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Abstract

Traditionally, Japanese firms are known for the use of a pay system which rewards their workers for long-term skill development through on-the-job training within the firm. Changing its traditional reward system to performance-related pay (PRP) which ties pay to shorter-term performance is one of the most often-discussed topics concerning Japan's human resource management (HRM) policies/practices in the last two decades or so. Proponents of the change urge Japanese firms to abandon their traditional reward system and adopt PRP in order to boost productivity and maintain/regain global competitiveness. Opponents question their underlying premise that PRP boosts enterprise productivity. The controversy has not been resolved in large part due to the lack of rigorous evidence on the productivity effect of PRP in Japan. In this paper, we provide such evidence by estimating production functions augmented by PRP, using unique firm-level panel data. Unlike prior studies that use cross-sectional data, we are able to estimate fixed effect models and hence identify the productivity effect of PRP separately from that of time-invariant unobserved firm characteristics such as corporate culture, tradition, and inherent managerial quality. Overall, we find no significant productivity effect of PRP, which tends to favor skeptics. However, we also find evidence that PRP does yield significant productivity gains for firms that no longer subscribe to the traditional "lifetime employment" practice; and for firms that use employee involvement and tap into local knowledge of frontline workers. As such, our findings point to the importance of HRM complementarity. Changing the traditional pay system to PRP without changing the rest of the traditional Japanese HRM system such as "lifetime employment" is ineffective. Likewise, it is futile to offer workers incentive (PRP) while neglecting to provide them with an opportunity to share their productivity-enhancing local knowledge (employee involvement).

Keywords: Performance-related pay, Pay for performance, Productivity, Japan
JEL M52, J33, J24, J53, O53.

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PERFORMANCE-RELATED PAY AND PRODUCTIVITY: Evidence from Japan*

I. 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, group incentive pay which ties pay to group performance and individual incentive pay which links pay to individual performance.

Group incentive pay is often called employee financial participation schemes which include profit sharing, employee stock ownership, stock option, and team incentive (or gainsharing) plans. With the rising use and interest in such employee financial participation schemes, many studies have examined their effects on enterprise performance in industrialized countries.[1] Most prior studies consider either Profit Sharing Plans (PSPs) in which at least part of the compensation for employees is dependent on firm performance (typically profit)[2] or Employee Stock Ownership Plans (ESOPs) through which the firm forms an ESOP trust consisting of its non-executive employees and promotes ownership of its own shares by the

[1] For a survey of the literature on financial participation schemes, see for instance Blasi, Conte and Kruse (1996) on employee stock ownership and Jones, Kato and Pliskin (1997) on profit sharing, gain sharing/team incentives. For a Meta-analysis of the literature, see Doucouliagos (1995). For a more theoretical survey of the literature, see Gibbons (1997) and Prendergast (1999). For more recent works, see the shared capitalism literature (see, for instance, Bryson and Freeman, 2008, and Kruse, Blasi and Park, 2008).

[2] For detailed discussion on the definition of PSPs, see Kruse (1993) and Jones, Kato and Pliskin (1997).

trust.[3] Moreover, an increasing number of firms (in particular "New Economy" firms) are extending the use of Stock Option Plans (SOPs) 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 TIPs (Team Incentive Plans) which makes at least part of the compensation for employees dependent on performance of the team or work group to which they belong.[5] 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).

Japanese firms are traditionally known for their extensive use of human resource management practices as intangible assets in the production process. Group incentive pay (employee ownership, profit sharing, and gainsharing) is a well-researched example of such a practice (see, for instance, Jones and Kato, 1995, Ohkusa and Ohtake, 1997, and Kato and Morishima, 2003). In contrast, traditionally individual incentive pay received less attention in the Japanese context. However following the burst of the financial bubble at the end of the 1980s, the Japanese economy fell into prolonged stagnation (Japan's Great Recession or Lost Decade). The inability of the Japanese employment system to respond to rapidly changing market conditions during Japan's Great Recession was often accused of a structural impediment to the swift and robust recovery of the Japanese economy (Ono and Rebick, 2003). Influential associations of Japanese business leaders, such as Keizai Doyukai (Japan Association of Corporate Executives) and Nippon Keidanren (Japan Business Federation) called for a

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

[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.

replacement of the Japanese system with the U.S. system. In this context, interest in American-style individual incentive pay--Performance-Related Pay (PRP) rose. While the traditional Japanese pay system tends to reward long-term skill acquisition through on-the-job training within the firm, American-style PRP links pay to individual performance over a relatively shorter time horizon as compared to the traditional Japanese reward system.[6] For instance, under American-style PRP, individual worker pay is determined by the supervisor's annual assessment of the extent to which the worker achieves a set of specific goals that were set during the annual consultation at the beginning of the year. A switch from the traditional Japanese pay system to the American-style PRP has been recommended as a means to boost Japanese firms' productivity and maintain/regain their competitiveness.

Skeptics question the underlying premise of proponents of PRP--PRP boosts labor productivity. The controversy has not been resolved in large part due to the lack of rigorous evidence on the productivity effect of PRP in Japan. In this paper we provide such evidence by estimating production functions augmented by PRP, using unique firm-level panel data. Unlike prior studies that use cross-sectional data (see, for instance, Benson and Brown, 2000), we are able to estimate fixed effect models and estimate the productivity effect of PRP separately from that of time-invariant unobserved firm characteristics such as corporate culture, tradition and inherent managerial quality.

Productivity gains from PRP do not translate into profitability gains if PRP also results in significant wage gains. To this end, we complete our production function analysis by conducting an exploratory analysis of possible wage gains and profitability gains from PRP.

[6] The English-language literature on recent changes in the Japanese pay system is thin. A notable recent exception is Chiang and Ohtake (2014). For the Japanese-language literature, see, for instance, Tsuru, Abe, and Kubo (2005).

The paper is organized as follows. In the next section, we describe the data. Section III provides our main empirical strategy and presents the key results, followed by our complementary analysis of wage and profitability gains in section IV. Section V concludes.

II. Data

We assemble unique long panel on Japanese manufacturing firms by merging the following three firm-level panel datasets using unique company codes; (i) Data from the Intangible Assets Interview Survey in Japan conducted by the RIETI (Research Institute of Economy, Trade, and Industry); and (ii) Corporate Proxy Statement Data compiled by Development Bank of Japan. The merged database consists of 8912 observations--254 publicly-traded manufacturing firms over 1956-2012. Importantly the database provides longitudinal information on the incidence of PRP.

Figure 1 shows the diffusion of PRP among Japan's publicly-traded firms over 1956-2012. As shown in the figure, PRP was not used by Japan's publicly-traded firms till 1980. Even after 1980, PRP remained a rather obscure practice among Japanese firms (only 5 percent of Japanese firms used PRP throughout 1980s). As discussed earlier, the interest in PRP was sparked during Japan's Lost Decade, and the proportion of Japanese firms with PRP started to rise. At the end of her Lost Decade (2001-02) before its modest recovery in 2003, the Japanese economy was bottoming out. It was at this breaking point of the Japanese Economy that PRP started to diffuse rapidly among Japanese firms. The diffusion of PRP since then has been astounding—from 20 percent in 2000 to 70 percent in 2012.

III. Econometric Specifications and Results

We begin with estimating Cobb-Douglas production functions with fixed effects, augmented by a dummy variable capturing the productivity effect of the incidence of PRP:

(1) $\ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 PRP_{it-j}$ + (firm specific fixed effects) + (year effects) + u_{it}

where Q_{it} is output of firm i in year t, measured by value added; K_{it} is the capital stock; L_{it} is labor; PRP_{it-j} is a dummy variable which takes the value of 1 if firm i in year t has used PRP over the last j years (j=1,2, ---, 7), and the value of zero otherwise; and β's are slope .

We allow for lags (up to seven years) in the productivity effects of PRP. First, it is highly unlikely that instituting a new PRP system will instantly change worker behavior. Second, one mechanism through which the introduction of PRP leads to productivity gains is positive worker sorting---high-productivity workers self-select into those firms with PRP while low-productivity workers opt out of such firms (see, for instance, Lazear, 2000) . Third, a newly established pay scheme may go through a significant amount of learning by doing in its early developmental years.[7] Last, in investigating the productivity effects of PRP, ideally we want to use the presence of such schemes, a *de jure* measure as well as the extent of PRP, a *de facto* measure (e.g., the penetration of such schemes to the labor force and the power of incentive generated by schemes). Unfortunately, panel data on *de facto* measures are not readily available. We can, however, measure the extent of PRP indirectly by allowing for lags in the productivity effects of PRP insofar as the extent of PRP is positively correlated with the length of time PRP has been in place (see Freeman and Kleiner, 2000 and Kato, 2006 for such positive correlations). In sum, we assume that it will take at least j years (j = 1, 2, ---, 7) for a newly introduced PRP to mature and hence realize its full potential for creating significant productivity gains for the firm.

As a robustness check, we also consider translog production functions and find that our

[7] See for instance Kato and Morishima (2002), Kato (2006), and Muller and Stegmaier (2014).

results change little when we consider translog production functions.[8] Furthermore, to account for possible endogeneity of labor input and selection, we also consider a method proposed by Olley and Pakes (1996) as well as Levinsohn and Petrin (2003) and simplified by Wooldridge (2009). Reassuringly there is no discernible change in the results although they are somewhat less precisely estimated.

The longitudinal structure of our data enables us to overcome the problem of unobserved firm heterogeneity that affects firm productivity as well as the firm's decision to introduce PRP. For instance, it is plausible that the firm with overall high-quality management is more likely to introduce a PRP scheme as an innovative and smart payment system. It is also quite plausible that overall high-quality management leads to higher enterprise productivity. Since we cannot reliably measure a variable such as high-quality management, the cross-section estimates are likely to be biased upward. A standard solution is the fixed effect (FE) estimation which controls for unobserved firm heterogeneity by exploiting the fact that much of unobserved firm heterogeneity such as overall management quality tends to be stable over time. Finally, to control for common year effects (including common trends and macro shocks), we will also consider year fixed effects.

Table 1 reports summary statistics, and Table 2 reports the Fixed Effect estimates of our baseline production function, Eq. (1). The estimated coefficients on capital and labor are positive and statistically significant, and their sizes are sensible. However, none of the estimated coefficients on PRP_{it-j} is statistically significant at the 10 percent level, suggesting the lack of the significant productivity effect of PRP in Japan. As such, the findings are not favorable to proponents of PRP.

It is, however, possible that PRP may have heterogeneous productivity effects, depending on types of firms. First, it has been argued that changing the traditional pay system to PRP cannot be

[8] These, and other, unreported regression results are available from the corresponding author tkato@colgate.edu upon request.

effective in boosting productivity unless another important traditional practice of "Lifetime Employment (LTE)" is also changed (see, for example, Morishima, 1995). To this end, we augment our baseline model with an interaction term involving PRP_{it-j} and LTE_i (= 1 if firm i still stresses lifetime employment for its employees, 0 otherwise).[9]

$$(2)\ \ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * LTE_i$$
$$+ (\text{firm specific fixed effects}) + (\text{year effects}) + u_{it}$$

The fixed-effect estimates of Eq. (2) are reported in Table 3. The estimated coefficients on PRP_{it-j} are positive and now statistically significant at the 10 percent level, suggesting that the introduction of PRP will result in a positive and significant productivity gain of 26 to 30% for those firms that no longer stress the importance of "lifetime employment". The estimated coefficients on the interaction term, $PRP_{it-j}*LTE_i$, are negative and significant or almost significant at the 10 percent level, and are similar in size to the estimated coefficients on PRP_{it-j} although they are of opposite signs. For firms that still stress the importance of "lifetime employment", productivity gains are equal to the sum of the coefficients on $PRP_{it-j}*LTE_i$ and PRP_{it-j} which is found to be close to zero and statistically indistinguishable from zero. As such, our finding is consistent with those who emphasize the importance of complementarity of HRM practices in general and Morishima (1995) in particular.

The literature on High Performance Work System points out yet another example of the importance of synergic relationships among various HRM practices (see, for instance, Kato, 2014). For PRP to be effective in boosting organizational productivity, the firm will also need to provide employees with an effective employee involvement mechanism through which they can create and

[9] The data on LTE are available only cross-sectionally. As such, we cannot estimate the coefficient on LTE itself in fixed effect models. However, the coefficient on the interaction term involving LTE and PRP can be estimated since PRP is time-variant.

share productivity-enhancing local knowledge with the firm. To test such complementarity between PRP and employee involvement, we estimate another augmented version of Eq. (1):

(3) $\ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * EI_i$

$+$ (firm specific fixed effects) $+$ (year effects) $+ u_{it}$

where EI_i (= 1 if frontline workers make suggestions in firm i, 0 otherwise). The estimated coefficients on the interaction term, $PRP_{it-j} * EI_i$, are positive and significant at least at the 5 percent level, pointing to the synergic relationship between PRP and EI. The estimated coefficients on PRP itself are not statistically significant even at the 10 percent level, pointing to the absence of productivity gains from PRP for firms without EI. In contrast, for firms with EI, productivity gains from PRP are the sum of the estimated coefficients on PRP_{it-j} and $PRP_{it-j} * EI_i$ which are found to be statistically significant at least at the 5 percent level. It suggests that PRP will boost productivity only when introduced in tandem with EI.

IV. Wage and Profit

The positive productivity gains from PRP may not translate into the positive profitability gains from PRP, for PRP may lead to offsetting wage gains. A switch from the traditional wage system to PRP in Japan represents an increase in uncertainty in pay—pay is subject to more short-term variation. As such, it is plausible that PRP may carry a risk premium, resulting in wage gains. If such wage gains are sufficiently large to offset the productivity gains from PRP, the productivity gains from PRP may not lead to any profitability gains. In this section we conduct an exploratory investigation of such a possibility. Specifically to explore any wage gain from PRP, we begin estimating the following baseline regression:

(4) $\ln Wage_{it} = \beta_1 PRP_{it-j}$ + (firm specific fixed effects) + (year effects) + (additional controls) $+ u_{it}$

where $Wage_{it}$ is the average wage level (adjusted for inflation) of firm i in year t. For additional controls, we include average employee age, average employee tenure, their quadratic terms, firm size (measured by the number of employees), capital/labor ratio, and ROA. In addition, as we have done for production function estimations in the previous section, we augment the baseline equation with an interaction term involving PRP_{it-j} and LTE_i:

(5) $\ln Wage_{it} = \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * LTE_i$

$+$ (firm specific fixed effects) $+$ (year effects) $+$ (additional controls) $+ u_{it}$

Likewise, considering an interaction term involving PRP_{it-j} and EI_i

(6) $\ln Wage_{it} = \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * EI_i$

$+$ (firm specific fixed effects) $+$ (year effects) $+$ (additional controls) $+ u_{it}$

Tables 5, 6 and 7 present the fixed effect estimates of Eq. (4), Eq. (5), and Eq. (6). First, as shown in Table 5. the estimated coefficients on PRP_{it-j} are positive and statistically significant at the 10 percent level for all j's except for j=1 although it is close to being significant, pointing to significant wage gains from PRP. The size of the coefficients implies that having PRP for at least one full year will lead to a significant increase in average employee wage by 8 to 9 percent.

Table 6 shows that the estimated coefficients on $PRP_{it-j} * LTE_i$ are negative, while the estimated coefficients on PRP_{it-j} *per se* are positive. The positive coefficients on PRP_{it-j} are statistically significant at the 10 percent level for j=1 and 2, and at the 5 percent level for j=3, 4, 5, 6, and 7. In contrast, the negative coefficients on the interaction term are somewhat less precisely estimated and statistically significant at the 10 percent level for j=4, 5, 6, and 7 but not for j=1, 2, and 3. In short, for firms that no longer stress the importance of lifetime employment (LTE=0), PRP will yield significant wage gains which are comparable to those productivity gains for such firms as shown in Table 3. For firms that still stress the importance of lifetime

employment, wage gains from PRP are the sum of the estimated coefficients on PRP_{it-j} and $PRP_{it-j}*LTE_i$, which is found to be much smaller and not significantly different from zero. This finding is also in line with the earlier production function estimations—a shift from the traditional wage system to PRP will lead to an increase in productivity only when introduced in tandem with a shift away from the traditional lifetime employment system.

Turning to the complementarity between PRP and EI, as shown in Table 7, on the one hand, the estimated coefficients on $PRP_{it-j}*EI_i$ are positive and statistically significant at the 1 percent level for j=1, 2, 3, and 4, and at the 5 percent level for j=5, 6, and 7, confirming the synergic relationship between PRP and EI. On the other hand, the estimated coefficients on PRP itself are not statistically significant even at the 10 percent level, pointing to the lack of wage gains from PRP for firms without EI. In contrast, for firms with EI, wage gains from PRP are the sum of the estimated coefficients on PRP_{it-j} and $PRP_{it-j}*EI_i$ which is found to be statistically significant at least at the 5 percent level. In short, as in the case of the productivity gains for firms with and without EI, wage gains from PRP will arise only for firms with EI.

Since PRP yields productivity gains as well as wage gains, and they are similar in size, we expect PRP to yield no profitability gain. To confirm our conjecture, we repeat the same analysis, using profit margin (profit divided by sales) as the dependent variable:

(7) $MARGIN_{it} = \beta_1 PRP_{it-j}$ + (firm specific fixed effects)

+ (year effects) + (additional control) + u_{it}

where $MARGIN_{it}$ is profit margin of firm i in year t. For additional control, we use firm size, which is measured by the number of employees. The fixed effect estimates of Eq. (7) are presented in Table 8. As expected, the estimated coefficients on $MARGIN_{it}$ are small and not statistically significant at all even at the 10 percent level.

As in the case of productivity gains and wage gains, we also estimate two augmented versions of Eq. (7):

$$(8)\ MARGIN_{it} = \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * LTE_i + (\text{firm specific fixed effects}) + (\text{year effects}) + (\text{additional control}) + u_{it}$$

$$(9)\ MARGIN_{it} = \beta_1 PRP_{it-j} + \beta_2 PRP_{it-j} * EI_i + (\text{firm specific fixed effects}) + (\text{year effects}) + (\text{additional control}) + u_{it}$$

As shown in Table 9, profitability gains for firms that no longer stress lifetime employment are indicated by the estimated coefficients on PRP_{it-j}, which are not statistically significant even at the 10 percent level. For firms that stress lifetime employment, profitability gains are the sum of the two coefficients, $\beta_1 + \beta_2$, which is also never statistically significant even at the 10 percent level. Likewise, we find no evidence for significant profitability gain for either firms with EI or firms without EI, as shown in Table 10.

IV. Conclusions

Traditionally Japanese firms are known for the use of a compensation system that rewards their employees for their long-term skill acquisition through experiencing a variety of jobs within the firm. Changing its reward system to Performance-Related Pay (PRP) that makes pay more sensitive to shorter-term performance is one of the most often-discussed topics concerning Japan's HRM policies/practices in the last two decades or so. Proponents of the change urge Japanese firms to abandon their traditional reward system and adopt PRP in order to boost productivity and maintain/regain their competitiveness. Opponents question their underlying premise that PRP boosts enterprise productivity. The controversy has not been resolved in large part due to the lack of rigorous evidence on the productivity effect of PRP in

Japan. In this paper we have provided such evidence by estimating production functions augmented by PRP, using unique firm-level panel data. Unlike prior studies that use cross-sectional data, we are able to estimate fixed effect models and estimate the productivity effect of PRP separately from that of time-invariant unobserved firm characteristics such as corporate culture, tradition and inherent managerial quality.

Overall we have found no significant productivity effect of PRP, which tends to favor skeptics on PRP. However, we have also found evidence that PRP does yield significant productivity gains for firms that no longer subscribe to the traditional "lifetime employment" practice; and for firms that use employee involvement and tap into local knowledge of frontline employees. As such, our findings point to the importance of HRM complementarity. In addition, we have found evidence that PRP will lead to significant wage gains which we interpret as a risk premium associated with increased variability of pay as a result of a shift from the traditional pay system to PRP which makes wage more variable in the short run. Wage gains from PRP have been also found to be similar in size to productivity gains from PRP, suggesting the lack of profitability gains from PRP. Our analysis of profitability and PRP has yielded evidence that is consistent with the absence of profitability gains from PRP.

The shift from the traditional wage system toward PRP has been promoted by policy makers in recent years. For instance, the government has adopted a bill to revise Japan's Labor Standard Law, which will allow employers to exempt a subset of their employees who are currently covered by overtime regulations from such regulations, and pay them according to their performance. Our findings suggest that PRP alone may not be a silver bullet to make Japanese firms regain and maintain their global competitiveness and that in promoting PRP, policy makers ought to be cognizant of synergy between PRP and other HRM practices, and design their public

policy such that the positive synergy between PRP and other HRM practices will be maximized.

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Table 1 Summary Statistics

Variable	Obs	Mean	S.D.
$lnOUT_{it}$	8773	15.51	1.59
lnL_{it}	8773	6.96	1.34
lnK_{it}	8773	15.86	1.66
PRP_{it-j}	8773	0.21	0.41
$lnWage_{it}$	8771	8.14	1.12
$MARGIN_{it}$	8772	0.05	0.08
LTE_{i}	8716	0.71	0.45
EI_{i}	8751	0.56	0.50

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Table 2 The Fixed Effect Estimates on the Productivity Effects of PRP:
Dependent variable=$lnOUT_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
lnK_{it}	0.108**	0.097*	0.105**	0.096*	0.092*	0.088*	0.083*
	[2.033]	[1.865]	[2.006]	[1.877]	[1.825]	[1.735]	[1.662]
lnL_{it}	0.774***	0.774***	0.771***	0.767***	0.764***	0.760***	0.755***
	[9.477]	[9.546]	[9.519]	[9.507]	[9.483]	[9.390]	[9.322]
PRP_{it-1}	0.105						
	[1.326]						
PRP_{it-2}		0.094					
		[1.207]					
PRP_{it-3}			0.094				
			[1.224]				
PRP_{it-4}				0.084			
				[1.104]			
PRP_{it-5}					0.082		
					[1.076]		
PRP_{it-6}						0.078	
						[1.013]	
PRP_{it-7}							0.067
							[0.835]
R-squared	0.66	0.642	0.626	0.604	0.583	0.562	0.54
N	8773	8516	8278	8030	7783	7536	7289

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.
Notes: All models include firm-fixed effects and time effects. Absolute value of cluster-robust t-statistics in parentheses.
Significance level: *** 1 percent ** 5 percent * 10 percent

Table 3 The Fixed Effect Estimates on the Productivity Effects of PRP for firms with and without maintaining "lifetime employment"

Dependent variable=ln OUT_{it}

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
lnK_{it}	0.110**	0.099*	0.107**	0.097*	0.093*	0.089*	0.084
	[2.031]	[1.865]	[1.994]	[1.856]	[1.794]	[1.698]	[1.618]
lnL_{it}	0.778***	0.779***	0.777***	0.774***	0.771***	0.768***	0.763***
	[9.509]	[9.587]	[9.584]	[9.590]	[9.579]	[9.505]	[9.437]
PRP_{it-1}	0.274*						
	[1.788]						
PRP_{it-1}*LTE_i	-0.249						
	[-1.403]						
PRP_{it-2}		0.258*					
		[1.698]					
PRP_{it-2}*LTE_i		-0.242					
		[-1.383]					
PRP_{it-3}			0.286*				
			[1.895]				
PRP_{it-3}*LTE_i			-0.282				
			[-1.615]				
PRP_{it-4}				0.280*			
				[1.848]			
PRP_{it-4}*LTE_i				-0.287			
				[-1.637]			
PRP_{it-5}					0.285*		
					[1.872]		
PRP_{it-5}*LTE_i					-0.295*		
					[-1.676]		
PRP_{it-6}						0.297*	
						[1.897]	
PRP_{it-6}*LTE_i						-0.315*	
						[-1.752]	
PRP_{it-7}							0.291*
							[1.782]
PRP_{it-7}*LTE_i							-0.320*
							[-1.724]
R-squared	0.661	0.643	0.627	0.605	0.585	0.565	0.542
N	8716	8460	8223	7977	7732	7487	7242

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects and time effects. Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 4 The Fixed Effect Estimates on the Productivity Effects of PRP for firms with and without employee involvement

Dependent variable=ln OUT_{it}

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
lnK_{it}	0.110**	0.098*	0.106**	0.096*	0.091*	0.086*	0.081
	[2.050]	[1.861]	[1.987]	[1.841]	[1.777]	[1.681]	[1.598]
lnL_{it}	0.766***	0.767***	0.764***	0.761***	0.758***	0.754***	0.751***
	[9.238]	[9.331]	[9.308]	[9.326]	[9.311]	[9.219]	[9.169]
PRP_{it-1}	-0.106						
	[-1.097]						
$PRP_{it-1}*EI_i$	0.357**						
	[2.496]						
PRP_{it-2}		-0.122					
		[-1.283]					
$PRP_{it-2}*EI_i$		0.364***					
		[2.597]					
PRP_{it-3}			-0.131				
			[-1.402]				
$PRP_{it-3}*EI_i$			0.375***				
			[2.696]				
PRP_{it-4}				-0.129			
				[-1.399]			
$PRP_{it-4}*EI_i$				0.354**			
				[2.571]			
PRP_{it-5}					-0.113		
					[-1.215]		
$PRP_{it-5}*EI_i$					0.323**		
					[2.337]		
PRP_{it-6}						-0.097	
						[-1.032]	
$PRP_{it-6}*EI_i$						0.291**	
						[2.072]	
PRP_{it-7}							-0.097
							[-1.039]
$PRP_{it-7}*EI_i$							0.271*
							[1.901]
R-squared	0.665	0.647	0.631	0.608	0.587	0.566	0.542
N	8751	8495	8259	8013	7767	7521	7275

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects and time effects. Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 5 The Fixed Effect Estimates on the Wage Effects of PRP
Dependent variable=$\ln Wage_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	0.082						
	[1.646]						
PRP_{it-2}		0.086*					
		[1.714]					
PRP_{it-3}			0.085*				
			[1.680]				
PRP_{it-4}				0.091*			
				[1.771]			
PRP_{it-5}					0.093*		
					[1.769]		
PRP_{it-6}						0.093*	
						[1.732]	
PRP_{it-7}							0.085
							[1.523]
R-squared	0.579	0.579	0.58	0.581	0.581	0.581	0.581
N	6614	6556	6447	6328	6204	6077	5949

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.
Notes: All models include firm-fixed effects, time effects as well as the following time-variant controls: average employee age, average employee tenure, their quadratic terms, firm size (measured by the number of employees), capital/labor ratio, and ROA. Absolute value of cluster-robust t-statistics in parentheses.
Significance level: *** 1 percent ** 5 percent * 10 percent

Table 6 The Fixed Effect Estimates on the Wage Effects of PRP for firms with and without maintaining "lifetime employment"

Dependent variable=$\ln Wage_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	0.200*						
	[1.826]						
$PRP_{it-1}*LTE_i$	-0.181						
	[-1.407]						
PRP_{it-2}		0.208*					
		[1.891]					
$PRP_{it-2}*LTE_i$		-0.188					
		[-1.449]					
PRP_{it-3}			0.221**				
			[2.000]				
$PRP_{it-3}*LTE_i$			-0.207				
			[-1.591]				
PRP_{it-4}				0.238**			
				[2.130]			
$PRP_{it-4}*LTE_i$				-0.222*			
				[-1.689]			
PRP_{it-5}					0.251**		
					[2.203]		
$PRP_{it-5}*LTE_i$					-0.236*		
					[-1.769]		
PRP_{it-6}						0.268**	
						[2.325]	
$PRP_{it-6}*LTE_i$						-0.259*	
						[-1.913]	
PRP_{it-7}							0.272**
							[2.280]
$PRP_{it-7}*LTE_i$							-0.273*
							[-1.964]
R-squared	0.584	0.585	0.586	0.588	0.588	0.588	0.589
N	6570	6512	6403	6285	6162	6036	5909

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects, time effects as well as the following time-variant controls: average employee age, average employee tenure, their quadratic terms, firm size (measured by the number of employees), capital/labor ratio, and ROA. Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 7 The Fixed Effect Estimates on the Wage Effects of PRP for firms with and without employee involvement

Dependent variable=$\ln Wage_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	-0.070						
	[-1.012]						
$PRP_{it-1}*EI_i$	0.274***						
	[2.663]						
PRP_{it-2}		-0.073					
		[-1.039]					
$PRP_{it-2}*EI_i$		0.283***					
		[2.721]					
PRP_{it-3}			-0.077				
			[-1.101]				
$PRP_{it-3}*EI_i$			0.284***				
			[2.729]				
PRP_{it-4}				-0.070			
				[-1.000]			
$PRP_{it-4}*EI_i$				0.279***			
				[2.657]			
PRP_{it-5}					-0.066		
					[-0.928]		
$PRP_{it-5}*EI_i$					0.269**		
					[2.534]		
PRP_{it-6}						-0.065	
						[-0.920]	
$PRP_{it-6}*EI_i$						0.268**	
						[2.478]	
PRP_{it-7}							-0.072
							[-1.018]
$PRP_{it-7}*EI_i$							0.263**
							[2.397]
R-squared	0.589	0.590	0.590	0.590	0.589	0.588	0.587
N	6588	6531	6424	6307	6185	6060	5934

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects, time effects as well as the following time-variant controls: average employee age, average employee tenure, their quadratic terms, firm size (measured by the number of employees), capital/labor ratio, and ROA. Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 8 The Fixed Effect Estimates on the Profit Effects of PRP

Dependent variable=$Margin_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	0.001						
	[0.081]						
PRP_{it-2}		-0.001					
		[-0.149]					
PRP_{it-3}			-0.001				
			[-0.177]				
PRP_{it-4}				-0.002			
				[-0.333]			
PRP_{it-5}					-0.001		
					[-0.191]		
PRP_{it-6}						0.002	
						[0.232]	
PRP_{it-7}							0.002
							[0.256]
R-squared	0.127	0.129	0.126	0.133	0.138	0.143	0.151
N	8856	8598	8356	8105	7855	7606	7357

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects, time effects as well as firm size (measured by employment). Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 9 The Fixed Effect Estimates on the Profit Effects of PRP for firms with and without maintaining "lifetime employment"

Dependent variable=$MARGIN_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	-0.011						
	[-1.181]						
$PRP_{it-1}*LTE_i$	0.018*						
	[1.736]						
PRP_{it-2}		-0.014					
		[-1.455]					
$PRP_{it-2}*LTE_i$		0.020*					
		[1.855]					
PRP_{it-3}			-0.013				
			[-1.291]				
$PRP_{it-3}*LTE_i$			0.017				
			[1.555]				
PRP_{it-4}				-0.013			
				[-1.200]			
$PRP_{it-4}*LTE_i$				0.015			
				[1.269]			
PRP_{it-5}					-0.01		
					[-0.892]		
$PRP_{it-5}*LTE_i$					0.013		
					[0.974]		
PRP_{it-6}						-0.002	
						[-0.140]	
$PRP_{it-6}*LTE_i$						0.006	
						[0.401]	
PRP_{it-7}							-0.003
							[-0.288]
$PRP_{it-7}*LTE_i$							0.009
							[0.577]
R-squared	0.125	0.127	0.128	0.134	0.139	0.144	0.151
N	8798	8541	8301	8052	7804	7557	7310

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects, time effects as well as firm size (measured by employment). Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

Table 10 The Fixed Effect Estimates on the Profit Effects of PRP for firms with and without employee involvement

Dependent variable=$MARGIN_{it}$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
PRP_{it-1}	0.011						
	[1.029]						
$PRP_{it-1}*EI_i$	-0.018*						
	[-1.808]						
PRP_{it-2}		0.01					
		[0.975]					
$PRP_{it-2}*EI_i$		-0.019*					
		[-1.802]					
PRP_{it-3}			0.011				
			[0.915]				
$PRP_{it-3}*EI_i$			-0.019*				
			[-1.748]				
PRP_{it-4}				0.009			
				[0.741]			
$PRP_{it-4}*EI_i$				-0.019			
				[-1.629]			
PRP_{it-5}					0.011		
					[0.835]		
$PRP_{it-5}*EI_i$					-0.021		
					[-1.605]		
PRP_{it-6}						0.015	
						[0.982]	
$PRP_{it-6}*EI_i$						-0.023	
						[-1.597]	
PRP_{it-7}							0.017
							[1.015]
$PRP_{it-7}*EI_i$							-0.023
							[-1.452]
R-squared	0.133	0.135	0.131	0.138	0.144	0.149	0.154
N	8830	8573	8333	8084	7836	7589	7342

Data: the Intangible Assets Interview Survey in Japan conducted by the RIETI; CSR Data compiled by Toyo Keizai; and Corporate Proxy Statement Data compiled by Development Bank of Japan.

Notes: All models include firm-fixed effects, time effects as well as firm size (measured by employment). Absolute value of cluster-robust t-statistics in parentheses.

Significance level: *** 1 percent ** 5 percent * 10 percent

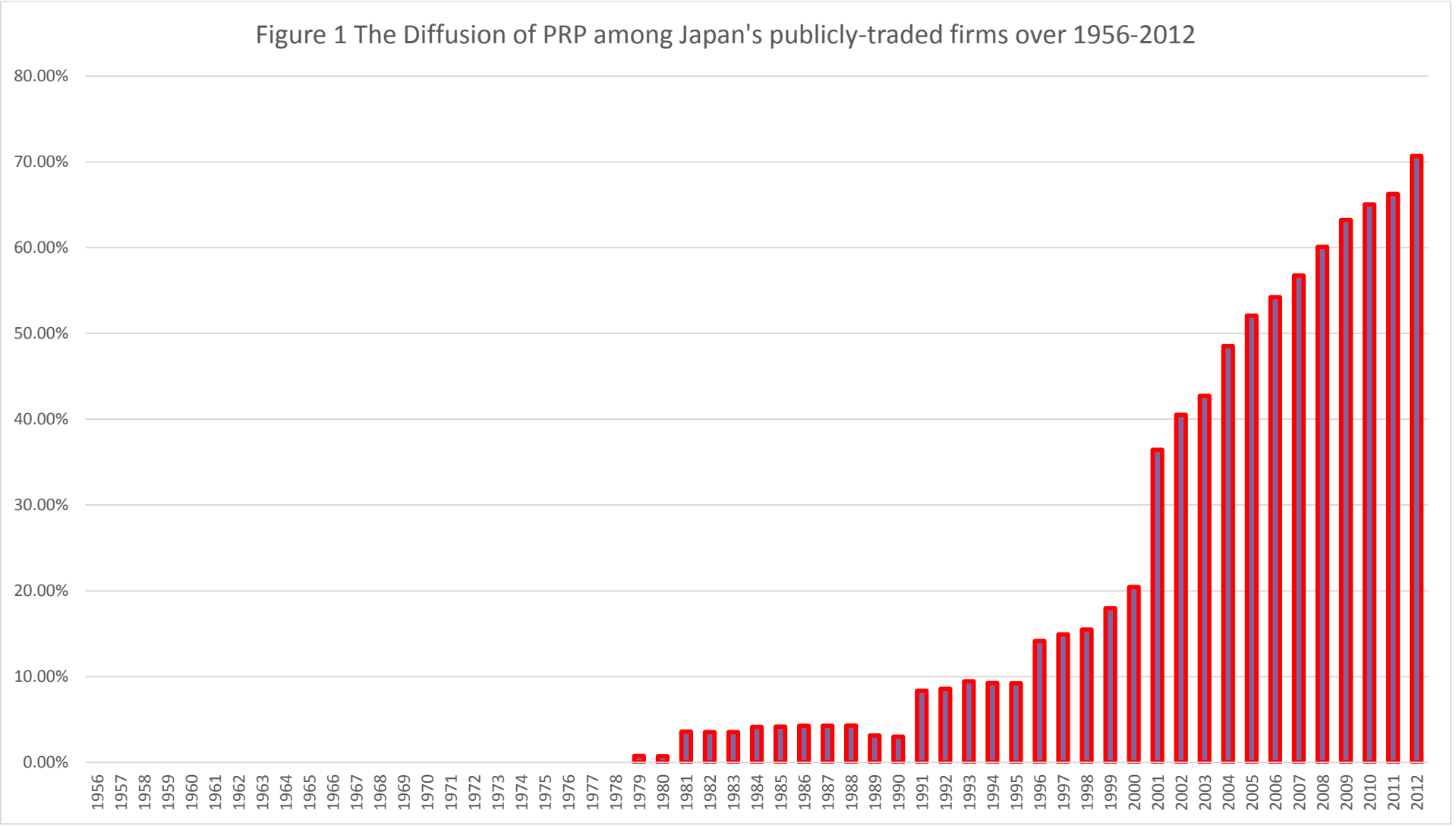
Figure 1 The Diffusion of PRP among Japan's publicly-traded firms over 1956-2012
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