# Does Employee Stock Ownership Work? Evidence from Publicly-Traded Firms in Japan*

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Abstract

This paper provides new evidence on the effects of employee stock ownership (ESO), a prominent example of shared capitalism. In so doing, we take advantage of our access to 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 are statistically significant yet rather modest. Our analysis of Tobin's Q suggests that the market tends to view such gains from ESO as permanent. We further find that increasing the stake of the existing core participants is more effective in boosting gains from ESO than bringing in more employees into the ESO plan. We use unique instruments (the peer firms' matching grant rate and abnormal return) to account for possible endogeneity of ESO, and show that the estimated positive gains from ESO are not biased upward and likely to be lower bounds. Finally the positive effects on productivity, profitability, wages and Tobin's Q are found to be larger when the proportion of powerful institutional investors and foreign investors are greater; and larger for smaller firms that are less subject to the free-rider problem.

*Keywords*: Employee stock ownership, Group incentive, Shared Capitalism, Productivity, Profitability, Wages, and Tobin's Q.
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## 1. Introduction

There has been a remarkable rise in the use and interest in Performance Related Pay (PRP) around the world (see, for instance, Lemieux, MacLeod and Parent, 2009; Bloom, 2011; and Bryson, et al, 2012). 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.[1] 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[2] or Profit Sharing Plans (PSPs) in which at least part of the compensation for employees is dependent on firm performance (typically profit).[3] Moreover, an increasing number of firms (in particular "New Economy" firms) are extending the use of

[1] 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) and Jones (2018). For a Meta-analysis of the literature, see Doucouliagos (1995). For a more theoretical survey of the literature, see Gibbons (1997) and Prendergast (1999).

[2] See, for instance, Jones and Kato (1995), Blasi, Conte and Kruse (1996) and Kruse and Blasi (1997).

[3] 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.[4] 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.[5] Most recently the shared capitalism literature has been documenting the growing importance of such financial participation schemes as an alternative form of capitalism (see, for instance, Freeman, Blasi, and Kruse, 2010, Kruse, Blasi, and Park, 2010, Bryson and Freeman, 2010).[6]

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 review, see, for example, 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

[4] See, for instance, Sesil, Kroumova, Blasi and Kruse (2002) and Conyon and Freeman (2004).

[5] See, for example, Hamilton, Nickerson and Owan (2003), Jones and Kato (2011) and Jones, Kalmi and Kauhanen (2010) for teams and TIPs.

[6] 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).

introduction of group incentive pay and related HRM practices (see, for example, Hamilton, Nickerson and Owan, 2003 and Jones, Kalmi and Kauhanen, 2010). Finally clean causal evidence on group performance gains from the introduction of group incentive pay is produced by randomized field experiments (Burgess, et al., 2010 and Bloom, et al., 2013).

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. While studies of the effects on the extensive margin help practitioners and policymakers decide whether to introduce group incentive pay, intensive margin studies will go beyond the question of "whether or not" and help practitioners and policymakers design specific attributes of group

incentive pay program. Furthermore for firms that already adopted group incentives, intensive margin studies help 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., 2017). 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, Kruse, 1993, Pendleton and Robinson, 2010), and as discussed above, while providing insightful and useful findings, 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 plans measured by stake per employee results in statistically significant and economically meaningful 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 as permanent. We further find that increasing stake of the existing core participants is more effective in boosting gains from ESO than bringing in more employees into the ESO plans. Furthermore we use unique instruments (the peer firms' matching grant rate and abnormal return) to account for possible

endogeneity of ESO, and show that the estimated positive gains from ESO are not biased upward and likely to be lower bounds.

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 with the growing importance of such powerful outside shareholders, the adverse managerial entrenchment effect of ESO may be reduced. This means that employee stock ownership and external monitoring may work as complements in improving productivity. Second, gains in productivity and profitability from ESO plans are found to be greater for smaller firms, which is consistent with a standard view of group incentive that group incentive is less subject to its potentially serious free-rider problem in smaller organizations.

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 3 we provide theoretical discussions on the possible effects of ESO plans on the intensive margin. Section 4 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 ESO Plans

Unlike the U.S. and the U.K. where different forms of employee stock ownership schemes (e.g., ESOPs, ESPPs, and 401K in the U.S. and SIP, SAYE, and CSOP in the U.K.) coexist, there is essentially only one form of employee stock ownership in Japan. The firm voluntarily establishes an

ESO trust (called mochikabukai) for non-executive employees (executives are ineligible for ESO plans). Unlike the U.S. and the U.K., there is no tax incentive for the establishment of Japanese ESO plans. Participation in Japanese ESO plans is also voluntary (executives are not allowed to participate), 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.) While individual participants' shares (and dividends) in the ESO plan are held in trust, each participant 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.[7] 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 (although leveraged ESO plans are recently promoted).

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.[8] Using most up-to-date data on key attributes of ESO plans for a balanced panel

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

[8] 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

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 over 60% in mid-2000 and dropped again near 50 percent after the financial crisis.[9] 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).[10] 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).[11]

## 3. The Effects of ESO: Theory and Measurement

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.

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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).

[9] 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.

[10] 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.

[11] 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. These as well as other unreported results are available upon request from the corresponding author at tkato@colgate.edu.

The interest of the firm is more aligned with the interest of its employees through ESO plans. The improved goal alignment would lead to improved enterprise productivity. First, employees whose interest is more aligned with that of the firm put more discretionary effort in general. Second, the goal alignment through ESO results in more active participation and involvement in various productivity-enhancing activities such as small group activities by employees, and to smoother and less costly collective bargaining (see, for instance, Kato, 2003).

Furthermore, goal alignment facilitated by ESO plans could makes a broader range of relational contracts between the firm and the employees feasible. There are at least two mechanisms. First, as discussed in Baker, Gibbons and Murphy (1994), there is a tension between the power of incentive and the firm's incentive to renege---in order to induce sufficient worker effort, the amount of compensation for hard work will need to be large but the large compensation will raise the firm's incentive to renege on the promise to pay this compensation. Since ESO plans serves as an alternative incentive mechanism by linking the worker's hard work to his/her financial well-being, the amount of compensation for hard work will not need to be as large as otherwise, and hence the firm's incentive to renege on the promise will be reduced.

Another possible mechanism is that with ESO, the firm tends to find it more costly to renege on the relational contracts, for ESO plans give the workers more ways to punish the firm. They could sell the stock in the market or vote against the management proposals at shareholders' meetings.

In sum, ESO plans could help the firm form new relational contracts or reinforce the existing ones which encourage workers to exert high efforts and remain in the firm to maintain firm-specific human capital, resulting in higher enterprise productivity.

There are, however, some possible adverse effects of ESO 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, ESO 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%

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.[12] 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, 2017).

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. As discussed in detail in the next section, 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 stock owned by the ESO plan per employees of firm *i* in year *t*. We consider this variable an overall

[12] Until recently reliable evidence on the worker sorting effects of employee ownership and other management practices was absent mostly due to data limitations. Such evidence is currently emerging (see, for example, Burdin, 2016 and Bender, et al., 2018 and)

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 stock 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 (depth); and (ii) higher participation rate (breadth). These three measures of ESO on the intensive margin are most relevant to the afore-mentioned goal alignment effects of ESO on discretionally effort, active participation in productivity-enhancing Small Group Activities, and relational contracts. As the ESO participant's stake increases, the goal alignment effect will become more intense, which will lead to greater productivity gains from ESO. Likewise, as a higher proportion of the labor force in the firm participates in its ESO plan, the process of goal alignment will become more wide-spread in the firm, which will also result in productivity gains. ESO per employees, comprised from ESO per participants and participation rate, will capture the overall positive effect of ESO on goal alignment.

Lastly, the data allow us to create ESO share$_{it}$, the proportion of the total shares owned by the ESO plan. This variable gauges the relative power of the ESO trust, and hence captures the negative effects of ESO on enterprise performance via managerial shirking and entrenchment. As a greater proportion of the total outstanding shares is owned by the ESO trust, the status of managers as the residual claimants will be weakened, resulting in managerial shirking. Furthermore, a higher proportion of the total shared owned by the ESO trust makes the insider power (a coalition of managers and employees) more powerful relative to outside shareholders, resulting in managerial entrenchment.

After estimating the effect of ESO on enterprise productivity, in section 5, we consider the effect of ESO on three alternative firm-level outcome variables, ROA (Return On Asset), average wage, and Tobin's Q. First, it is of considerable importance to study the extent to which productivity gains or losses due to ESO result in profitability gains and losses (measured by ROA). Second, whether or not productivity gains or losses from ESO lead to profitability gains or losses depends on the extent to which productivity gains or losses due to ESO result in wage

gains or losses for all workers including not only ESO plan participants but also non-participants. Third, we examine whether profitability gains or losses due to ESO are deemed "transitory" or "permanent" by the market. Fortunately our data allow for the construction of Tobin's Q for each firm in each year, which can be used to examine the permanent or transitory nature of profitability gains and losses from ESO.

Finally in section 6, we will explore possible interplays between the effects of ESO and firm characteristics such as ownership structure, firm size, and firm age. 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 collude with ESO plan participants and engage in managerial entrenchment at the cost of shareholders. The potential adverse effect of ESO on productivity and profitability via managerial entrenchment may be more mitigated as the proportion of shared owned by institutional and foreign investors grows, making the overall positive effect of ESO greater for firms with a greater proportion of shared owned by institutional and foreign investors.

Second, group incentive schemes including ESO are potentially subject to the free-rider problem, which makes group incentive schemes less effective. To the extent that the free-rider problem is less acute in smaller firms, the effect of ESO is expected to be greater for smaller firms. Last, a better growth prospect of younger firms may make the return to forming a more cooperative and participatory relational contract through ESO greater. As such, productivity gains from ESO may be greater for such young firms. There is, however, another view. As discussed above, there are some complementary human resource management practices such as Small Group Activities. It is plausible that such complementary practices are still less developed among younger firms, and therefore that productivity gains from ESO may be more limited for such younger firms. We plan to examine those two opposing hypotheses.

## 4. Data, Basic Empirical Strategy and Main Results

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.[13] 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.[14] 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 (corporate financial and stock market information, and corporate governance evaluation system) that provides corporate accounting and stock price information as well as ownership and corporate governance data for all publicly-held firms in Japan. The resulting database was further linked to the Development Bank of Japan data which provide additional data on firm-level average wage and average tenure of all

[13] 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. Reassuringly for key firm characteristics such as total assets, PBR, and Tobin's Q, our sample mean is found to be similar to the population mean.

[14] Nikkei Needs do not report value added for most stock-holding companies. As such we exclude a small number of stock-holding companies. In addition, there are a handful of firms for which the number of employees on a consolidated basis who are eligible for ESO diverges considerably from the one on a non-consolidated basis. We also exclude such firms.

employees. All nominal variables are converted to real variables, using various price indices constructed by Bank of Japan and Statistics Bureau. [15]

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

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

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 Average employee $\text{tenure}_{it}$, $\ln(\text{firm age}_{it})$, industry-specific quadratic time trends (124 industries); $\alpha_i$ is firm specific fixed effects; $\tau_t$ is year effects; and $\beta$s are slope coefficients. For the disturbance term, $u_{it}$, we assume $u_{it} \sim NID(0, \sigma^2)$. ESO per employee is lagged since raising stake per employee may not lead to stronger goal alignment right away.

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 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 effects ($\tau_t$) 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 changes.

Firm specific fixed effects ($\alpha_i$) control for all unobserved confounders that are time-invariant. For instance, in the context of our production function estimation, it is plausible that a stronger form of ESO plan is adopted in firms with more progressive corporate culture/traditions. If so, the coefficient on an ESO plan variable might indicate the effects of progressive corporate culture/traditions as well as the actual effects of ESO. Firm specific fixed effects will help separate the two effects

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

(see, for example, Wadhwani and Wall, 1990 for profit sharing and Jones and Kato, 1995 for employee ownership). Another relevant example is other human resource management practices that may lead to productivity gains, including Small Group Activities such as kaizen (continuous improvement), Zero Defect, and QC circles; Joint Labor Management Committees; Shop-Floor Committees; Extensive OJT; and Long-term Employment (Kato, 2014). Conceivably firms that use such productivity-enhancing practices are more apt to use a stronger form of ESO. Firm fixed effects will help identify the productivity effect of changes in ESO attributes separately from the effect of such productivity-enhancing practices, to the extent to which they are time-invariant.

While they can account for unobserved confounders that are time-invariant, firm-fixed effects are unable to control for unobserved confounders that are time-variant. Thus, in discussing our fixed effect estimates of Eq. (1), we assume that there is no such unobserved time-variant confounder, and that ESO per employee is not endogenous. After presenting the fixed effect estimates of Eq. (1), we will relax this endogeneity assumption and provide IV estimates of Eq. (1).

Table 1 presents summary statistics, and the first column of Table 2 presents the fixed effect (FE) estimates of Eq. (1). Frist, to see whether the translog production functions are well behaved, we calculate the elasticity of output with respect to capital and labor evaluated at the mean values. First, reassuringly estimated elasticities are always positive. We also estimate a simpler Cobb-Douglass production function and find fairly close estimated elasticities.[16] 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, pointing to the positive productivity effect of ESO on the intensive margin . A 10-percent increase in ESO 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 (0.95-percent increase in productivity after one year of lag).

[16] 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.

To decompose the productivity effect of ESO on the intensive margin, we divide ESO per employee into ESO per participant and participation rate, and estimate a slightly modified translog production function:

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

The FE estimates of Eq. (2) are presented in the second column of Table 2. The estimated coefficient on ln(ESO per participant$_{it-1}$) is positive and statistically significant at the 1 percent level, suggesting that the depth of ESO (stake) does matter. A 10-percent increase in ESO plan stake per participant will lead to a 1.2 percent increase in productivity. The estimated coefficient on ln(participation rate$_{it-1}$) is also positive and statistically significant at the 1 percent level, confirming that the breadth of ESO also matters. However, the estimated elasticity of output with respect to participation rate is roughly 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 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 and introduce ESO share$_{it}$.

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

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 2 shows the FE 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). Second and more importantly, the estimated coefficient on ln (ESO share$_{it}$) is negative and statistically significant at the 1 percent

level, providing some evidence on the adverse managerial shirking and entrenchment effect of ESO. The overall effect of ESO is, however, positive, for 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$_{it}$.[17]

As discussed above, the above FE estimates may be still subject to the difficult problem of unobserved time-variant confounders causing endogeneity of ESO. Specifically there is a plausible case for upward bias of the FE estimates on productivity gains from ESO. For example, suppose that Japan's celebrated Small Group Activities (SGAs) come up with an idea to enhance productivity which is private information to insiders (workers). Alternatively frontline engineers and marketing staff come to 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 plan participants or decide to join ESO plans if they are not. 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 productivity-enhancing ideas produced via SGAs) incorrectly to productivity gains from ESO. Thus, the estimated productivity gains from ESO will be biased upward.

To address such possible endogeneity of the ESO plan variables, we consider the instrumental variable (IV) approach. Finding valid instruments is almost always an elusive enterprise. In our quest for such valid instruments, we conducted extensive interviews with veteran managers of a leading securities firm who are in charge of managing ESO plans of their client firms. The interviews revealed that ESO plan directors of individual firms tend to learn about their peer firms' ESO plans, including employer matching rates, through the following two channels. First, as described above, each individual firm's ESO plan is managed by a major

[17] 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 a non-linear effect.

securities firm, and the director of each client firm's ESO plan is in regular communication with the manager of the securities firm in charge of managing its ESO fund. Through such regular communication with the securities firm's manager, the ESO director often learns about its peer firms' ESO plans. Second, ESO plan directors learn about their peer firms' ESO plans through *Kabushiki Konwakai*, Association of Shareholder Affairs, which is a long-established network of investor relations practitioners including ESO directors that are organized along sectors.[18] Our extensive field work indicates that there is a natural and distinct peer group for each firm, all other firms in the same industry, which entrust the same securities firm with the task of managing their ESO accounts. Thus, we construct a peer group for each firm by identifying all other firms in the same industry that use the same securities firm for their ESO account management.[19]

Using these peer groups, we construct the following two variables as IVs. First, as described in section 2, the firm with ESO plans matches each employee participant's contribution by varying generosity, ranging between 0 to 100 percent of employee contributions. Most importantly as shown in Table 3, the employer contribution matching rate is reasonably time-variant, making it a promising instrument in our fixed effect models. We use the highest matching rate among the firm's peers because the aforementioned interviews indicate that ESO directors are more acutely aware of such peer leader's changes. Suppose firm i learns that its peer leader with the most generous employer matching rate raises its matching rate further. Firm i will follow this industry leader's rate increase by raising its own matching rate. On the one hand, such increased generosity of the focal firm's ESO plan will result in an increase in ESO per employee. On the other hand, it is unlikely that a hike in the employer matching rate of the peer leader is significantly correlated with the focal firm's productivity after controlling for industry

[18] *Tokyo Kabushiki Konwakai*, the oldest such organization, was established in 1931 by Tokyo Stock Exchange.

[19] In order to keep at least three firms in the same peer group consistently over time, when needed, we put together neighboring industries to form meaningful peer groups, resulting in 148 peer groups in total.

time trends in the quadratic form. As such, we are reasonably confident that the highest matching rate among the firm's peers meets the exclusion restriction.

Second, we use the average abnormal shareholder return of firm i's peers in year t as another instrument. To demonstrate that this variable can be a valid instrument, consider an increase in the average abnormal return of the peer firms relative to that of the focal firm. First, when its peer firms enjoy rising abnormal return, the focal firm may become more fearful of becoming a takeover target.[20] In response to the heightened fear of takeover, the focal firm may promote ESO through raising its contribution matching rate, holding promotional seminars, and asking supervisors to have informal conversations with their subordinates about ESO. It follows that the focal firm's ESO per employee may increase. The resultant increase in ESO per employee is largely due to the management's effort to ease the market pressure in the face of rising attractiveness of its peer firms measured by their abnormal returns, and hence has less to do with the focal firm's productivity. Thus, we are again reasonably sanguine about the average abnormal shareholder return of the peer firms satisfying the exclusion restriction.

Additionally, note that we control for the productivity trend in the quadratic form at the 3-digit industry level (124 industries), which should also help mitigate bias caused by unobserved time-variant confounders. Our proposed set of IVs passed standard diagnostic tests including the Hansen J test of over-identifying restrictions as well as Kleibergen-Paap rk LM test of under-identification in the baseline models for value added, wage and Tobin's Q.

The IV (FE 2SLS) estimates of Eqs. (1)-(3) are shown in the fourth to sixth columns, Eqs. (1)'-(3)'. Although the first stage regression results are not shown in the table, both the coefficients of Highest matching $\text{rate}_{it}$ and Average abnormal shareholder $\text{return}_{it}$ are of the expected signs. The IV estimates of our baseline equation with the summary measure of ln(ESO per $\text{employee}_{it}$) passed both Kleibergen-Paap rk LM test of under-identification and the Hansen J test of over-identifying restrictions, suggesting that our IVs are relevant and reliable. The

[20] Edmans, Goldstein, and Wei (2012) present a similar argument and provide supporting evidence.

estimated coefficient on ln(ESO per employee$_{it}$) is positive and statistically significant at the 1 percent level, confirming that our earlier result (without IV) of the significant productivity gains from ESO on the intensive margin is not caused by the aforementioned upward bias due to endogeneity of ESO. In fact, the IV estimates of the coefficient on ln(ESO per employee$_{it}$) is considerably larger than the OLS estimates. As discussed in the large empirical literature on the returns to schooling that has grappled with a similar puzzle---the IV estimates of the returns to schooling are often substantially larger than the OLS estimates (see, for instance, Harmon, Oosterbeek, and Walker, 2003), there are a number of possible reasons why the IV estimates of the productivity effect of ESO exceed the OLS estimates.

First and perhaps most important, the size of the productivity effect of ESO may differ from one peer group of firms to another. The large and significant IV estimates of the productivity effect of ESO may be indicating that the productivity effect of ESO is greater for a subset of our Japanese firms experiencing greater changes in the IVs---the peer leader's employer matching rate and the peer's average abnormal return---, as compared to other group of firms. Conversely the productivity effect of ESO is smaller for a group of firms with little change in the peer leader's matching rate and the peer's average abnormal return. It is plausible that such groups of firms are well-established, mature, and stable industries. As discussed above, a main channel through which the goal alignment facilitated by ESO will lead to productivity gains is various Small Group Activities involving frontline workers. In well-established, mature, and stable industries, such grassroots innovation activities might have already reached the point of sharp diminishing returns, and hence further goal alignment due to ESO may not result in significant productivity gains (Ghosh, Kato, and Morita, 2018's case study of an auto parts supplier and a metal producer in Japan demonstrates the diminishing effectiveness of Japan's once celebrated bottom-up innovation activities in such mature industries). It is also conceivable that firms in such well-established, mature and stable industries tend not to change their matching rate for ESO often, and that abnormal returns are relatively stable in such industries.

Second, there may be a time-variant unobservable variable that is positively (negatively)

correlated with the ESO plan variables, AND is negatively (positively) 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. The IV estimates correct such downward bias of the OLS estimates and hence are greater than the OLS estimates.

Third, there may be considerable measurement errors with our ESO variables which bias the OLS estimates downward. Again, the IV estimates suffer less from such attenuation bias, and are thus larger than the downward-biased OLS estimates.

Turning to the decomposed specifications, Eqs. (2) and (3), our IVs are found not to perform as well as in the case of the baseline model of Eq. (1), failing to pass the test of under-identification implying that the coefficients are not effectively identified due to weak instruments. As such, the IV estimates of Eqs. (2) and (3) ought to be interpreted with caution. That being said, all the coefficients are sizable and have the same signs as the OLS estimates.[21] Especially our earlier result from the fixed effects models that stake (depth of the ESO participation) appears to play a much greater role in the productivity effect of ESO than participation rate (breadth) continue to be valid here.

In sum, while our IVs perform well in the baseline model but not so well in the decomposed models, 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 usual concern

[21] Hasen J test of over-identification cannot be calculated because the equations are exactly identified (i.e. the number of endogenous variables is equal to the number of instruments).

over possible overestimation of the effects of ESO plans due to endogeneity may not be serious.

## 5. **Profitability, Wages, and Tobin's Q**

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):

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

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

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

The fixed effect estimates of Eqs. (4)-(6) with and without IVs are reported in Table 4. In essence, we find similar but somewhat weaker results than for the productivity effects of ESO, suggesting that the productivity gains from ESO translate into profitability gains but on a smaller scale. This implies that the productivity gains from ESO may be captured in part by wage increases. Specifically, as shown in Eq. (4) of the table, the estimated coefficient on ESO per $\text{employee}_{it-1}$ is 0.00963. A 10-percent increase in ESO per employee will lead to an increase in ROA by 0.096 percentage points from the average ROA of 4.71% (as shown in Table 1), which amounts to a growth of ROA by 2.04%. Given that capital share of income is 32% on average in Japan, the 2.04-percent growth of ROA is translated into 0.65-percent growth of value added. Note that as discussed earlier (Table 2), a 10% increase in the ESO per employee leads to a 0.95-percent increase in value added. This implies that roughly two thirds (=0.65/0.95) of the productivity gains from ESO plans remain as profit. This picture does not change significantly when we use the IV estimates in Eq. (1)', which leads to the conclusion that almost four fifth

(=0.434/4.71*100*0.32/3.69) of the productivity gains from ESO plans remain as profit.

To confirm this conjecture, we further estimate the effect of ESO on wages by estimating a slightly modified version of Eqs. (4)-(6) with $\ln(wage_{it})$ as the dependent variable and one additional control, average employee age. The results are shown in Table 5 (Eqs. (7)-(9) correspond to Eqs. (4)-(6)). Similarly to the results for productivity and profitability gains, we find statistically significant wage gains from ESO. While the size of the wage gains is quite modest in the OLS estimates in Eqs. (7)-(9), as shown in Table 5, they turn out to be quite sizable and significant at the 5 % level in the IV estimates in Eqs. (7)'-(8)'. For instance, a 10-percent increase in ESO per employee is found to lead to a modest 0.2-percent increase in wages if the result in Eq. (7) is used, but is found to result in a 2.0-percent increase in wages according to Eq. (7)', which is close to one third of the productivity gain found earlier in Eq. (1)'. This 2SLS estimate of the effect on wages (accounting for one third of the productivity gain) is consistent with the fixed effect estimate of the effect on profitability (account for two thirds of the productivity gain). Furthermore, only raising stake results in significant and positive wage gains whereas increasing participation rate leads to no wage gain after accounting for possible endogeneity.

Finally, to see if productivity gains and profitability gains are viewed as temporary or permanent by the market, we estimate the effect of ESO on Tobin's Q. The estimation equations are identical to Eqs. (4)-(6) with Tobin's Q as the dependent variable rather than ROA. The results are summarized in Table 6 (Eqs. (10)-(12) correspond to Eqs. (4)-(6) ). The results are overall comparable to those for the effects of ESO on productivity and insensitive to the use of instrumental variables. Specifically the estimated coefficient on ESO per $employee_{it-1}$ in Eq. (10) of Table 6 is 0.167, suggesting that a 10-percent increase in the ESO per employee will lead to an increase in the corporate value by 1.67%. This scale of increase is almost the same as the scale of the rate of increase in ROA (2.04%) calculated in Eq. (4) of Table 4. However, when we compare the gains using the IV estimates from Eq. (4)' of Table 4 and Eq. (10)' of Table 6, the numbers change substantially to 2.61% (Tobin's Q) vs. 9.21% (ROA), suggesting that the market is likely to consider long-term profitability gains from ESO much smaller than short-term gains.

In addition, according to Eq. (11) of Table 6, increasing stake of the existing core participants is more effective in boosting Tobin's Q from ESO than bringing in more employees into the plan. This is robust to the use of IVs and the difference is even more discernible in Eq. (11)'.

## 6. Heterogeneous Effects: Ownership and Firm Size/Age

The observed effects on productivity, profitability, wages, and Tobin's Q of ESO may differ, depending on the strength of market pressure. With the proportion 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 of ESO on productivity and profitability via managerial entrenchment may be lessened, and thereby we may observe greater overall productivity and profitability gains from ESO for firms with higher proportions of stock owned by powerful outside investors. To study such an interplay between the ESO effects and the proportion of shares owned by powerful outside investors, we repeat the above analysis, 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 use the two investor groups—institutional investors and foreign investors—as powerful outside investors. Specifically for each firm we first calculate the proportion of outstanding shares owned by institutional investors. We normalize it by subtracting the market mean from it and then dividing the resulting difference by the market standard deviation. Then, we average it over 1989-2013 to construct a time-invariant variable, institutional investor$_i$. Likewise, we construct foreign investor$_i$, time-averaged normalized proportion of foreign investors.

The results are summarized in Table 7. When value added is chosen as the dependent variable, as shown in column (1), the estimated coefficient on ln(ESO per employee$_{i\,t-1}$)*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 through managerial entrenchment. The size of the estimated coefficient on ln(ESO per employee$_{i\,t-1}$)*institutional investor$_i$ in column (1) implies that the productivity effect of ESO plans will be zero when institutional investor$_i$ is equal to -2.5 (=-0.088/0.035). In other words, for firms with the proportion of institutional investors being lower than mean by two and a half standard deviations, there is no productivity gain from ESO. Likewise, the size of the estimated coefficient on ln(ESO per employee)$_{t-1}$*foreign investor$_i$ in column (2) implies that for firms with the proportion of foreign investors being lower than mean by two and a half standard deviations, the productivity effect of ESO is zero.

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 more from ESO in the presence of more powerful institutional and foreign investors through receiving a modest yet still positive share of additional productivity gains from ESO.

Lastly, we consider two additional possible interplays between ESO plans and other firm characteristics. The first and second columns of Table 8 show the results for possible interplays between ESO and firm size as well as firm age. Standardized firm size/age measures are constructed in the same way as institutional investor$_i$ and foreign investor$_i$. Specifically for each firm we start with ln(number of employees $_{it}$) and ln(firm age $_{it}$) and calculate their normalized measures by subtracting the market mean from it and dividing the resulting difference by the market standard deviation. Then, we average it over 1989-2013 to construct a time-invariant variables, standardized firm size measure$_i$ and standardized firm age measure$_i$.

Since firm size and firm age are correlated with the proportion of institutional/foreign investors, we include the interaction between ln(ESO per employee$_{it-1}$) and institutional investor$_{it-1}$ to avoid omitted variable bias. The estimated coefficient on the interaction term involving ESO per employee$_{it-1}$ and firm size is negative and statistically significant at the 1 percent level. ESO appears to yield greater productivity gains for smaller firms. Likewise, the estimated coefficient on the

interaction term involving ESO per employee$_{it-1}$ and firm age is also negative yet not statistically significant.

The observed relationship between the size of the productivity gains from ESO and firm size is consistent with what we have learned in the literature of free-riding. Normally when team incentives are provided, free riding can occur. However, if there is peer monitoring and peer pressure imposes discipline, the free rider problem afflicting team incentives will be lessened and their productivity effect will be restored (Knez 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). In sum, the goal alignment and the formation of relational contract should have a greater incentive effect in smaller firms because the return to efforts is higher and peer monitoring to reduce free-riding is more feasible in smaller firms.

The lack of significant relationship between the size of the productivity gains from ESO and firm age may be due to two countervailing effects. On the one hand, young firms have better growth prospect that makes the productivity effect of ESO plans greater. On the other hand, however, some human resource management practices that are complementary to ESO might be less developed in young firms. As such, the favorable effects of ESO may be smaller in young firms with less developed complementary work practices.

## 7. 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 statistically significant and modest yet meaningful gains in productivity. Furthermore, we have confirmed that such productivity gains lead to considerable profitability gains since wage gains from ESO plans are significant yet rather modest. Our analysis of Tobin's Q has suggested that the market considers profitability gains from ESO long-term gains.

We have used unique instruments---the peer firms' employer matching grant rate and abnormal return to account for possible endogeneity of our ESO variables, and have shown that the above estimated positive gains from ESO plans using simple OLS fixed effect models are not biased upward and likely to be lower bounds.

By decomposing our summary ESO variable into ESO plan participant's average stake (depth) and participation rates (breadth), we have found that increasing stake of the existing core participants is more effective in boosting gains from ESO than bringing in more employees into the ESO plan.

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 once endogeneity is accounted for. As such, compared to other ESO variables, we are less confident on the observed negative effect of the proportion of shared owned by the ESO plan. 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 greater productivity gains from ESO for smaller firms, which is consistent with the standard view that group incentive pay is more effective in smaller firms which are less subject to the free-riding problem.

**References**


**Baker, George ; Gibbons, Robert and Murphy, Kevin J.** "Subjective Performance Measures in Optimal Incentive Contracts." *Quarterly Journal of Economics*, 1994, *109*(4), pp. 1125-56.

**Bender, Stefan; Bloom, Nicholas; Card, David; Van Reenen, John and Wolter, Stefanie.** "Management Practices, Workforce Selection, and Productivity." *Journal of Labor Economics*, 2018, *36*, pp. S371-S409.

**Blasi, Joseph; Conte, Michael and Kruse, Douglas.** "Employee Stock Ownership and Corporate Performance among Public Companies." *Industrial and Labor Relations Review*, 1996, *50*(1), pp. 60-79.

**Blasi, Joseph R.; Freeman, Richard B.; Mackin, Chris and Kruse, Douglas L.** "Creating a Bigger Pie? The Effects of Employee Ownership, Profit Sharing, and Stock Options on Workplace Performance," National Bureau of Economic Research, Inc, NBER Working Papers: 14230, 2008,

**Bloom, Nicholas; Eifert, Benn; Mahajan, Aprajit; McKenzie, David and Roberts, John.** "Does Management Matter? Evidence from India." *Quarterly Journal of Economics*, 2013, *128*(1), pp. 1-51.

**Bloom, Nicholas and Reenen, John Van.** "Human Resource Management and Productivity," O. Ashenfelter and D. Card, *Handbook of Labor Economics.* Elsevier, 2011, 1697 - 767.

**Bryson, Alex and Freeman, Richard B.** "How Does Shared Capitalism Affect Economic Performance in the United Kingdom?," D. L. Kruse, R. B. Freeman and J. R. Blasi, *Shared Capitalism at Work: Employee Ownership, Profit and Gain Sharing, and Broad-Based Stock Options.* NBER Conference Report series. Chicago and London: University of Chicago Press, 2010, 201-24.

**Bryson, Alex, Richard Freeman, Claudio Lucifora, Michele Pellizzari and Virginie Perotin. .** "Paying for Performance: Incentive Pay Schemes and Employees' Financial Participation.," CEP Discussion Paper No 1112, 2012. ,

**Burdin, Gabriel.** "Equality under Threat by the Talented: Evidence from Worker-Managed Firms." *Economic Journal*, 2016, *126*(594), pp. 1372-403.

**Burgess, Simon; Propper, Carol; Ratto, Marisa; von Hinke, Stephanie; Scholder, Kessler and Tominey, Emma.** "Smarter Task Assignment or Greater Effort: The Impact of Incentives on Team Performance." *Economic Journal*, 2010, *120*(547), pp. 968-89.

**Che, Yeon-Koo and Yoo, Seung-Weon.** "Optimal Incentives for Teams." *American Economic Review*, 2001, *91*(3), pp. 525-41.

**Conyon, Martin J. and Freeman, Richard B.** "Shared Modes of Compensation and Firm Performance: U.K. Evidence," D. Card, R. Blundell and R. B. Freeman, *Seeking a Premier Economy: The Economic Effects of British Economic Reforms, 1980-2000.* Chicago and London: University of Chicago Press, 2004, 109-46.

**Doucouliagos, Chris.** "Worker Participation and Productivity in Labor-Managed and Participatory Capitalist Firms: A Meta-Analysis." *Industrial and Labor Relations Review*, 1995, *49*(1), pp. 58-77.

**Edmans, Alex; Goldstein, Itay and Jiang, Wei.** "The Real Effects of Financial Markets: The Impact of Prices on Takeovers." *Journal of Finance*, 2012, *67*(3), pp. 933-71.

**Faleye, Olubunmi; Mehrotra, Vikas and Morck, Randall.** "When Labor Has a Voice in

Corporate Governance." *Journal of Financial and Quantitative Analysis*, 2006, *41*(3), pp. 489-510.

**Freeman, Richard B.; Blasi, Joseph R. and Kruse, Douglas L.** "Shared Capitalism at Work: Introduction," D. L. Kruse, R. B. Freeman and J. R. Blasi, *Shared Capitalism at Work: Employee Ownership, Profit and Gain Sharing, and Broad-Based Stock Options.* NBER Conference Report series. Chicago and London: University of Chicago Press, 2010, 1-37.

**Gibbons, Robert.** "Incentives and Careers in Organizations," *Advances in Economics and Econometrics: Theory and Applications: Seventh World Congress. Volume 2.* Cambridge; New York and Melbourne: Cambridge University Press, 1997, 1-37.

**Guedri, Zied and Hollandts, Xavier.** "Beyond Dichotomy: The Curvilinear Impact of Employee Ownership on Firm Performance," *Corporate Governance: An International Review.* Wiley-Blackwell, 2008, 460-74

**Hamilton, Barton H.; Nickerson, Jack A. and Owan, Hideo.** "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation." *Journal of Political Economy*, 2003, *111*(3), pp. 465-98.

**Jensen, Michael C. and Meckling, William H.** "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." *Journal of Financial Economics*, 1976, *3*(4), pp. 305-60.

**Jones, Derek C.** "The Economics of Participation and Employee Ownership (Peo): An Assessment." *Journal of Participation and Employee Ownership*, 2018, *1*(1), pp. 4-37.

**Jones, Derek C.; Kalmi, Panu; Kato, Takao and Mäkinen, Mikko.** "Complementarities between Employee Involvement and Financial Participation: Do Institutional Context, Differing Measures, and Empirical Methods Matter?" *Industrial and Labor Relations Review*, 2017, *70*(2), pp. 395–418.

**Jones, Derek C.; Kalmi, Panu and Kauhanen, Antti.** "Teams, Incentive Pay, and Productive Efficiency: Evidence from a Food-Processing Plant." *Industrial and Labor Relations Review*, 2010, *63*(4), pp. 606-26.

**Jones, Derek C. and Kato, Takao.** "Employee Stock Ownership Plans and Productivity in Japanese Manufacturing Firms." *British Journal of Industrial Relations*, 1993, *31*(3), pp. 331-46.

**____.** "The Impact of Teams on Output, Quality, and Downtime: An Empirical Analysis Using Individual Panel Data." *Industrial and Labor Relations Review*, 2011, *64*(2), pp. 215-40.

**____.** "The Productivity Effects of Employee Stock-Ownership Plans and Bonuses: Evidence from Japanese Panel Data." *American Economic Review*, 1995, *85*(3), pp. 391-414.

**Jones, Derek C.; Kato, Takao and Pliskin, Jeffrey.** "Profit Sharing and Gainsharing: A Review of Theory, Incidence and Effects," D. Lewin, D. Mitchell and M. Zaidi, *The Human Resource Management Handbook Part I.* Greenwich, CT: JAI Press, 1997, pp. 153-74.

**Kambayashi, Ryo and Kato, Takao.** "Long-Term Employment and Job Security over the Past 25 Years: A Comparative Study of Japan and the United States." *ILR Review*, 2017, *70*(2), pp. 359-94.

**Kato, Takao.** "High-Involvement Work Systems in Japan, the United States, and Korea: Evidence from Field Research," J. Ortega, *Advances in the Economic Analysis of*

*Participatory and Labor-Managed Firms,Volume 15 - International Perspectives on Participation* Bingley, U.K.: Emerald, 2014, 95-119.

**____.** "The Recent Transformation of Participatory Employment Practices," S. Ogura, T. Tachibanaki and D. Wise, *Nber Conference Report Labor Markets and Firm Benefit Policies in Japan and the United States.* Chicago: University of Chicago Press, 2003, 39-80.

**Kim, E. Han and Ouimet, Paige.** "Broad-Based Employee Stock Ownership: Motives and Outcomes." *Journal of Finance*, 2014, *69*, pp. 1273-319.

**Knez, Marc and Simester, Duncan.** "Firm-Wide Incentives and Mutual Monitoring at Continental Airlines." *Journal of Labor Economics*, 2001, *19*(4), pp. 743-72.

**Kruse, Douglas and Blasi, Joseph R.** "Employee Ownership, Employee Attitudes, and Firm Performance," D. Lewis, D. Mitchell and M. Zaidi, *The Human Resource Management Handbook Part I.* Greenwich, CT: JAI Press, 1997, pp. 113-52.

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

**Kruse, Douglas L.; Blasi, Joseph R. and Park, Rhokeun.** "Shared Capitalism in the U.S. Economy: Prevalence, Characteristics, and Employee Views of Financial Participation in Enterprises," D. L. Kruse, R. B. Freeman and J. R. Blasi, *Shared Capitalism at Work: Employee Ownership, Profit and Gain Sharing, and Broad-Based Stock Options.* NBER Conference Report series. Chicago and London: University of Chicago Press, 2010, 41-75.

**Lemieux, Thomas; MacLeod, W. Bentley and Parent, Daniel.** "Performance Pay and Wage Inequality." *Quarterly Journal of Economics*, 2009, *124*(1), pp. 1-49.

**Levinsohn, James and Petrin, Amil.** "Estimating Production Functions Using Inputs to Control for Unobservables." *Review of Economic Studies*, 2003, *70*(243), pp. 317-41.

**Livingston, D. T. and Henry, James B.** "The Effect of Employee Stock Ownership Plans on Corporate Profits." *Journal of Risk and Insurance*, 1980, *47*(3), pp. 491-505.

**Pendleton, Andrew.** "Incentives, Monitoring, and Employee Stock Ownership Plans: New Evidence and Interpretations." *Industrial Relations*, 2006, *45*(4), pp. 753-77.

**Pendleton, Andrew and Robinson, Andrew.** "Employee Stock Ownership, Involvement, and Productivity: An Interaction-Based Approach." *Industrial and Labor Relations Review*, 2010, *64*(1), pp. 3-29.

**Prendergast, Canice.** "The Provision of Incentives in Firms." *Journal of Economic Literature*, 1999, *37*(1), pp. 7-63.

**Sesil, James C.; Kroumova, Maya K. ; Blasi, Joseph R. and Kruse, Douglas L.** "Broad-Based Employee Stock Options in Us 'New Economy' Firms." *British Journal of Industrial Relations*, 2002, *40*(2), pp. 273-94.

Table 1 Summary Statistics

| Variable | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|
| ln(ESO per employee$_{it}$) | 12.8472 | 1.0656 | 3.2453 | 17.2601 | 21591 |
| ln(ESO per participant$_{it}$) | 13.7618 | 0.7842 | 4.9619 | 19.1868 | 21591 |
| ln(participation rate$_{it}$) | -0.9146 | 0.6632 | -7.5063 | 2.4456 | 21591 |
| ESO share$_{it}$ (%) | 1.4897 | 1.5381 | 0.0001 | 24.5104 | 21591 |
| ln(value added$_{it}$) | 9.6808 | 1.3153 | 2.2012 | 15.0226 | 21591 |
| ln(average wage$_{it}$) | 15.4452 | 0.2823 | 8.2908 | 16.6812 | 21576 |
| ROA$_{it}$ | 0.0471 | 0.0425 | -0.6138 | 0.4877 | 21591 |
| Tobin's Q$_{it}$ | 1.0050 | 0.6659 | 0.1170 | 13.3954 | 21591 |
| lnL$_{it}$ | 7.1068 | 1.1809 | 4.6052 | 12.4913 | 21591 |
| lnK$_{it}$ | 10.3597 | 1.5375 | 5.5866 | *16.4059* | 21591 |
| ln(firm age$_{it}$) | 3.9537 | 0.4124 | 0 | 4.8520 | 21591 |
| Average employee age$_{it}$ | 38.5721 | 3.7185 | 24.4000 | 57.4000 | 21586 |
| Average employee Tenure$_{it}$ | 14.7845 | 4.4574 | 1.0000 | 29.1000 | 21587 |
| ln(total asset$_{it}$) | 11.3632 | 1.3964 | 7.1732 | 16.5335 | 21591 |
| ln(leverage$_{it}$) | -0.8218 | 1.6649 | -13.8448 | 6.5481 | 21567 |
| Capital labor ratio$_{it}$ | 45.9013 | 102.578 | 0.4247 | 4966.637 | 21591 |
| Employer matching contribution rate$_{it\ (\%)}$ | 6.7949 | 3.6817 | 0 | 100 | 15929 |

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

Table 2 The Effect of ESO on the intensive margin: Productivity

| VARIABLES | Eq. (1) | Eq. (2) | Eq. (3) | Eq. (1)' | Eq. (2)' | Eq. (3)' |
|---|---|---|---|---|---|---|
| | Fixed Effect Model (1989-2013) | | | FE 2SLS Model (1995-2013 excl. 1999) | | |
| $lnL_{it}$ | 0.959*** | 0.942*** | 0.964*** | 1.119*** | 1.017*** | 1.120*** |
| | (0.156) | (0.156) | (0.157) | (0.190) | (0.380) | (0.189) |
| $lnK_{it}$ | 0.174* | 0.170* | 0.181** | 0.201* | 0.147 | 0.249 |
| | (0.0902) | (0.0902) | (0.0903) | (0.117) | (0.206) | (0.214) |
| $lnL_{it}^2$ | 0.0118 | 0.0128 | 0.0107 | 0.0105 | 0.0196 | 0.00781 |
| | (0.0156) | (0.0154) | (0.0155) | (0.0190) | (0.0332) | (0.0217) |
| $lnK_{it}^2$ | 0.0168* | 0.0176* | 0.0155 | 0.0148 | 0.0240 | 0.00912 |
| | (0.00948) | (0.00947) | (0.00956) | (0.0117) | (0.0307) | (0.0246) |
| $lnK_{it}*lnL_{it}$ | -0.0507** | -0.0519** | -0.0488** | -0.0594** | -0.0714 | -0.0502 |
| | (0.0231) | (0.0229) | (0.0232) | (0.0280) | (0.0439) | (0.0449) |
| $ln(\text{firm age}_{it})$ | 0.412*** | 0.402*** | 0.412*** | 0.723*** | 0.554 | 0.619 |
| | (0.104) | (0.105) | (0.106) | (0.178) | (0.586) | (0.447) |
| Average employee $\text{tenure}_{it}$ | 0.00298 | 0.00370 | 0.00333 | 0.000375 | 0.00327 | 0.00433 |
| | (0.00275) | (0.00274) | (0.00274) | (0.00353) | (0.0100) | (0.0152) |
| $ln(\text{ESO per employee}_{t-1})$ | 0.0945*** | | 0.111*** | 0.369*** | | 0.368*** |
| | (0.00762) | | (0.00831) | (0.0663) | | (0.0680) |
| $ln(\text{ESO per participant}_{t-1})$ | | 0.119*** | | | 0.393*** | |
| | | (0.00895) | | | (0.0951) | |
| $ln(\text{participation rate}_{t-1})$ | | 0.0436*** | | | 0.000633 | |
| | | (0.0114) | | | (1.196) | |
| $ln(\text{ESO share}_{t-1})$ | | | -0.0361*** | | | -0.250 |
| | | | (0.00519) | | | (0.931) |
| Observations | 23,094 | 23,094 | 23,094 | 16,744 | 16,744 | 16,744 |
| Number of id_code | 1,729 | 1,729 | 1,729 | 1,618 | 1,618 | 1,618 |

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 3 The number of firms that changed their employer contribution matching rates

| Fiscal Year | Number of firms with match rate | | | Total |
|---|---|---|---|---|
| | Reduced | Unchanged | Raised | |
| 1995 | 10 | 1,008 | 16 | 1,034 |
| 1996 | 12 | 1,029 | 19 | 1,060 |
| 1997 | 10 | 1,053 | 33 | 1,096 |
| 2000 | 27 | 833 | 43 | 903 |
| 2001 | 17 | 893 | 40 | 950 |
| 2002 | 25 | 1,135 | 43 | 1,203 |
| 2003 | 17 | 1,173 | 27 | 1,217 |
| 2004 | 10 | 1,234 | 52 | 1,296 |
| 2005 | 14 | 1,228 | 83 | 1,325 |
| 2006 | 39 | 1,257 | 81 | 1,377 |
| 2007 | 10 | 1,232 | 84 | 1,326 |
| 2008 | 28 | 1,317 | 73 | 1,418 |
| 2009 | 41 | 1,565 | 38 | 1,644 |
| 2010 | 28 | 1,522 | 88 | 1,638 |
| 2011 | 17 | 1,496 | 46 | 1,559 |
| 2012 | 16 | 1,564 | 47 | 1,627 |
| 2013 | 11 | 1,744 | 57 | 1,812 |
| Throughout | 115 | 2,365 | 608 | 3,088 |

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

Table 4 The Effect of ESO on the intensive margin: ROA

| 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$_{it}$) | 0.00226 | 0.00144 | 0.00120 | -0.0114** | 0.00555 | 0.0304 |
| | (0.00239) | (0.00237) | (0.00243) | (0.0054) | (0.0265) | (0.0937) |
| ln(leverage$_{it}$) | -0.00630*** | -0.00615*** | -0.00593*** | -0.00519*** | -0.00657** | 0.00395 |
| | (0.000751) | (0.000748) | (0.000744) | (0.00101) | (0.00278) | (0.0193) |
| Capital Labor Ratio$_{it}$ | -0.000015* | -0.000011 | -0.000017* | -0.000027* | -0.000079 | -0.000120 |
| | (0.000008) | (0.000008) | (0.000009) | (0.000015) | (0.000142) | (0.000201) |
| ln(Firm Age) | -0.00501 | -0.00787 | -0.00561 | 0.0328 | -0.131 | -0.131 |
| | (0.00988) | (0.00988) | (0.00974) | (0.0214) | (0.220) | (0.370) |
| Average Employee Tenure | -0.000476 | -0.000362 | -0.000426 | -0.00091** | 0.00165 | 0.00336 |
| | (0.000299) | (0.000301) | (0.000297) | (0.00041) | (0.00354) | (0.00932) |
| ln(ESO per employee$_{t-1}$) | 0.00963*** | | 0.0117*** | 0.0434*** | | 0.00656 |
| | (0.000797) | | (0.000894) | (0.00898) | | (0.0876) |
| ln(ESO per participant$_{t-1}$) | | 0.0135*** | | | 0.0550*** | |
| | | (0.00102) | | | (0.0176) | |
| ln(participation rate$_{t-1}$) | | 0.00240** | | | -0.178 | |
| | | (0.000974) | | | (0.291) | |
| ln(ESO share$_{t-1}$) | | | -0.00505*** | | | -0.232 |
| | | | (0.000705) | | | (0.488) |
| Observations | 21,260 | 21,260 | 21,260 | 15,113 | 15,113 | 15,113 |
| Number of id_code | 1,617 | 1,617 | 1,617 | 1,476 | 1,476 | 1,476 |

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 5 The Effect of ESO on the intensive margin: Wages

| 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) | | |
| ln(total assets$_{it}$) | 0.0863*** | 0.0858*** | 0.0839*** | 0.00998 | 0.0153 | 0.0593 |
| | (0.00641) | (0.00641) | (0.00649) | (0.0454) | (0.0565) | (0.560) |
| ln(leverage$_{it}$) | -0.00972*** | -0.00964*** | -0.00884*** | 0.00171 | 0.00120 | -0.0422 |
| | (0.00149) | (0.00150) | (0.00146) | (0.00704) | (0.00775) | (0.478) |
| Capital labor ratio$_{it}$ | 0.000067*** | 0.000069*** | 0.000062** | 0.000589 | 0.000884 | 0.000237 |
| | (0.000025) | (0.000025) | (0.000024) | (0.000474) | (0.000126) | (0.00193) |
| ln(Firm age$_{it}$) | -0.0102 | -0.0117 | -0.00819 | 0.142 | 0.102 | -0.109 |
| | (0.0347) | (0.0347) | (0.0347) | (0.114) | (0.231) | (2.761) |
| Average employee age$_{it}$ | 0.00165 | 0.00165 | 0.00154 | -0.000955 | -0.000550 | -0.00352 |
| | (0.00421) | (0.00422) | (0.00421) | (0.00423) | (0.00474) | (0.0290) |
| Average employee tenure$_{it}$ | 0.0131*** | 0.0132*** | 0.0133*** | 0.0138*** | 0.0139*** | 0.00716 |
| | (0.00348) | (0.00348) | (0.00348) | (0.00348) | (0.00355) | (0.0718) |
| ln(ESO per employee$_{t-1}$) | 0.0209*** | | 0.0258*** | 0.191** | | -0.0123 |
| | (0.00270) | | (0.00281) | (0.0971) | | (2.236) |
| ln(ESO per participant$_{t-1}$) | | 0.0229*** | | | 0.195** | |
| | | (0.00280) | | | (0.0839) | |
| ln(participation rate$_{t-1}$) | | 0.0171*** | | | 0.107 | |
| | | (0.00428) | | | (0.391) | |
| ln(ESO share$_{t-1}$) | | | -0.0118*** | | | 0.629 |
| | | | (0.00219) | | | (6.832) |
| Observations | 21,242 | 21,242 | 21,242 | 14,290 | 14,290 | 14,290 |
| Number of id_code | 1,617 | 1,617 | 1,617 | 1,403 | 1,403 | 1,403 |

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 Effect of ESO plans on the intensive margin: Tobin's Q

| VARIABLES | Eq. (10) | Eq. (11) | Eq. (12) | Eq. (10)' | Eq. (11)' | Eq. (12)' |
|---|---|---|---|---|---|---|
| | Fixed Effect Model (1989-2013) | | | FE 2SLS Model (1995-2013 excl. 1999) | | |
| ln(total assets$_{it}$) | -0.193*** | -0.206*** | -0.213*** | -0.246*** | -0.198* | -0.128 |
| | (0.0325) | (0.0320) | (0.0319) | (0.0600) | (0.110) | (0.294) |
| ln(leverage$_{it}$) | -0.00718 | -0.00480 | -0.000038 | 0.00142 | -0.00247 | 0.0272 |
| | (0.00870) | (0.00854) | (0.00847) | (0.00950) | (0.0124) | (0.0608) |
| Capital labor ratio$_{it}$ | 0.000111 | 0.000168 | 0.000072 | 0.000475 | 0.000345 | -0.000216 |
| | (0.000114) | (0.000114) | (0.000115) | (0.000130) | (0.000533) | (0.000650) |
| ln(firm age$_{it}$) | -0.206 | -0.252* | -0.218 | -0.165 | -0.627 | -0.628 |
| | (0.156) | (0.152) | (0.149) | (0.279) | (0.826) | (1.132) |
| Average employee tenure$_{it}$ | -0.00660** | -0.00480* | -0.00566** | -0.0104*** | -0.00313 | 0.00169 |
| | (0.00289) | (0.00279) | (0.00275) | (0.00342) | (0.0136) | (0.0290) |
| ln(ESO per employee$_{t-1}$) | 0.167*** | | 0.208*** | 0.261*** | | 0.157 |
| | (0.0172) | | (0.0193) | (0.0901) | | (0.276) |
| ln(ESO per participant$_{t-1}$) | | 0.228*** | | | 0.294*** | |
| | | (0.0213) | | | (0.110) | |
| ln(participation rate$_{t-1}$) | | 0.0528*** | | | -0.363 | |
| | | (0.0154) | | | (1.122) | |
| ln(ESO share$_{t-1}$) | | | -0.0964*** | | | -0.654 |
| | | | (0.0104) | | | (1.531) |
| Observations | 21,261 | 21,261 | 21,261 | 15,114 | 15,114 | 15,114 |
| Number of id_code | 1,617 | 1,617 | 1,617 | 1,476 | 1,476 | 1,476 |

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 Interplays between ESO per employee and Ownership Structure

| | 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$_{t-1}$) | 0.0879*** | 0.0884*** | 0.0204*** | 0.0204*** | 0.00919*** | 0.00917*** | 0.159*** | 0.160*** |
| | (0.0077) | (0.0076) | (0.0027) | (0.0027) | (0.00080) | (0.00080) | (0.018) | (0.018) |
| ln(ESO per employee$_{t-1}$)*institutional investor$_i$ | 0.0350** | | 0.0026* | | 0.00248*** | | 0.0467** | |
| | (0.0157) | | (0.0015) | | (0.00094) | | (0.0147) | |
| ln(ESO per employee)$_{t-1}$*foreign investor$_i$ | | 0.0352** | | 0.0027* | | 0.00277*** | | 0.0455** |
| | | (0.0165) | | (0.0016) | | (0.00095) | | (0.0152) |
| Observations | 23,094 | 23,094 | 21,242 | 21,242 | 21,260 | 21,260 | 21,261 | 21,261 |
| R-squared | 0.510 | 0.510 | 0.681 | 0.681 | 0.214 | 0.214 | 0.317 | 0.317 |
| Number of firms | 1,729 | 1,729 | 1,617 | 1,617 | 1,617 | 1,617 | 1,617 | 1,617 |

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 The heterogeneous productivity effect of ESO plan

| VARIABLES | (1) Smaller Firms | (2) Younger Firms |
|---|---|---|
| $lnL_{it}$ | 0.962*** | 0.952*** |
| | (0.158) | (0.159) |
| $lnK_{it}$ | 0.169* | 0.193** |
| | (0.0927) | (0.0927) |
| $lnL_{it}^2$ | 0.00959 | 0.0127 |
| | (0.0156) | (0.0157) |
| $lnK_{it}^2$ | 0.0162* | 0.0161* |
| | (0.00955) | (0.00966) |
| $lnK_{it}$*$lnL_{it}$ | -0.0477** | -0.0510** |
| | (0.0232) | (0.0234) |
| ln(firm $age_{it}$) | 0.419*** | 0.414*** |
| | (0.106) | (0.104) |
| Average employee $tenure_{it}$ | 0.00315 | 0.00273 |
| | (0.00274) | (0.00275) |
| ln(ESO per $employee_{it-1}$) | 0.0958*** | 0.0951*** |
| | (0.00775) | (0.00771) |
| ln(ESO per $employee_{t-1}$) | 0.0370*** | 0.0250*** |
| *institutional $investor_i$ | (0.0105) | (0.00958) |
| ln(ESO per $employee_{it-1}$) | -0.0235*** | |
| * Standardized firm size $measure_i$ | (0.00746) | |
| ln(ESO per $employee_{it-1}$) | | -0.00390 |
| * Standardized firm age $measure_i$ | | (0.00761) |
| Observations | 22,638 | 22,638 |
| R-squared | 0.512 | 0.511 |
| Number of id_code | 1,665 | 1,665 |

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.

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