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Does Employee Stock Ownership Work? Evidence from publicly-traded firms in Japan

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Does Employee Stock Ownership Work?[*] Evidence from publicly-traded firms in Japan

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Abstract

This paper provides novel evidence on the effects of employee stock ownership (ESO), using new panel data on Japanese ESO plans for a highly representative sample of publicly-traded firms in Japan (covering more than 75% of all firms listed on Tokyo Stock Exchange) over 1989-2013. Unlike most prior studies, we focus on the effects of changes in varying attributes of existing ESO—the effects on the intensive margin. Our fixed effect estimates show that an increase in the strength of the existing ESO plans measured by stake per employee results in statistically significant productivity gains. Furthermore, such productivity gains are found to lead to profitability gains since wage gains from ESO plans are statistically significant yet rather modest. Our analysis of Tobin's Q suggests that the market tends to view such gains from ESO plans as permanent. We further find that increasing the stake of the existing core participants is more effective in boosting gains from ESO plans than bringing in more employees into the trust. Reassuringly, our key results are found to be robust to the use of instrumental variables to account for possible endogeneity of ESO plans. Finally, we explore possible interplays between ESO plans and firm characteristics such as ownership structure and firm size/age. First, the positive effects on productivity, profitability, wages and Tobin's Q are found to become larger as the proportion of powerful institutional investors and foreign investors rises, implying that the growing importance of such powerful outside shareholders may be reducing the adverse managerial entrenchment effect of ESO plans. Second, productivity gains from ESO plans are found to be more limited for smaller and younger firms. We interpret the finding as evidence in favor of the institutional complementarity view that ESO plans are an integral part of the Japanese High Performance Work System (HPWS)—a complementary cluster of human resource management practices which are more pervasive among larger and older firms in Japan.

Keywords: Employee stock ownership, Group incentive, Productivity, Tobin's Q, Managerial entrenchment.
JEL J54, M52, G32.

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1 Introduction

Compensation systems have been shifting away rapidly from a fixed wage contractual payment basis in many nations around the world (Ben-Ner and Jones, 1995). Particularly prominent is the explosion in the use and interest in Performance Related Pay (PRP) (see, for instance, Bryson, 2012 and Lemieux, MacLeod and Parent, 2009). There are two types of PRP: (i) group incentive schemes which link the financial well-being of workers to group performance such as firm performance; and (ii) individual incentive pay which links pay to individual performance. The focus of this paper is group incentive schemes.

Group incentive pay is also called employee financial participation which includes employee stock ownership, profit sharing, broad-based stock option, and gainsharing/team incentive pay. With the rising use and interest in such employee financial participation schemes, many studies have examined their effects on organizational performance in industrialized countries.[5] Most prior studies consider either Employee Stock Ownership (ESO) plans through which the firm forms an ESO trust consisting of its non-executive employees and promotes ownership of its own shares by the trust[6] or Profit Sharing Plans (PSPs) in which at least part of the compensation for employees is dependent on firm performance (typically profit).[7] Moreover, an increasing number of firms (in particular "New Economy" firms) are extending the use of

[5] For surveys of the literature on financial participation schemes, see for instance Blasi, Conte and Kruse (1996) on employee stock ownership, Jones, Kato and Pliskin (1997) on profit sharing, gain sharing/team incentives, and more recently Blasi, et.al. (2008). For a Meta-analysis of the literature, see Doucouliagos (1995). For a more theoretical survey of the literature, see Gibbons (1997) and Prendergast (1999).
[6] See, for instance, Jones and Kato (1995), Blasi, Conte and Kruse (1996) and Kruse and Blasi (1997). The abbreviation ESO is used to indicate a broader range of employee stock ownership schemes including ESOPs in the US and employee stock ownership plans in Japan.
[7] For detailed discussion on the definition of PSPs, see Kruse (1993) and Jones, Kato and Pliskin (1997).

stock option plans to include non-executive employees in recent years.[8] Finally, with the rising popularity of "High Performance Workplace Practices (notably self-directed teams)", more firms are introducing team incentive pay which makes at least part of the compensation for employees dependent on performance at a more disaggregate level such as the department and the work group.[9] Most recently the shared capitalism literature has been documenting the growing importance of such financial participation schemes (see, for instance, Bryson and Freeman, 2008, and Kruse, Blasi and Park, 2008).[10]

One of the most frequently addressed questions in the literature is whether the introduction of group incentive pay leads to an increase in organizational productivity and if so, how much. By now we have a rich body of evidence on this question (for a recent review, see Bloom and Van Reenen, 2011). Earlier cross-sectional studies, using a large representative survey of firms/establishments, show cross-sectional estimates on the relationship between organizational productivity and the incidence of group incentive pay. A number of subsequent studies obtain organizational-level panel data and provide fixed effect estimates to show that such correlational evidence does not simply reflects an association between unobserved characteristics of organizations (e.g., managerial quality) and the incidence of group incentive pay and that group incentive pay may have a causal relationship with productivity (see, for instance, Jones and Kato, 1995). More recently detailed econometric case studies of organizations provide compelling evidence on the productivity change before and after the introduction of group incentive pay and related HRM practices (see, for example, Hamilton,

[8] See, for instance, Sesil, Kroumova, Blasi and Kruse (2002) and Conyon and Freeman (2004).
[9] See, for example, Hamilton, Nickerson and Owan (2003), Jones and Kato (2011) and Jones, Kalmi and Kauhanen (2010) for teams and TIPs.
[10] The literature on individual incentive pay is equally rich, including a variety of econometric case studies, field experiments, and laboratory experiments (see, for instance, Dohmen and Falk, 2011, Lazear, 2000, and Shearer, 2004).

Nickerson and Owan, 2003 and Jones, Kalmi and Kauhanen, 2010).

In short, most studies on the effects of group incentive pay estimate the effects of the incidence of group incentive pay--- on the extensive margin. There is a disproportionate dearth of evidence on the effect of changes in various attributes of group incentive pay—on the intensive margin.

We believe that the effects on the intensive margin are a mostly unexplored yet potentially fruitful area of inquiry. First, studies of the effects on the extensive margin can be subject to serious measurement errors. As an illustration, consider two firms responding affirmatively to a survey question, “does your firm use group incentive pay?” Studies of the effects on the extensive margin deem those two firms “firms with group incentive pay” and assume that both firms will have the same magnitude of the effects of group incentive pay. Nonetheless, it is plausible that one firm’s group incentive plan applies to only a small proportion of the firm’s labor force, and the other firm’s scheme covers all employees. Studies of the effects on the extensive margin yield the estimate on the productivity effects of group incentive pay that is incorrectly assumed to be identical for both firms. Clearly studies of the effects on the intensive margin are less subject to such measurement errors.

Second, studies of the effects on the intensive margin provide richer policy implications. Specifically for firms that are adopting group incentive pay, evidence on the effects on the intensive margin helps practitioners and policy makers design an effective group incentive pay program. Furthermore for firms that already adopted group incentives, evidence helps them improve the existing programs by modifying their attributes.

Finally with its growing importance, the effects on the intensive margin rather than on the extensive margin are becoming more relevant (see Jones, et al., 2015). For instance, when most

firms use group incentive pay, estimating the effects of group incentive pay on the extensive margin is less relevant, and what really matters is the scope and intensity of the use of the existing group incentives, in other words, the effects on the intensive margin.

There are a number of cross-sectional studies on the effects on the intensive margin (e.g., Jones and Kato, 1993), and as discussed above, such cross-sectional studies cannot yield any causal evidence. Few attempts have been made to use panel data on varying attributes of group incentive pay for a large representative sample of firms, and provide fixed effect estimates on the intensive margin effects of the group incentives. This paper provides such evidence, using reliable panel data on the attributes of Japanese ESO plans for a large representative sample of Japanese firms listed on Tokyo Stock Exchange over the 1989-2013 (accounting year) period.

Our fixed effect estimates show that an increase in the strength of the existing ESO plan measured by stake per employee results in statistically significant productivity gains. Furthermore, such productivity gains are found to lead to profitability gains since wage gains from ESO plans are statistically significant yet rather modest. Our analysis of Tobin's Q suggests that the market tends to view such gains from ESO plans as permanent. We further find that increasing stake of the existing core participants is more effective in boosting gains from ESO plans than bringing in more employees into the trust. Reassuringly our key results are found to be robust to the use of instrumental variables to account for possible endogeneity of ESO plans. Finally we explore possible interplays between ESO plans and firm characteristics such as ownership structure and firm size/age. First, the positive effects on productivity, profitability, wages and Tobin's Q are found to become larger as the proportion of powerful institutional investors and foreign investors rises, implying that the growing importance of such powerful outside shareholders may be reducing the adverse managerial entrenchment effect of ESO plans.

This means that employee stock ownership and external monitoring may work as complements in improving productivity. Second, productivity gains from ESO plans are found to be more limited for smaller and younger firms. We interpret the finding as evidence in favor of institutional complementarity theory that ESO plans are an integral part of the Japanese High Performance Work System (HPWS)--a complementary cluster of human resource management practices which are more pervasive among larger and older firms in Japan.

The paper is organized as follows. In the next section, we provide some background information on ESO plans (institutional information and basic statistics). In section III we provide theoretical discussions on the possible effects of ESO plans on the intensive margin. Section IV presents the basic empirical strategy and main results. Additional analyses concerning the heterogeneous effects of ESO plans are presented in the following section. The concluding section follows.

2 Japanese Employee Stock Ownership Plans

Unlike the U.S. where different forms of employee stock ownership schemes (e.g., ESOPs, ESPPs, and 401K) coexist, there is essentially only one form of employee stock ownership in Japan. The firm voluntarily establishes an ESO trust (called mochikabukai). Unlike the U.S., there is no tax incentive for the establishment of Japanese ESO plans. Participation in Japanese ESO plans is also voluntary, and to induce individual employees to participate in the ESO plan, companies offer subsidies (typically the firm matching each employee's contribution by giving 5 to 10 percent of the contribution as well as bearing administrative costs.)[11] As is the norm elsewhere, individual participants' shares (and dividends) in the ESO plan are held in trust. Unusually, however, each par-

[11] Executives are normally not eligible for membership in ESO plans but they are often eligible for separate executive stock ownership plans.

ticipant has a right to withdraw the shares in round lots and share withdrawals are privately owned. While members may freely exit completely from the ESO plan, re-entry is restricted. Upon retirement, model rules adopted by most ESO plans require retiring workers to exit completely from the ESO plan, and withdraw all of their shares. Such withdrawn shared are owned privately and thereby can be sold freely at the prevailing market price. Finally, general director (rijicho) represents stockholders in the ESO plan. The general director is chosen by other participants, on a one-participant, one-vote basis.[12] 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 ESO plan and thus is not an executive. Unlike U.S. ESOPs, Japanese ESO plans are not leveraged.

As discussed in Kato (2003), ESO plans grew remarkably in Japan during Japan's rapid growth era and managed to weather Japan's Great Recession in the 1990s and early 2000s. According to Tokyo Stock Exchange (TSE), in 2013, 91 percent of firms listed on TSE are reported to have ESO plans.[13] Using most up-to-date data on key attributes of ESO plans for a balanced panel of 572 firms provided by TSE, we produce Figure 1. The figure depicts changes in key attributes of ESO plans of publicly-traded firms in Japan for which we can get data consistently over 1989-2013. As such, the figure captures changes in ESO plans on the intensive margin. In terms of participation rates, the proportion of the labor force in listed firms with ESO plans who participate in the plans has been on a gradual upward trend from below 50 percent in early 1990s to

[12] In practice the general director sometimes assumes the directorship without formal election.

[13] As discussed in detail in Owan, Kato, and Miyajima (2016), the data used to calculate the proportion of TSE-listed firms with ESO plans are based on ESO plans managed by five largest securities firms. Firms with ESO plans managed by trust banks and smaller securities firms were not counted as firms with ESO plans. As such, the true proportion of TSE-listed firms with ESO plans is higher than 91 percent (at least 95% according to some industry experts).

over 60% in mid-2000 and dropped again near 50 percent after the financial crisis.[14] Concerning employee stakes, in 2009, the average participant owns stock worth close to 1.5 million yen that constitutes close to 40% of the value of total financial asset holdings of the average employee household (according to the 2009 National Survey of Family Income and Expenditure).[15] However, these plans do not own large percentages of company stock. For listed companies the proportion of stock owned by ESO plans has been rising recently yet it is still around 2 percent (2.09 in 2013).[16]

3 The Effects of ESO plans: Theoretical Explorations and Testable Hypotheses

The most direct positive effects of ESO plans result from enterprise success being reflected in a higher price of its equity, and thus higher wealth for employees who own stock in the ESO plan. Financially, the interest of the firm is more aligned with the interest of its employees through ESO plans. This better alignment would lead to more active participation and involvement in various productivity-enhancing activities such as small group activities (hallmark of Japanese management), and to smoother and less costly collective bargaining.

Furthermore, goal alignment facilitated by ESO plans could take more subtle, psychological, indirect routes as well. Employees may develop a sense of identity or loyalty to their company though forming a more cooperative relational contract that is otherwise less feasible. As such, when the firm growth is expected, ESO plans can encourage the workers to stay longer with the current

[14] Our participation rate is the number of participants divided by the number of employees of stock-issuing parent company but employees in the subsidiaries including those in the second and third tiers are typically eligible for ESO plans, leading to overestimation of participation rates. Therefore, the trend depicted in Figure 1 may be exaggerated by reorganization of many Japanese companies, which span off their cost-center operations as subsidiaries.

[15] We use data on the value of total financial asset holdings for all households headed by standard employees, excluding all other employee households headed by non-standard employees (such as part-time workers, temporary contract and subcontract workers). Ideally we should use the value of total financial asset holdings for all households headed by standard employees who work in firms listed on TSE. Unfortunately such data are not available.

[16] We also produce the same figure, using the whole data (unbalanced panel) instead of the balanced panel, and find qualitatively similar changes in the three key attributes over the same time period.

employers, thus reducing turnover of workers with valuable firm-specific human capital, and thereby boost enterprise productivity. Decreases in voluntary turnover increase returns from training (human capital investment), and promote the accumulation of firm-specific human capital.

Finally, previous research has often pointed to the peer monitoring effect that arises from ESO plans. Normally when team incentives are provided freeriding can easily occur, but if peer monitoring works and peer pressure imposes discipline, productivity may also increase (Knes and Simester 2001). This mechanism works when a team is organized at a size that makes peer monitoring possible, and when there are expectations of a long-term relationship with colleagues (Che and Yoo 2001).

Turning to the effects on managers of ESO plans, there are some possible adverse effects on managers and firm performance. First, the early literature on employee ownership suggests that employee ownership can dilute the residual claimant status of managers and hence managerial incentive while making the job of managers more difficult—increased voice of workers may make it difficult for managers to take actions to improve efficiency such as wage cuts, lay-offs, or reorganization (Jensen and Meckling, 1976). Second, employee ownership may lead to more managerial entrenchment. Since employee owners are insider owners, in principle managers and employee owners form an insider coalition against the shareholder interest, resulting in insider entrenchment and worsening firm performance.

Therefore, the adoption of an ESO plan could involve tradeoffs between positive and negative effects and either effect may dominate the other depending on differences in the proportion of the total shares owned by the ESO plan. In fact, Guedri and Hollandts (2008) put forth the hypothesis that the relationship between the ESO stockholding and corporate performance can be depicted as an inverted U curve, and using cross-section data from 230 of the 250 representative firms that comprise France's stock index, they have obtained results that are consistent with their hypothesis. Kim and Ouimet (2012) used panel data for U.S. firms to show that the ESOP adoption effect had on average a significantly positive influence on wages and corporate value when the ESO share was below 5%, but the positive effects were offset by the negative effects when the ESO share was above 5%, and the influence on wages and corporate value turned neutral.

Finally in theory group incentive pay such as ESO plans can lead to adverse worker sorting—ESO plans attract low-ability workers who see ESO plans an opportunity to free ride on high-ability workers. We believe that such worker sorting effects are less relevant to listed firms in Japan that continue to use implicit long-term employment contracts for their core employees and their turnover is low (Kambayashi and Kato, 2016).

Based on the above discussions on the possible effects of ESO plans on the intensive margin, we now derive a number of empirically testable hypotheses. Our panel data allow us to construct multiple variables that can capture changes in the existing ESO plans on the intensive margin. First, ESO per employee$_{it}$ is the average value of the capital stake owned by the ESO plan per employees of firm *i* in year *t*. We consider this variable an overall measure of the strength of ESO plans. ESO per employee$_{it}$ can be further decomposed into two components: ESO per participant$_{it}$ (the average value of the capital stake owned by the ESO plan per ESO plan participants of firm i in year t) and participation rate$_{it}$ (the proportion of ESO plan participants of firm i in year t). In other words, the overall strength of ESO plans comes from two separate sources: (i) greater stake of ESO plan participants; and (ii) higher participation rate. Lastly, ESO share$_{it}$ is the proportion of the total shares owned by the ESO plan. This variable gauges the relative power of the ESO plan to other shareholders.

Straightforward applications of the above theoretical explorations to those specific variables yield the following basic hypotheses:

Hypothesis 1: An increase in ESO per employee boosts the goal alignment effect of ESO plans and hence enterprise productivity.

Hypothesis 2: An increase in ESO per participant boosts the goal alignment effect of ESO plans and hence enterprise productivity.

Hypothesis 3: An increase in participation rate boosts the goal alignment effect of ESO plans and hence enterprise productivity.

Hypothesis 4: An increase in ESO share causes the managerial shirking and managerial entrenchment effects of ESO plans to rise, resulting in worsening productivity and profitability.

Hypothesis 5: An increase in ESO per employee also leads to an increase in profitability if not all productivity gains from ESO plans are captured by workers through an equal amount of wage gains.
Hypothesis 6: An increase in ESO per participant also leads to an increase in profitability if not all productivity gains from ESO plans are captured by workers through an equal amount of wage gains.
Hypothesis 7: An increase in participation rate also leads to an increase in profitability if not all productivity gains from ESO plans are captured by workers through an equal amount of wage gains.

We also consider a possibility that complementary practices affect our analyses. One of the most important changes in the workplace across the world in the last three decades is the rising prominence of a new work system often called the High Performance Work System (HPWS). In short, in the HPWS, first workers work in team, and produce product as well as engaging in problem solving activities and producing valuable local knowledge through their collective efforts and share it with management. Workers also deal with local shocks often autonomously through collaboration among themselves. Second, to sustain the interest and desire of workers to take full advantage of such problem solving activities on top of their regular production activities, the firm often pays efficiency wage (high wage/benefits). Furthermore, the interest alignment between workers and the firm is fostered by (i) financial participation schemes by which the financial wellbeing of workers is more tied to the final wellbeing of the firm (ESO plans); and (ii) information sharing mechanisms through which management shares important information with workers, and fosters their loyalty and commitment to the firm. Third, in the HPWS, workers are often provided with strong job security which will enable them to take advantage of the aforementioned opportunities wholeheartedly without fearing any job loss. Finally, careful screening and training are integral part of the HPWS (see, for instance, Ichniowski, Shaw and Prennushi, 1997). The HPWS emerged first in Japan in the 1960s and diffused widely among large and well-established firms in the late 1960s and the 1970s (see, for instance, Kato and Morishima, 2002 and Ichniowski and Shaw, 2003).[17] The HPWS is often

[17] For more detailed analysis of the rise of the High Performance Work System in Japan, see Koike, 2005,

considered a significant example of a system with powerful institutional complementarities (Aoki, 1990, Milgrom and Roberts, 1994, Williamson, 1996, Koike, 2005, and Morita, 2005).

A key insight of institutional complementarities is that one practice such as ESO plans works better when used in tandem with all other complementary practices. Keeping this complementarity issue in mind, we will explore possible interplays between the above hypothesized ESO plan effects and firm characteristics such as ownership structure, firm size and firm age, and the incidence of stock option. First, as powerful institutional investors and foreign investors increase their share of the stock and enhance their influence on the firm's corporate governance, management's ability to deviate from short-term profit maximization will be constrained. This has two implications. On the one hand, the existence of powerful outside owners may limit the management's ability to commit to job security—integral part of the High Performance Work System (HPWS), which is expected to lower the observed effect of ESO plans. On the other hand, it may effectively counteract the adverse effect on productivity and profitability of ESO plans by preventing the management from colluding with ESO plan participants and engaging in entrenchment at the cost of shareholders. As such, it is an empirical question whether we observe greater or smaller overall productivity gains and profitability gains from ESO plans as institutional investors and foreign investors increase their share.

Second, whether the effects of ESO plans are to be more limited for smaller and less-established (younger) firms is *a priori* unknown. One hypothesis is that a smaller size will mitigate free-riding and a better growth prospect of younger firms will improve the return to forming a more cooperative and participatory relational contract or corporate culture associated with employee financial participation, leading to a better productivity gain of ESO plans. But, there is another view. Since the HPWS practices that are complementary with ESO plans are less pervasive among smaller and younger firms, productivity gains from ESO plans may be more limited for such smaller and younger firms. We plan to examine the two opposing hypotheses.

Aoki, 2000, Itoh, 1994, Morita, 2001; 2005, Moriguchi and Ono, 2006 and Rebick, 2005).

Third, stock option is an alternative to ESO plans as a means to increase stake of core employees. As such, stock option may make ESO plans somewhat redundant and thereby less effective, limiting productivity gains from ESO plans. Productivity gains from ESO plans may be smaller for firms that use stock option. Stock option programs introduced at most Japanese firms, however, target only executives or managers. In contrast, ESO plans cover all employees except for executives, to whom executive stock ownership or stock option plans are typically offered. As such, if the benefit of goal alignment is greater when both management and employees hold some stock ownership, the two programs may not be substitutes, or even exhibit complementarity.

4 Data, Basic Empirical Strategy and Main Results

4.1 Effects on Productivity through Multiple Channels

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

(1) $$Q = F(K, L, E, Z)$$

where Q denotes a measure of output, K and L are a measure of total capital stock and total employment; E is a vector of variables representing the effects of ESO plans on productivity; and Z is a vector of control variables such as managerial ability and other human resource management practices.

We estimate various specifications of Eq. (1) by using an important new panel mainly assembled by merging two data bases. First, data on ESO plans are from the Survey of Current Status of Employee Stock Ownership (SCSESO) over FY1989-2013 conducted initially by National Conference of Stock Exchanges (FY1989-1998) and later by Tokyo Stock Exchange (FY1999-2013). This survey relies on the data provided by major securities firms and we were given full access to roughly 80 percent of all firms with ESO plans that are listed on Tokyo Stock Exchange

over 1989-2013.[18] Since well over 90 percent of firms listed on Tokyo Stock Exchange have ESO plans, our data cover more than 75 percent of all firms listed on Tokyo Stock Exchange. As such, our data cover an unusually representative sample of publicly-traded firms in Japan. We further dropped stock-holding companies for whom our outcome variables cannot be calculated. Our final sample contains 1,613 firms over the 1989-2013 (accounting year) period. Second, using unique firm identifiers, the ESO plan data were merged with Nikkei NEED database that provides corporate accounting and stock price information as well as ownership and corporate governance data for all publicly-held firms in Japan. All nominal variables are converted to real variables, using various price indices constructed by Bank of Japan and Statistics Bureau. Additionally, the average wage information was obtained from the corporate accounting database of Development Bank of Japan.[19]

We begin with the following translog production function with fixed effects, augmented by our summary ESO plan variable, ESO per employee:

$$(1) \qquad \ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_{KK}(\ln K_{it})^2 + \beta_{LL}(\ln L_{it})^2 + \beta_{KL}(\ln K_{it} * \ln L_{it}) + \beta_E \ln(\text{ESO per employee}_{it-1}) + X_{it}\lambda + \alpha_i + \tau_t + u_{it}$$

where Q_{it} is output of firm i in year t; K_{it} is the capital stock; L_{it} is labor; X_{it} is a vector of time-variant control variables including ln(share of institutional investors$_{it}$), ln(firm age$_{it}$), industry-specific quadratic time trends; α_i is firm specific fixed effects; τ_t is year effects; and βs are slope coefficients. For the disturbance term, u_{it}, we assume $u_{it} \sim NID(0, \sigma^2)$.

Output is measured by value added deflated by Corporate Goods Price Index for each industry published by the Bank of Japan for each accounting year. The capital stock is proxied by the fixed assets of the firm deflated by Corporate Goods Price Index for capital goods. Labor is

[18] Tokyo Stock Exchange gave us access to the data with the condition that the securities firms which manage the ESO trusts also agree with the use. One of them did not give us its consent. There are also ESO trusts that are managed by smaller securities firms and trust banks, whose information is not surveyed by Tokyo Stock Exchange.

[19] For more information on the data and additional analyses of the data, see Owan, Kato, and Miyajima (2016).

measured by the number of workers (executives and temporary workers excluded). For both capital and labor, we use the average of beginning value and ending value of each accounting year.

We include year dummy variables (τ_t) to capture technological change and other shocks that are common to all firms. As we have stated earlier, industry-specific quadratic time trends will additionally capture industry-specific productivity shocks. Firm specific fixed effects (α_i) capture the time-invariant heterogeneity of our firms. In particular, firm specific fixed effects will attempt to control for differences among firms in managerial abilities, worker quality and other human resource management practices. As Wadhwani and Wall (1990) argue in the case of profit sharing and Jones and Kato (1995) in the case of employee ownership, a stronger form of ESO plan might be adopted in firms that are better managed. If so, the coefficients on a ESO plan variable might indicate the effects of superior managers as well as the actual effects of ESO plans. 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, firms with ESOPs 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. They will also capture differences among firms in their use of other human resource management practices such as the separation payment system (Taishoku Kin Seido), the Joint Consultation Committees (Roshi Kyogi Sei) and QC circles, again to the extent that these practices are time-invariant. Finally, any other time-invariant firm characteristics including corporate culture and traditions are also controlled for by firm fixed effects.

ESO per employee is lagged since raising stake per employee may not lead to stronger goal alignment right away. Eq. (1) assumes that ESO per employee is not endogenous. We will relax this assumption below and provide IV estimates of Eq. (1).

Tables 1 and 2 present summary statistics, and the first column of Table 3 presents the fixed effect estimates of Eq. (1). Frist, to see whether the translog production functions are well behaved, we calculated the elasticity of output with respect to capital and labor evaluated at the mean values. Always we find positive elasticities. We also estimated a simpler Cobb-Douglass production

function and found fairly close estimated elasticities.[20] Since F-test indicates that translog is preferred to CD, we report the translog results throughout the paper.

The estimated coefficient on ln(ESO per employee$_{it}$) is positive and statistically significant at the 1 percent level, supporting Hypothesis 1. A 10-percent increase in ESO plan stake per employee (our summary measure of ESO plan on the intensive margin) is found to lead to a modest yet non-trivial productivity gain (0.76 percent increase in productivity after one year of lag). To decompose the productivity effect of ESO plans on the intensive margin, we divide ESO per employee into ESO per participant and participation rate, and estimate a slightly modified translog production function:

$$\begin{aligned}(2)\qquad \ln Q_{it} = {} & \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_{KK}(\ln K_{it})^2 + \beta_{LL}(\ln L_{it})^2 + \beta_{KL}(\ln K_{it} * \ln L_{it}) \\ & + \beta_{E1} \ln(\text{ESO per participant}_{it-1}) + \beta_{E2} \ln(\text{Participant rate}_{it-1}) \\ & + X_{it}\lambda + \alpha_i + \tau_t + u_{it}\end{aligned}$$

The fixed effect estimates of Eq. (2) are presented in the second column of Table 3. The estimated coefficient on ln(ESO per participant$_{it-1}$) is positive and statistically significant at the 1 percent level, supporting Hypothesis 2. A 10-percent increase in ESO plan stake per participant will lead to a 1 percent increase in productivity. The estimated coefficient on ln(participation rate$_{it-1}$) is also positive and statistically significant at the 5 percent level, again favoring Hypothesis 3. However, the estimated elasticity of output with respect to participation rate is less than one third of the estimated elasticity of output with respect to stake per participant. Stake appears to play a much greater role in the productivity effect of ESO plan than participation rate. In other words, deepening the existing ESO plan (raising stake of core ESO plan participants) appears to be a more effective way to raise productivity than broadening the existing ESO plan (increasing participation rate).

Finally we consider a potentially negative effect of ESO plans and introduce ESO share$_{it}$.

[20] Furthermore, to account for possible endogeneity of labor input and selection, we also consider a method proposed by Levinsohn and Petrin (2003). Reassuringly there is no discernible change in the results although they are somewhat less precisely estimated.

$$(3) \qquad \ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_{KK}(\ln K_{it})^2 + \beta_{LL}(\ln L_{it})^2 + \beta_{KL}(\ln K_{it} * \ln L_{it}) + \beta_{E1}\ln(\text{ESO per employee}_{it-1}) + \beta_{E2}\ln(\text{ESO share}_{it-1}) + X_{it}\lambda + \alpha_i + \tau_t + u_{it}$$

For efficiency, we use our summary measure of the goal alignment effect of ESO plans, ESO per employee$_{it}$ instead of its decomposed two measures. The third column of Table 3 shows the fixed effect estimates of Eq. (3). First, reassuringly the estimated coefficient on ln(ESO per employee$_{it}$) is again positive and statistically significant at the 1 percent level, and the size of the coefficient is comparable to that of our benchmark model of Eq. (1). In contrast, the estimated coefficient on ln (ESO share$_{it}$) is negative and statistically significant at the 1 percent level, pointing to the adverse managerial shirking and entrenchment effect of ESO plans (Hypothesis 4). The absolute value of the estimated output elasticity with respect to ESO per employee$_{it}$ is more than three times larger than the absolute value of the estimated output elasticity with respect to ESO share$_{it}$, pointing to an overall positive effect of ESO plans on the intensive margin.[21]

4.2 Estimation using Instrumental Variables

It is, however, possible that our FE estimates are biased upward due to endogeneity of ESO plans. For example, Japan's celebrated Small Group Activities (SGAs), such as QC circles and kaizen, come up with an idea to enhance productivity which is private information to insiders (workers). Or, engineers and marketing staff know that their company has promising investment opportunities or is incubating innovative products. Based on such private information, workers may increase their contributions to their ESO plans if they are already a plan participant or decide to join ESO plans. Unfortunately such productivity-enhancing firm-specific shocks are private information and unobservable to econometricians. It follows that the FE estimates will lead us to attribute such productivity gains from unrelated sources (such as

[21] We also estimated, adding ln(ESO share$_{it}$)^2 to see if the negative managerial shirking and entrenchment effect of ESO plans is non-linear as Guedri and Hollandts (2008) found for French ESOPs. We found no consistent evidence for such non-linear effect.

SGAs) incorrectly to productivity gains from ESO plans---productivity gains from ESO plans will be biased upward.

To account for such possible endogeneity of the ESO plan variables, we consider the following two variables and their interaction term as IVs. First, as described in section II, the firm with ESO plans matches each employee participant's contribution by varying generosity, ranging between 0 percent to 100 percent of employee contributions. Most importantly as shown in Table 4, the employer contribution matching rate is reasonably time-variant, making it a promising instrument in our fixed effect models. We calculate the average matching rate of all other firms in the same industry for each year. Likewise, we also calculate the average abnormal shareholder return of all other firms in the same industry. A set of IVs are comprised of those two variables and their product. It is plausible that employees of firm *i* in year *t* responds to the employer contribution matching rates offered to their counterparts in all other firms in the same industry in year *t* by changing their decision on whether or not to participate in their firm's ESO plan or if they have been already participating, how much to contribute. At the same time, it is unlikely that the employer matching rates of all other firms in the same industry are strongly correlated with the focal firm's productivity after controlling for industry time trend in the quadratic form. An analogous argument can be made for the average shareholder return of all other firms in the same industry. Reassuringly our proposed set of IVs passed standard diagnostic tests including the Sargan test of overidentifying restrictions as well as weak instrument tests.

The IV (FE 2SLS) estimates of Eqs. (1)-(3) are shown in the fourth to sixth columns, Eqs. (1)'-(3)'. The IV estimate of the coefficient on our summary measure, ln(ESO per employee_{it}), is still positive and statistically significant at the 1 percent level, pointing to the robustness of the positive goal alignment effect of ESO plans on the intensive margin although the magnitude of the effect is substantially greater in the IV estimation. Likewise, the IV estimate of the coefficient on ln(ESO per participant_{it}) is still positive and statistically significant at the 1 percent level, confirming that the positive goal alignment effect of stake per participant is insensitive to the IV estimation. Note that the size of the effect is considerably larger in the IV

estimation. In contrast, the IV estimate of the coefficient on participation rate and the IV estimate of the coefficient on ESO share are found to be no longer statistically significant even at the 10 percent level.

In sum, though our IVs passes standard diagnostic tests including the Sargan test of overidentifying restrictions as well as weak instrument tests, they are definitely not perfect. As such, we ought to interpret the IV estimates with caution. That being said, however, it is reassuring that the estimated coefficients on the ESO plan variables are always larger in the IV estimation than in the OLS estimation, suggesting that the aforementioned concern over possible overestimation of the effects of ESO plans due to endogeneity may not be serious.[22]

4.3 Effects on Other Corporate Performance Measures

We now examine whether the positive productivity effect of ESO plans lead to improved profitability, measured by ROA. Specifically we estimate a slightly modified version of Eqs. (1) - (3):

(4) $$ROA_{it} = \beta_K \ln(\text{total asset})_{it} + \beta_L \ln(\text{leverage})_{it} + \beta_{KK}(\text{capital labor ratio})_{it} + \beta_E \ln(\text{ESO per employee}_{it-1}) + X_{it}\lambda + \alpha_i + \tau_t + u_{it}$$

(5) $$ROA_{it} = \beta_K \ln(\text{total asset})_{it} + \beta_L \ln(\text{leverage})_{it} + \beta_{KK}(\text{capital labor ratio})_{it} + \beta_{E1} \ln(\text{ESO per participant}_{it-1}) + \beta_{E2} \ln(\text{Participant rate}_{it-1}) + X_{it}\lambda + \alpha_i + \tau_t + u_{it}$$

(6) $$ROA_{it} = \beta_K \ln(\text{total asset})_{it} + \beta_L \ln(\text{leverage})_{it} + \beta_{KK}(\text{capital labor ratio})_{it} + \beta_{E1} \ln(\text{ESO per employee}_{it-1}) + \beta_{E2} \ln(\text{ESO share}_{it-1})$$

[22] The IV estimation suggests that we may still have time-variant unobservable variables that are positively correlated with the ESO plan variables, AND are negatively correlated with productivity. For example, the firm introduces another form of performance-related pay that can be a substitute for ESO plans. The firm's employees may decide to reduce their contributions to their ESO plans or even exit as a result of the introduction of their substitute plan. Suppose that the introduction of such a new performance-related pay boosts productivity. Since we are not controlling for the introduction of a new performance-related pay, and such a time-variant unobservable variable cannot be accounted for by firm fixed effects, the fixed effect estimate of the productivity effect of ESO plans without IV may be biased downward.

$$+ X_{it}\lambda + \alpha_i + \tau_t + u_{it}$$

The fixed effect estimates of Eqs. (4)-(6) with and without IVs are reported in Table 5. In essence, we find similar results to the productivity effects of ESO plans, suggesting that the productivity gains from ESO plans translate into profitability gains. The firm benefits from ESO plans. This implies that the productivity gains from ESO plans are not fully captured by wage increases. More specifically, Column 1 (Equation 4) has a coefficient of 0.00833 for ESO per employee$_{it-1}$, so if the ESO per employee increases by 10%, then the ROA should increase by 0.083 percentage points. Since the average ROA in our sample is 4.71% (Table 1), this means a profit increase of around 1.77%, which is translated into 0.57% of value added given the 32% of average capital share of income in Japan. Note that a 10% increase in the ESO per employee leads to a 0.76% increase in value added according to Table 4. This implies that roughly three quarters (=0.57/0.76) of the productivity gains from ESO plans remain as profit.

To confirm this conjecture, we further estimate the effect on wages of ESO plans by estimating a slightly modified version of Eqs. (4)-(6) with ln(wage$_{it}$) as the dependent variable and two additional controls, average employee age and average employee tenure. The results are shown in Table 6. We fail to find statistically significant wage gains from ESO plans more often than productivity and profitability gains, and when we find statistically significant results, the size of the wage gains is quite modest. For instance, a 10-percent increase in ESO per employee is found to lead to a 0.76-percent growth in productivity, while the same 10-percent increase in ESO per employee is found to result in only a 0.2-percent increase in wages. Overall, Hypotheses 4-7 are supported.

Finally, to see if productivity gains and profitability gains are viewed as temporary or permanent by the market, we estimate the effect on Tobin's Q of ESO plans. The estimation equations are identical to Eqs. (4)-(6) with Tobin's Q as the dependent variable rather than ROA. Table 7 presents the results. The results are overall comparable to those for the effects on productivity and ROA. More precisely, the coefficient for ESO per employee$_{it-1}$ in Column 1 is 0.157, so an increase of 10% in the ESO per employee would increase the corporate value by 1.57%. This scale

of increase is almost the same as the scale of the rate of increase in the ROA (1.7%) calculated from Table 5, suggesting that the market is likely to regard productivity gains and profitability gains from ESO plans as permanent.

5 Heterogeneous Effects

5.1 Ownership Structure

The observed effects on productivity, profitability, wages, and Tobin's Q of ESO plans may differ, depending on the strength of market pressure. On the one hand, as the proportion of stock owned by powerful institutional investors and foreign investors rises, these outside owners may press the management to focus more on the short-term profit, weaken its commitment to job security, and thus undermine the effectiveness of the High Performance Work System (HPWS). This might lower the observed effect of ESO plans. On the other hand, with the portion of powerful outside investors increasing, management's ability to collude with ESO plan participants and engage in entrenchment at the cost of shareholders may diminish. As such, the adverse effect on productivity and profitability of ESO plans may be lessened, and thereby we may observe greater overall productivity gains and profitability gains from ESO plans. In short, it is an empirical question whether the effect on productivity and profitability of ESO plans is larger or smaller for firms with greater proportions of shares owned by institutional investors or foreign investors. To this end, we repeat the analysis in the last section, adding an interaction term involving our summary ESO plan variable (ESO per employee) and a variable measuring the strength of the influence of powerful outside investors. We then repeat the same analysis, adding an interaction term involving ESO per employee and a variable gauging the strength of the influence of foreign investors. Specifically for each firm we first calculate the average proportion of share owned by institutional investors over 1989-2013, and then construct a dummy variable, institutional investor_i, which takes a value of 1 if firm i's average proportion of shared owned by institutional investors exceeds the fifth quintile value of the distribution of all firms by the average proportion of shared owned by institutional investors, zero otherwise. In other words, the firm with institutional

investor$_i$=1 is among top 20 percent of all firms in terms of the strength of the influence of institutional investors. Likewise, we construct foreign investor$_i$=1 if firm i's average proportion of shares owned by foreign investors exceeds the fifth quintile.

The results are summarized in Table 8. When value added is chosen as the dependent variable (Column 1), the estimated coefficient on ln(ESO per employee$_{t-1}$)*institutional investor$_i$ is positive and statistically significant at the 5 percent level. Likewise, the estimated coefficient on ln(ESO per employee)$_{t-1}$*foreign investor$_i$ is also positive and statistically significant at the 5 percent level. Both results are consistent with the positive role of powerful outside investors in preventing management and employee owners from colluding and exploiting shareholders, and hence limiting the adverse effect of ESO plans through managerial shirking and entrenchment.[23]

We repeat the same analysis for ROA, wages, and Tobin's Q. As shown in the table, overall, we find similar positive interplays between ESO plans and the strength of outside investor influence. Particularly noteworthy is that workers also gain from having more powerful institutional and foreign investors through receiving a modest yet still positive share of additional productivity gains from ESO plans.

5.2 Other firm characteristics: stock option, firm size and firm age

Lastly, we consider three additional possible interplays between ESO plans and other firm characteristics. The preceding analysis implies that raising stake of core existing ESO plan participants is more effective than increasing participation rates. An alternative device to raise stake of core employees can be stock option. Presumably the use of stock option as an alternative to ESO

[23] Although the results are not presented, we repeat the same analysis, using Third Tertile and Fourth Qaurtile instead of Fifth Quintile, and find no discernible fall in the estimated coefficients on the interaction terms as we downgrade the definition of powerful institutional investors and foreign investors from Fifth Quintile to Fourth Qaurtile to Third Tertile. It follows that the impact of powerful outside investors on the adverse managerial entrenchment effect of ESO plans changes gradually with the portion of such investors and there is no threshold around which such impact increases discretely.

plans may make ESO plans somewhat redundant and less effective as a means to raise stake of core employees, resulting in more limited gains from ESO plans. To study such an interplay between the use of stock option and the ESO plan effects, we add an interaction term involving ESO per $employee_{it-1}$ and $stock\ option_{it-1}$ (=1 if firm i uses stock option in year t-1, 0 otherwise) to our initial production function estimation, Eq. (1). [24] The first column of Table 9 shows the fixed effect estimates of such augmented Eq. (1). The estimated coefficient on the interaction term as well as the estimated coefficient on the stock option variable itself (not reported) are statistically insignificant even at the 10 percent level, suggesting that stock option may not make ESO plans redundant and hence less effective. We speculate that stock option in Japan may be too narrowly-focused on top management and that it may not work as a substitute for ESO plans, making broader group incentive pay still necessary for positive goal alignment effects and the resultant productivity gains.

The second and third columns of Table 9 show the results for possible interplays between ESO plans and firm size as well as firm age. The estimated coefficient on the interaction term involving ESO per $employee_{it-1}$ and SMF_i (=1 if firm i's average employment level over 1989-2013 is below the first tertile value of the distribution of all firms by the average employment level, 0 otherwise) is negative and statistically significant at the 1 percent level. ESO plans appear to yield more modest productivity gains for smaller firms. Likewise, the estimated coefficient on the interaction term involving ESO per $employee_{it-1}$ and $Young_i$ (=1 if firm i's average age over 1989-2013 is below the first tertile, 0 otherwise) is also negative and significant at the 1 percent level, suggesting that the productivity gains from ESO plans are smaller for younger firms.

As expanded in section III, the observed relationship between the size of the productivity gains from ESO plans and firm size/firm age is consistent with the institutional complementarity

[24] Data on stock options were obtained from publicly available information in Nikkei NEEDS-cges (Corporate governance evaluation system), and the results should be interpreted with caution because it is not clear what the scope of the stock option system is—whether it is made available only to directors, senior managers, or to all managers. Few companies offer stock options to non-managerial employees.

view that ESO plans are an integral part of the Japanese High Performance Work System (HPWS)--a complementary cluster of human resource management practices which are more pervasive among larger and more established (older) firms in Japan.

6 Conclusions

This paper has provided novel evidence on the effects of employee stock ownership, using reliable panel data on Japanese Employee Stock Ownership (ESO) plans for a highly representative sample of publicly-traded firms in Japan (covering more than 75 percent of all firms listed on Tokyo Stock Exchange) over 1989-2013. Unlike many prior studies, we have focused on the effects of changes in varying attributes of existing employee stock ownership—the effects on the intensive margin. Furthermore, we have done so not only for productivity but also for ROA, wages, and Tobin's Q. Our fixed effect estimates have shown that an increase in the strength of the existing ESO plan measured by stake per employee results in a statistically significant and modest yet meaningful gain in productivity. Furthermore, we have confirms that such productivity gains lead to considerable profitability gains since wage gains from ESO plans are significant yet rather small. Our analysis of Tobin's Q has suggested that the market considers such gains from ESO plans permanent gains.

By decomposing our summary ESO plan variable into ESO plan participant's average stake (depth) and participation rates (width), we have found that increasing stake of the existing core participants is more effective in boosting gains from ESO plans than bringing in more employees into the trust. In addition, we have found that broader-based ESO plans still improve productivity even for firms that use stock option, suggesting that stock option plans currently introduced among Japanese firms are too narrowly-focused on top management and hence not

making ESO plans redundant.

Reassuringly when we have accounted for possible endogeneity of the ESO plan variables by using IVs, the results are qualitatively similar. However, the size of the positive effects on productivity, ROA, wages and Tobin's Q are substantially larger with the fixed effect IV estimations. As such, the above estimated positive gains from ESO plans using simple fixed effect models ought to be viewed as lower bounds.

Although we have found a significantly negative effect of the ESO share—the proportion of shares owned by the ESO plan—on firm productivity, the coefficient becomes insignificant when using IVs. This may reflect the fact that a majority of ESO plans have a very low share—less than 1%—and very few firms exceed five percent, the level perceived as giving the management the opportunity to form influential insider coalition against the shareholder interest according to Kim and Ouimet (2014).

We have also uncovered that the positive effects on productivity, profitability, wages and Tobin's Q are larger when the proportion of powerful institutional investors and foreign investors rises. The growing importance of such powerful outside shareholders may be making it more difficult for management to take advantage of the rise of insider ownership through ESO plans and engage in managerial entrenchment.

Finally we have found that productivity gains from ESO plans are more limited for smaller and less-established younger firms. As such the finding favors institutional complementarity theory that ESO plans is an integral part of the HPWS (a cluster of complementary human resource management practices which are less pervasive among smaller and younger firms).

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Table 1 Summary Statistics: Key variables

Variable		Mean	Std. Dev.	Min	Max	Observations
$\ln(\text{ESO per employee}_{it})$	overall	12.8472	1.0656	3.2453	17.2601	21591
	between		1.0252	6.5953	16.2699	1647
	within		0.5551	4.4654	15.8294	13.1093
$\ln(\text{ESO per participant}_{it})$	overall	13.7618	0.7842	4.9619	19.1868	21591
	between		0.7228	8.9807	16.9432	1647
	within		0.4778	5.2168	17.4650	13.1093
$\ln(\text{participation rate}_{it})$	overall	-0.9146	0.6632	-7.5063	2.4456	21591
	between		0.6299	-4.8862	1.6161	1647
	within		0.3278	-7.1883	1.4390	13.1093
ESO share_{it} (%)	overall	1.4897	1.5381	0.0001	24.5104	21591
	between		1.8865	0.0026	23.9458	1647
	within		0.5971	-4.6158	9.3649	13.1093
$\ln(\text{value added}_{it})$	overall	9.6808	1.3153	2.2012	15.0226	21591
	between		1.3132	5.2353	14.9627	1647
	within		0.3539	3.8918	11.7806	13.1093
$\ln(\text{average wage}_{it})$	overall	15.4452	0.2823	8.2908	16.6812	21576
	between		0.2164	14.1627	16.4512	1643
	within		0.2006	8.9305	16.4843	13.1321
ROA_{it}	overall	0.0471	0.0425	-0.6138	0.4877	21591
	between		0.0428	-0.2314	0.4094	1647
	within		0.0302	-0.3902	0.4034	13.1093
Tobin's Q_{it}	overall	1.0050	0.6659	0.1170	13.3954	21591
	between		0.6320	0.1447	7.8118	1647
	within		0.4834	-2.7570	10.9421	13.1093
$\ln L_{it}$	overall	7.1068	1.1809	4.6052	12.4913	21591
	between		1.1648	4.6052	12.2164	1647
	within		0.2525	5.0709	10.0832	13.1093
$\ln K_{it}$	overall	10.3597	1.5375	5.5866	16.4059	21591
	between		1.4991	5.6668	16.1853	1647
	within		0.3672	7.4403	12.0969	13.1093

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED

Table 2 Summary Statistics: Control variables

Variable		Mean	Std. Dev.	Min	Max	Observations
ln(firm age$_{it}$)	overall	3.9537	0.4124	0	4.8520	21591
	between		0.4998	0.6931	4.7517	1647
	within		0.1241	2.3473	4.7848	13.1093
Average employee age$_{it}$	overall	38.5721	3.7185	24.4000	57.4000	21586
	between		3.6750	25.8600	55.1591	1646
	within		1.9497	27.3352	49.4312	13.1142
Average employee Tenure$_{it}$	overall	14.7845	4.4574	1.0000	29.1000	21587
	between		4.7566	1.2000	24.5700	1646
	within		1.8266	2.3845	25.9702	13.1148
ln(total asset$_{it}$)	overall	11.3632	1.3964	7.1732	16.5335	21591
	between		1.3949	7.2403	16.4385	1647
	within		0.2319	9.3378	13.5677	13.1093
ln(leverage$_{it}$)	overall	-0.8218	1.6649	-13.8448	6.5481	21567
	between		1.6244	-9.8505	3.0981	1646
	within		0.8591	-10.0882	4.8988	13.1027
Capital labor ratio$_{it}$	overall	45.9013	102.578	0.4247	4966.637	21591
	between		130.395	1.0606	4408.206	1647
	within		56.580	-941.3434	3765.159	13.1093
ln(share of institutional investors$_{it}$)	overall	2.4505	0.9553	0	4.3292	19015
	between		0.9306	0.0100	4.2553	1551
	within		0.5056	-0.2909	4.8156	12.2598
ln(share of foreign investors$_{it}$)	overall	1.8334	1.0007	0	4.3935	19052
	between		0.9070	0	4.2789	1552
	within		0.5521	-0.6822	4.3702	12.2758
Employer matching contribution$_{it\ (\%)}$	overall	6.7949	3.6817	0	100	15929
	between		3.8641	0	100	1626
	within		1.9408	-20.3480	48.1074	9.79643
Average matching contribution of other firms in the same industry$_{it}$	overall	6.7107	1.5511	0	21.3333	15870
	between		1.3536	0.8333	16.6111	1624
	within		1.0285	0.2638	14.8597	9.77217
Average shareholder return of other firms in the same industry$_{it}$	overall	0.0538	0.2907	-0.9574	5.2420	19859
	between		0.1228	-0.5382	1.2486	1530
	within		0.2824	-1.1249	4.7605	12.9797

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED

Table 3 The Fixed Effect Estimates of the Effect on Productivity of ESO plans on the intensive margin

	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)'	Eq. (2)'	Eq. (3)'
VARIABLES	Fixed Effect Model (1989-2013)			FE 2SLS Model (1995-2013 excl. 1999)		
lnL_{it}	0.724***	0.704***	0.726***	1.097***	0.985***	1.099***
	(0.177)	(0.176)	(0.178)	(0.101)	(0.121)	(0.234)
lnK_{it}	0.167*	0.169*	0.178*	0.142**	0.141**	0.135
	(0.0986)	(0.0989)	(0.0985)	(0.0657)	(0.0639)	(0.565)
lnL_{it}^2	0.0177	0.0181	0.0166	0.00700	0.0125	0.00720
	(0.0158)	(0.0156)	(0.0157)	(0.00850)	(0.00897)	(0.0181)
lnK_{it}^2	0.0131	0.0133	0.0118	0.0152***	0.0175***	0.0159
	(0.00966)	(0.00965)	(0.00971)	(0.00464)	(0.00474)	(0.0489)
$lnK_{it}*lnL_{it}$	-0.0394*	-0.0396*	-0.0376	-0.0528***	-0.0556***	-0.0536
	(0.0233)	(0.0230)	(0.0234)	(0.0109)	(0.0108)	(0.0668)
$ln(\text{ESO per employee}_{t-1})$	0.0760***		0.0869***	0.394***		0.393***
	(0.00778)		(0.00858)	(0.0646)		(0.0760)
$ln(\text{ESO per participant}_{t-1})$		0.101***			0.430***	
		(0.00948)			(0.0667)	
$ln(\text{participation rate}_{t-1})$		0.0269**			0.184	
		(0.0117)			(0.147)	
$ln(\text{ESO share}_{t-1})$			-0.0269***			0.0150
			(0.00693)			(1.213)
Observations	20,207	20,207	20,207	15,216	15,216	15,216
R-squared	0.507	0.509	0.508	0.355	0.391	0.349
Number of firms	1,613	1,613	1,613	1,484	1,484	1,484

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4 The number of firms that changed their employer contribution matching rates

Fiscal Year	Number of firms with match rate			Total
	Reduced	Unchanged	Raised	
1995	28	1,631	24	1,683
1996	23	1,654	35	1,712
1997	21	1,688	48	1,757
1999	52	869	42	963
2000	43	1,332	70	1,445
2001	25	1,382	51	1,458
2002	30	1,502	48	1,580
2003	18	1,529	36	1,583
2004	12	1,401	54	1,467
2005	10	1,384	82	1,476
2006	41	1,676	91	1,808
2007	9	1,360	80	1,449
2008	24	1,402	56	1,482
2009	35	1,626	30	1,691
2010	30	1,651	90	1,771
2011	16	1,593	48	1,657
2012	15	1,617	28	1,660
2013	17	1,706	49	1,772
Throughout	181	2,990	793	3,964

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED

Table 5 The Fixed Effect Estimates of the Effect on ROA of ESO plans on the intensive margin

VARIABLES	Eq. (4)	Eq. (5)	Eq. (6)	Eq. (4)'	Eq. (5)'	Eq. (6)'
	Fixed Effect Model (1989-2013)			FE 2SLS Model (1995-2013 excl. 1999)		
ln(total assets$_{it}$)	0.000516	-0.000287	-0.000095	-0.0165***	-0.0165***	-0.0197**
	(0.00267)	(0.00267)	(0.00270)	(0.00353)	(0.00354)	(0.00983)
ln(leverage$_{it}$)	-0.00609***	-0.00597***	-0.00581***	-0.00412***	-0.00412***	-0.00535
	(0.000829)	(0.000828)	(0.000821)	(0.000591)	(0.000592)	(0.00353)
Capital Labor Ratio$_{it}$	-0.000013	-0.00001	-0.000015*	-0.000027***	-0.000027**	-0.000013
	(0.000008)	(0.000008)	(0.000008)	(0.000007)	(0.000011)	(0.000039)
ln(ESO per employee$_{t-1}$)	0.00833***		0.0101***	0.0570***		0.0563***
	(0.000874)		(0.000970)	(0.00735)		(0.00877)
ln(ESO per participant$_{t-1}$)		0.0120***			0.0568***	
		(0.00114)			(0.00811)	
ln(participation rate$_{t-1}$)		0.00204**			0.0578***	
		(0.00100)			(0.0176)	
ln(ESO share$_{t-1}$)			-0.00475***			0.0302
			(0.000840)			(0.0852)
Observations	18,948	18,948	18,948	14,045	14,045	14,045
R-squared	0.225	0.231	0.229	-0.198	-0.204	-0.629
Number of nkcode	1,534	1,534	1,534	1,389	1,389	1,389

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 6 The Fixed Effect Estimates of the Effect on Wages of ESO plans on the intensive margin

VARIABLES	Eq. (7)	Eq. (8)	Eq. (9)	Eq. (7)'	Eq. (8)'	Eq. (9)'
	Fixed Effect Model (1989-2013)			FE 2SLS Model (1995-2013 excl. 1999)		
Average employee age$_{it}$	0.00235	0.00233	0.00237	0.00102	0.00115	0.00165
	(0.00424)	(0.00425)	(0.00422)	(0.00151)	(0.00155)	(0.00336)
Average employee tenure$_{it}$	0.0124***	0.0125***	0.0126***	0.0124***	0.0130***	0.0128***
	(0.00346)	(0.00346)	(0.00345)	(0.00127)	(0.00135)	(0.00233)
ln(total assets$_{it}$)	0.0889***	0.0885***	0.0874***	0.0826***	0.0830***	0.0889***
	(0.00663)	(0.00663)	(0.00675)	(0.0128)	(0.0131)	(0.0327)
ln(leverage$_{it}$)	-0.00991***	-0.00984***	-0.00910***	-0.00955***	-0.00955***	-0.00740
	(0.00155)	(0.00156)	(0.00153)	(0.00210)	(0.00216)	(0.0104)
Capital Labor Ratio$_{it}$	-0.000055**	-0.000057**	-0.00005**	-0.000054**	0.000104***	0.000031**
	(0.000024)	(0.000024)	(0.000023)	(0.000026)	(0.000039)	(0.000113)
ln(ESO per employee$_{t-1}$)	0.0195***		0.0246***	0.0351		0.0363
	(0.00281)		(0.00292)	(0.0263)		(0.0271)
ln(ESO per participant$_{t-1}$)		0.0217***			0.0561*	
		(0.00300)			(0.0294)	
ln(participation rate$_{t-1}$)		0.0158***			-0.0687	
		(0.00442)			(0.0636)	
ln(ESO share$_{t-1}$)			-0.0134***			-0.0519
			(0.00233)			(0.247)
Observations	18,928	18,928	18,928	14,030	14,030	14,030
R-squared	0.667	0.667	0.668	0.530	0.505	0.524
Number of nkcode	1,533	1,533	1,533	1,389	1,389	1,389

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 7 The Fixed Effect Estimates of the Effect on Tobin's Q of ESO plans on the intensive margin

	Eq. (10)	Eq. (11)	Eq. (12)	Eq. (10)'	Eq. (11)'	Eq. (12)'
VARIABLES	Fixed Effect Model (1989-2013)			FE 2SLS Model (1995-2013 excl. 1999)		
ln(total assets$_{it}$)	-0.304***	-0.317***	-0.316***	-0.403***	-0.402***	-0.355***
	(0.115)	(0.114)	(0.115)	(0.0379)	(0.0376)	(0.0807)
ln(leverage$_{it}$)	-0.00528	-0.00329	0.000192	0.00450	0.00441	0.0240
	(0.00950)	(0.00939)	(0.00921)	(0.00670)	(0.00664)	(0.0293)
Capital Labor Ratio$_{it}$	1.56e-05	5.13e-05	-5.94e-06	-3.61e-05	-1.79e-06	-0.000141
	(9.43e-05)	(9.13e-05)	(9.77e-05)	(6.31e-05)	(8.34e-05)	(0.000166)
ln(ESO per employee$_{t-1}$)	0.157***		0.192***	0.322***		0.321***
	(0.0199)		(0.0224)	(0.0802)		(0.0862)
ln(ESO per participant$_{t-1}$)		0.216***			0.343***	
		(0.0236)			(0.0866)	
ln(participation rate$_{t-1}$)		0.0512**			0.204	
		(0.0216)			(0.206)	
ln(ESO share$_{t-1}$)			-0.0934***			-0.510
			(0.0124)			(0.741)
Observations	19,344	19,344	19,344	14,332	14,332	14,332
R-squared	0.259	0.267	0.267	0.176	0.193	0.050
Number of nkcode	1,608	1,608	1,608	1,439	1,439	1,439

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 8 Interplays between ESO per employee and Ownership Structure in the productivity effects

	Fixed Effect Estimates（1989-2013）							
Dependent Variables	Value Added$_{it}$		Wages$_{it}$		ROA$_{it}$		Tobin's Q$_{it}$	
Lagged Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(ESO per employee$_{t-1}$)	0.0680***	0.0680***	0.0204***	0.0204***	0.00870***	0.00870***	0.151***	0.151***
	(0.00787)	(0.00787)	(0.00279)	(0.00279)	(0.000902)	(0.000902)	(0.0206)	(0.0206)
ln(ESO per employee$_{t-1}$)*institutional investor$_i$	0.0374**		0.00321**		0.00291***		0.0314**	
	(0.0146)		(0.00146)		(0.00103)		(0.0135)	
ln(ESO per employee)$_{t-1}$*foreign investor$_i$		0.0375**		0.00321**		0.00291***		0.0314**
		(0.0146)		(0.00146)		(0.00103)		(0.0135)
Observations	20,207	20,207	18,928	18,928	18,948	18,948	19,344	19,344
R-squared	0.509	0.509	0.666	0.666	0.206	0.206	0.260	0.260
Number of firms	1,613	1,613	1,533	1,533	1,534	1,534	1,608	1,608

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 9 The heterogeneous productivity effect of ESO plan

VARIABLES	(1) Stock Option	(2) Small Firms	(3) Young Firms
lnL_{it}	0.690***	0.714***	0.716***
	(0.182)	(0.178)	(0.177)
lnK_{it}	0.156	0.179*	0.165*
	(0.101)	(0.0990)	(0.0983)
lnL_{it}^2	0.0186	0.0193	0.0183
	(0.0159)	(0.0158)	(0.0158)
lnK_{it}^2	0.0128	0.0129	0.0132
	(0.00977)	(0.00970)	(0.00965)
lnK_{it}*lnL_{it}	-0.0379	-0.0406*	-0.0395*
	(0.0236)	(0.0234)	(0.0233)
ln(ESO per $employee_{it-1}$)	0.0762***	0.0847***	0.0799***
	(0.00796)	(0.00887)	(0.00800)
ln(ESO per $employee_{it-1}$)*$Stock\ option_{it-1}$	6.32e-05		
	(0.00106)		
ln(ESO per $employee_{it-1}$)*SMF_i		-0.0255***	
		(0.00919)	
ln(ESO per $employee_{it-1}$)*$Young_i$			-0.0110**
			(0.00524)
Observations	19,615	20,207	20,207
R-squared	0.504	0.508	0.507
Number of nkcode	1,597	1,613	1,613

Sources: the Survey of Current Status of Employee Stock Ownership (SCSESO) over 1989-2013 and Nikkei NEED
Notes: Cluster-Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Figure 1：Changes in Key Attributes of ESO Plans over 1989-2013: Balanced Panel of 572 firms