*	27.11		
IGEMP	1.46	6.70	4.09	6.08
Sample size	126		126	
Mean of dependent variable	0.37		0.37	
Log of the likelihood function	−80.49		−82.20	
Model χ^2	4.40		0.98	

SOURCES: *Human Resource Management Survey of Japanese Firms; Nikkei NEEDS* for firm-level variables; and *Japan Statistical Yearbook* for industry-level variables.
HRMP = 1 if at least one of HRMPs (JLMCs, SFCs, PSPs, ESOPs) is adopted during 1972–1974, 0 otherwise.
ROA = Return on asset (net profit/total asset); CROA = change in ROA from previous year;
MARG = profit margin (net profit/sales); CMARG = change in MARG from previous year;
IROA = industry average of ROA; ICROA = industry average of CROA;
IGEMP = industry average of annual employment growth rate.
*significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

unemployment rate) over 1972–1992. Overall, there appears to be no clear and strong time-series correlation between HRMP adoption and firm profitability (measured by ROA)/change in firm profitability/unemployment rate except that firm performance/unemployment and HRMP adoption seemed to have moved somewhat together before and after the first oil crisis. Thus, in the early 1970s, prior to the first oil crisis, ROA was high and unemployment rate was low, and the number of HRMP adoptions was high. As a result of the first oil crisis in 1975, firm performance worsened and the unemployment rate rose substantially. At the same time, the number of HRMP adoptions declined sharply. For the next few years, firm performance remained weak, unemployment remained high, and the number of HRMP adoptions remained relatively low.

To provide more systematic evidence on HRMP adoption, we specify Probit models. Let $HRMP_i$ be a binary variable that assumes the value of 1 if the ith firm adopts any of JLMCs, SFCs, ESOPs, and PSPs during 1972–1974. Thus, we assume for the ith firm that:

$$\Pr(\mathrm{HRMP_i} = 1) = \mathrm{F}(\mathrm{X_i}ß) \tag{4}$$

where X_i is a vector of explanatory variables; ß is a vector of unknown coefficients; and $F(\cdot)$ is the standard normal cumulative distribution function.

Our data enable us to consider the following five explanatory variables: (1) firm profitability; (2) change in profitability from the previous year; (3) industry profitability; (4) change in industry profitability; and (5) industry employment growth rate. We consider two alternative profitability measures, ROA and MARG (profit margin).

The period of 1972–1974 is chosen because HRMP adoption occurred most frequently during this period, as shown in Figure 1. The maximum likelihood estimates of equation (4) are reported in Table 7. As shown in the table, we were unable to find any statistically significant effects on HRMP adoption of firm's profitability and change in profitability. The absence of significant effects on HRMP adoption of firm's profitability and change in profitability does not depend on whether we control for industry-level profitability variables.[28]

Conclusions

We report the first results for Japanese firms on the effects of groups of HRMPs by estimating production functions using a unique new panel data set. We found evidence for the importance of introducing clusters of HRMPs in the following three areas: (1) employee participation/involvement at the top level; (2) employee participation/involvement at the grassroots level; and (3) financial participation. Specifically, moving from the traditional system of no HRMPs to a highly participatory system with

[28]The Probit analysis presented here ought to be viewed as a preliminary exploration. The small sample size with limited information on HRMP adoption makes it difficult to estimate more fully specified models.

HRMPs in all three areas leads to a significant 8 to 9 percent increase in productivity.[29] The full productivity effect is, however, felt only after a fairly long gestation period (seven years). At the same time, we found no evidence for significant productivity gains from changing the industrial relations system from the traditional system to any intermediate system that lacks HRMPs in any one of the three key areas.[30]

Our findings suggest that the goal-alignment process needs to be supported both by direct methods (financial participation) and indirect ones (employee participation/involvement). Furthermore, employee participation/involvement needs to take place not only at the top level but at the grassroots level. In other words, the goal-alignment process occurs most strongly when the interests of the two parties are aligned through financial participation and when this interest alignment is facilitated by mechanisms both at the top level and at the grassroots level. Our findings also point to the importance of a long-term perspective in evaluating the success of HRMPs. First, it does take time for the goal-alignment process to take root. It is highly unlikely that instituting a HRMP will instantly create significant interest alignment of groups of employees with the firm. Furthermore, there is substantial learning by doing in the evolution of HRMPs. HRMPs "mature" over time and only matured HRMPs tend to yield significant productivity gains.

References

Athey, Susan, and Scott Stern. 1998. *An Empirical Framework for Testing Theories About Complimentarity in Organizational Design*. Working Paper No. 6600. Cambridge, MA: National Bureau of Economic Research.

Baker, George, Gibbons Robert, and Kevin J. Murphy. 1994. "Subjective Performance Measures in Optimal Incentive Contracts." *Quarterly Journal of Economics* 108:1125–56.

[29]As shown in Table 2, the average firm's value added was 17 billion of 1980 yen. It follows that the estimated 8 to 9 percent productivity gain amounts to over one billion of 1980 yen in value added per year. This hardly negligible productivity gain might, however, include the positive productivity effects of other employment practices such as small-group activities (e.g., QC circles), use of selective recruitment, job training, extensive performance feedback, or, more generally, better-developed internal labor markets. Unfortunately, data do not allow us to consider these other practices. To the extent that these practices are time invariant, however, our firm-specific fixed effects can capture the effects of these other practices. In addition, the omission of QC circles may not be too serious since prior evidence on the effects of QC circles in Japan seems to be at best mixed. For example, Lincoln and Kalleberg (1996) use a rich and unique comparative data set for Japanese and U.S. manufacturing plants and find no evidence for the positive effects on the commitment of employees of their participation in QC circles in Japanese plants (whereas they do find some evidence for such effects in U.S. plants).

[30]Our results are consistent with Ichniowski, Shaw, and Prennushi (1997) who find that in U.S. steel finishing lines, groups of complementary HRMPs have significant productivity effects whereas individual HRMPs have little effect.

Bartel, Ann P. 2000. *Human Resource Management and Performance in the Service Sector: The Case of Bank Branches*. Working Paper No. 7467. Cambridge, MA: National Bureau of Economic Research.

Becker, Brian E., and Mark A. Huselid. 1998. "High Performance Work Systems and Firm Performance: A Synthesis of Research and Managerial Implications." In *Research in Personnel and Human Resources Management*, edited by Gerald R. Ferris, Vol. 16, pp. 53–101. Greenwich, CT: JAI Press.

Ben-Ner, Avner, and Derek C. Jones. 1995. "Employee Participation, Ownership, and Productivity: A Theoretical Framework." *Industrial Relations* 34:532–54.

Black, Sandra E., and Lisa M. Lynch. 1997. *How to Compete: The Impact of Workplace Practices and Information Technology on Productivity*. Working Paper No. 6120. Cambridge, MA: National Bureau of Economic Research.

Blasi, Joseph R. 1988. *Employee Ownership: Revolution or Ripoff*? Cambridge, MA: Balinger.

Blinder Alan S. (ed.). 1990. *Paying for Productivity*. Washington, DC: Brookings Institution.

Brunello, Giorgio. 1991. "Bonuses, Wages and Performances in Japan: Evidence from Micro Data." *Ricerche Economiche* 45:377–96.

Cable, John R., and Nicholas Wilson. 1989. "Profit Sharing and Productivity: An Economic Analysis of UK Engineering Firms." *Economic Journal* 99:366–75.

———. 1990. "Profit Sharing and Productivity: Some Further Evidence." *Economic Journal* 100:550–55.

Commission on the Future of Worker-Management Relations. 1994. Fact Finding Report. Washington, DC: Department of Labor.

Conte, Michael A., and Jan Svejnar. 1990. "The Performance Effects of Employee Ownership Plans." In *Paying for Productivity*, edited by Alan S. Blinder, pp. 143–72. Washington, DC: Brookings Institution.

Ehrenberg, Ronald G. 1990. "Comment." In *Paying for Productivity*, edited by Alan S. Blinder, pp. 88–94. Washington, DC: Brookings Institution.

Fitzroy, Felix R., and Kornelius Kraft. 1987, "Cooperation, Productivity and Profit Sharing." *Quarterly Journal of Economics* 102:23–35.

Freeman Richard B. 1976. "Individual Mobility and Union Voice in the Labor Market." *American Economic Review* 66:361–68.

Freeman, Richard, Morris Kleiner, and Cheri Ostroff. 2000. "The Anatomy of Employee Involvement and it's Effects on FIRMS and Workers." Working Paper No. 8050. Cambridge, MA: National Bureau of Economic Research.

———. 2000. "Who Benefits Most from Employee Involvement: Firms or Workers?" *American Economic Review* 90:219–23.

Freeman, Richard B., and Martin L. Weitzman. 1987. "Bonuses and Employment in Japan." *Journal of the Japanese and International Economies* 1:168–94.

Gibbons, Robert, and Michael Waldman. 1999. "Careers in Organizations: Theory and Evidence." In *Handbook of Labor Economics*, edited by O. Ashenfeler and D. Card, Vol. 3, pp. 2373–2437. New York: Elsevier Science.

Helper, Susan. 1998. *Complementarity and Cost Reduction: Evidence from the Auto Supply Industry*. Working Paper No. 6033 (revised). Cambridge, MA: National Bureau of Economic Research.

Holmstrom, Bengt, and Paul Milgrom. 1994. "The Firm as an Incentive System." *American Economic Review* 84:972–91.

Hong, Yongmiao, and John McMillan. 1994. "The Firm as an Incentive System: Evidence from China's State Firms." Mimeo. New York: Department of Economics, Cornell University.

Ichniowski, Casey, and Kathryn Shaw. 1995. "Old Dogs and New Tricks: Determinants of the Adoption of Productivity-Enhancing Work Practices." *Brookings Papers on Economic Activity, Microeconomics* 1–55.

——— and Giovanna Prennushi. 1997. "The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines." *American Economic Review* 87:291–313.

Inagami, Takeshi. 1988. *Japanese Workplace Industrial Relations*. Industrial Relations Series, No. 14. Tokyo: Japan Institute of Labour.

Japan Productivity Center. 1990. *To Improve Joint Labor Management Committees*. Tokyo: Japan Productivity Center.

Jones, Derek C., and Takao Kato. 1993. "On the Scope, Nature and Effects of Employee Stock Ownership Plans in Japan." *Industrial and Labor Relations Review* 46:352–67.

———. 1995. "The Productivity Effects of Employee Stock Ownership Plans and Bonuses: Evidence from Japanese Panel Data." *American Economic Review* 85:391–414.

Jones, Derek C., and Jeffrey Pliskin. 1991. "The Effects of Worker Participation, Employee Ownership and Profit Sharing on Economic Performance: A Partial Review." In *Ownership and Participation: International Handbook of Participation in Organizations*, edited by Raymond Russell and Veljko Rus, Vol. 2, pp. 43–63. Oxford: Oxford University Press.

Kandel, Eugene, and Edward Lazear. 1992. "Peer Pressure and Partnerships." *Journal of Political Economy* 100:801–17.

Kato, Takao. 2000. *The Recent Transformation of Participatory Employment Practices*. Working Paper No. 7965. Cambridge, MA: National Bureau of Economic Research.

——— and Motohiro Morishima. 1998. "The Productivity Effects of Participatory Employment Practices: Evidence From New Japanese Panel Data." Paper presented at the NBER Summer Institute. Cambridge, MA.

——— and Mark Rockel. 1992. "The Importance of Company Breeding in the U.S. and Japanese Managerial Labor Markets: A Statistical Comparison." *Japan and the World Economy* 4:39–45.

Kleiner, Morris M., and Marvin L. Bouillon. 1991. "Information Sharing of Sensitive Business Date with Employees." *Industrial Relations* 30:480–91.

Koike, Kazuo. 1978. *Worker Participation*. Tokyo: Nihon Hyoron Sha.

Kruse, Douglas L. 1993. *Profit Sharing: Does It Make a Difference?* Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Lawler, Edward E, Susan A. Mohrman, and Gerald Ledford. 1995. *Creating High Performance Organizations*. San Francisco, CA: Jossey-Bass.

Levine, David I. 1995. *Reinventing the Workplace*. Washington, DC: Brookings Institution.

——— and Laura D'Andrea Tyson. 1990. "Participation, Productivity and the Firm's Environment." In *Paying for Productivity*, edited by Alan S. Blinder, pp. 183–236. Washington, DC: Brookings Institution.

Lincoln, James R., and Arne L Kalleberg. 1996. "Commitment, Quits, and Work Organization in Japanese and U.S. Plants." *Industrial and Labor Relations Review* 50:39–59.

Milgrom, Paul, and John Roberts. 1995. "Complementarities and Fit: Strategy, Structure, and Organizational Change in Manufacturing." *Journal of Accounting and Economics* 19:179–208.

Morishima, Motohiro. 1991a. "Information Sharing and Firm Performance in Japan: Do Joint Consultation Committees Help?" *Industrial Relations* 30:37–61.

———. 1991b. "Information Sharing and Collective Bargaining in Japan: Effects on Wage Negotiations." *Industrial and Labor Relations Review* 44:469–85.

Nakamura, Masao, and Alice Nakamura. 1989. "Risk Behavior and the Determinants of Bonus Versus Regular Pay in Japan." *Journal of the Japanese and International Economies* 3:270–91.

Ohashi, Isao. 1989. "On the Determinants of Bonuses and Basic Wages in Large Japanese Firms." *Journal of the Japanese and International Economies* 3:451–79.

Ohkusa, Yasushi, and Fumio Ohtake. 1997. "The Productivity Effects of Information Sharing, Profit-Sharing and ESOPs." *Journal of the Japanese and International Economies* 11:385–402.

Pil, Frits K., and John Paul MacDuffie. 1996. "The Adoption of High-Involvement Work Practices." *Industrial Relations* 35:423–55.

Shimada, Haruo. 1992. "Japan's Industrial Culture and Labor-Management Relations." In *The Political Economy of Japan, Volume 3: Cultural and Social Dynamics*, edited by Shumpei Kumon and Henry Rosovsky, pp. 267–91. Stanford, CA: Stanford University Press.

Tracy, Joseph S. 1992. "An Investigation into the Determinants of U.S. Strike Activity." In *Economic Models of Trade Unions*, edited by P. Garonna, P. Mori, and P. Tedeschi, pp. 213–31. London, New York, and Melbourne: Chapman and Hall.

Tsuru, Tsuyoshi, and Motohiro Morishima. 1999. "Nonunion Employee Representation in Japan." *Journal of Labor Research* 20:93–110.

Wadhwani, Sushil, and Martin Wall. 1990. "The Effects of Profit-Sharing on Employment, Wages, Stock Returns and Productivity: Evidence from UK Micro-Data." *Economic Journal* 100:1–17.

Weitzman, Martin L., and Douglas L. Kruse. 1990. "Profit Sharing and Productivity," In *Paying for Productivity*, edited by Alan S. Blinder, pp. 95–140. Washington, DC: Brookings Institution.