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Evidence from Finnish Manufacturing

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HRM Practices and Firm Performance: Evidence from Finnish Manufacturing[1]

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Abstract: We study how HRM practices such as employee involvement (EI) in firm decision making and financial participation (FP) are associated with firm performance. Our novel HRM survey data set has advantages over most data sets typically used in related studies since it is a panel, includes a broad variety of practices and is a representative random sample. Also we take into account other important drivers of firm performance, notably computer use, product market competition, and family and foreign majority ownership. The sensitivity of findings to different empirical approaches is investigated and our preferred approach is novel and uses robust regression methods. While results are sensitive to different specifications we find that performance-based pay and indices of FP are positively related to firm performance. Contrary to many previous findings we do not find a significant positive association between indices of EI and firm performance, though in some case we find that individual EI practices do enhance business performance.

JEL Codes: M54, J53, L23

Keywords: new workplace practices; HRM; employee participation; firm productivity

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1. Introduction

A growing body of empirical research evidence from several industrialized countries suggests that human resource management practices (HRMPs) have become increasingly common forms of employee participation during the last years (see, e.g., Blasi and Kruse 2006, Kruse *et al*. 2010 for the US; Bryson and Freeman 2010 for the UK; Kato 2006 for Japan; Jones *et al.* 2010a, Kalmi and Kauhanen 2008 for Finland). In parallel with the mushrooming of these practices there has been an outpouring of empirical research that focuses on the impacts of HRMPs on firm performance. Whereas some of these studies examine combinations of HRMPs--e.g. Chi *et al*. (2007) construct employee involvement indices (EI) based on eight practices-- others focus on a single HRM practice, such as stock options (e.g. Jones *et al*. 2010b; Mäkinen 2010; Sesil *et al*. 2002).

However, the key conclusions obtained in many of these previous studies might be premature, since often they have at least one of the following potential limitations. For one thing, the underlying data may not be representative. Several studies use subjective performance measures, while others do not conduct their empirical analysis using methods that are derived from a strong conceptual framework but rather use ad hoc regressions. Also, several studies are likely to suffer from omitted variable bias, because of a failure to include all relevant HRMPs or other important factors that are likely to affect firm performance. In addition all studies that are based on self-reported surveys are prone to measurement errors (e.g. survey noise biases).[1] Finally, the two-stage estimation method applied in some studies (e.g. Black and Lynch 2001; Zwick 2004) may be problematic itself and suffer from outlying observations (e.g. due to noisy company micro data, or due to biased first-step fixed effects estimates) which, especially in small samples, can lead to the erroneous estimates of coefficients and standard errors, and potentially flawed conclusions.

In this paper we estimate how HRM practices are related to firm performance. While we cannot address *all* the potential limitations of previous work, we are able to respond to many of these matters. In particular, we focus on the following issues concerning data and methods. First, we use a new survey data set from the Finnish manufacturing sector that covers a broad set of HRM practices in 398 firms which constitutes 38% of firms in the population.[2] This HRM survey is a representative random sample of those manufacturing firms that employed at least 50 persons in 2005. The response rate of nearly 50% is relatively high compared to previous HRM surveys in this area (e.g. compare with Freeman and Kleiner 2000 or Kato and Morishima 2002). Most unusually, the wide range of practices we survey enables us to distinguish strategic or high-level forms of employee participation in decision making (such as board representation) from low-level practices (such as self-managed teams). As well as investigating the effects of individual HRM practices, we also follow some previous studies and use summated rating indices of these practices to measure firms' overall HRM activity. Importantly, when assessing the association of HRMPs with firm performance, we are able control for many factors that previous work has found to be important for firm business performance; these include computer use, the extent of market competition, and family and foreign ownership. By following Bloom and van Reenen (2007) another innovation is to control for survey interview biases (noise errors). From an econometric point of view, our novel contribution is to apply estimators that are to robust to outlying observations, both in cross sectional as well as in a two-step estimation approach. Finally, because we have access to panel data, we are able to control for omitted variable bias by using the fixed effects estimator.

The paper is organized as follows. In section 2, we provide a brief conceptual framework and in section 3 we describe our data. After outlining the empirical strategy in section 4, we report our key findings in section 5 while in the final section we provide our conclusions.

2. Conceptual framework

There are several standard arguments in the personnel economics literature as to why one might expect a positive effect of a single workplace HRM practice on firm performance. For example, increased employee financial participation (FP) can improve goal-alignment and motivation of employees and lead them to exert more discretionary effort. Increased employee involvement (EI) in firm decision making may lead empowered employees to make business decisions that were previously within the realm of managers' duties and also encourage employees to share important information with managers and coworkers, thus leading to better information flows within the firm. Also, management may voluntarily share important firm information with employees leading workers to increase their commitment and loyalty which, in turn, enhances firm performance. Furthermore, managers' top-down sharing of firm information might increase workers' trust for management and reduce management's opportunistic behavior.

Empirical evidence in support of a positive effect of a single HRM practice on firm performance is found in several important studies. For example, what comes to employee financial participation, profit-sharing plans have often been found to be positively related to firm performance. This is the key conclusion of several surveys and studies (see, e.g., Cable and Wilson 1990; Jones and Pliskin 1991; Knez and Simester 2001; Kruse 1992; Robinson and Wilson 2006; Wadhwani and Wall 1990; Weitzman and Kruse 1990). In addition, empirical studies of employee stock ownership plans (ESOPs) also usually support the existence of a positive relationship between ESOPs and firm productivity in a variety of institutional settings (see, e.g., Bryson and Freeman 2010 for the UK; Kato *et al.* 2010 for Korea; Kumbhakar and Dunbar 1993 for the US; Jones and Kato 1995 for Japan; Perotin and Robinson 2003 for various European countries). However, as many surveys point out (e.g. Kruse 2002), the empirical evidence in support of this positive link is probably less robust than for profit sharing.

Another major underlying theme in the conceptual literature is the claim that there are complementarities among HRM practices—i.e. the returns of a workplace HRM practice can be substantially higher when they are combined with other workplace practices rather than introduced alone. For instance, the effects of increased employee discretion, such as teamwork, might be higher when they are introduced in tandem with performance-based pay. The theoretical framework to analyze complementarities has been laid out in several studies (e.g. Aoki 1990; Ben-Ner and Jones 1995; Dessein and Santos 2006; Milgrom and Roberts 1995). In support of this prediction, empirical research has often found a positive association between clusters of workplace HRM practices and firm performance in various institutional contexts (see, e.g., Black and Lynch 2001, Black and Lynch 2004, Huselid 1995 and Ichniowski *et al.* 1997 for the US; Kato and Morishima 2002 for Japan; Conyon and Freeman 2004, Guest *et al.* 2003, Robinson and Wilson 2006 for the UK; Zwick 2004 for Germany; Eriksson 2003 for Denmark; Jones *et al.* 2010c for a Finnish econometric case study). However several studies have been unable to find support for the complementarity theses (e.g. Addison and Belfield 2001; Cappelli and Neumark 2001), suggesting that institutional context, nonrepresentative samples or econometric specifications may influence results (Kaufman 2010). On the other hand, Pendleton and Robinson (2010) suggest (in the case of employee stock ownership) that when there is a minority participation in the ESOP, the plan needs employee involvement in decision-making (or voice) to be effective, but when there is a majority participation, the plan has an independent effect on productivity.

As well as these findings reported in the literature on the effects of HRM practices on firm performance, there is a rich literature on how other factors are related to firm performance. For one thing, empirical work using micro data suggests a positive link between computer use and productivity (e.g. Brynjolfsson and Hitt 1997, 2000). Foreign ownership has also found to enhance firm performance (Aitken and Harrison 1999; Griffith 1999). [3] Furthermore, family ownership (or,

more generally, concentrated ownership) may have advantages over highly dispersed share ownership due to the principal-agent problem (Berle and Means 1932) being less severe. The benefits of family ownership are also linked to issues such as working hard due to a higher social shame of failure, and greater trust and loyalty to other stakeholders, whereas conflicts between business operations and family interests are associated with costs (Bennedsen *et al*. 2007). Overall, family ownership seems to be expected to have a mixed effect of firm performance, whereas family management appears to have a significant negative effect (Perez-Gonzalez 2006, Villalonga and Amit 2006). Finally, product market competition has the most straightforward theoretical link with firm performance through a Darwinian selection process whereby high competition simply drives less efficient firms out of the market. On this point, empirical research has found supportive evidence (e.g. Bloom and van Reenen 2007; Nickell 1996; Olley and Pakes 1996).

3. Data

3.1. HRM survey

A) Background information

Our firm population is Finnish manufacturing companies employing at least 50 persons as listed in Statistics Finland's Business Register in September 2005.[4] The size of the population with 50+ employees in the Business Register is 1,054 companies. Because the register basically includes all Finnish firms that are liable to pay value added tax or have paid employees, we can define the population accurately. We decided to focus on manufacturing firms employing at least 50 persons due to following reasons: (i) HRM practices might not be common in smaller firms; (ii) respondents in smaller firms may be reluctant to participate in surveys (e.g. due to lack of time); (iii) financial statements are not easily available for smaller firms; and (iv) to show comparable findings with many previous studies that also focus on manufacturing firms (e.g. Black and Lynch 2001).

Because our accounting data are at the firm-level, the survey was also addressed to

firms rather than establishments. However, for the Finnish case this is probably not a large source of concern since it is widely believed that there is not much heterogeneity concerning HRM practices within multi-plant Finnish manufacturing firms --establishments do not have a large measure of autonomy concerning the adoption of HRM practices.

A well-known market research firm, operating in the field for over 20 years, conducted the Computer Assisted Telephone Interviews on HRM practices. The interviewers are specially trained (most are university students) and called firms in a random order and asked the firm's switchboard operator to be connected with our target respondent: *"a manager who is in charge of the firm's human resource management issues in Finland."* In the beginning of each survey, they stressed to respondents that full anonymity and confidentiality would be guaranteed. Altogether 832 calls were made between December 2005 and January 2006, and we have data on 398 manufacturing firms (the sample size n=398) that participated fully in the survey. This is 38% of the firms in the population and almost 50% of our target respondents. The duration of each interview fluctuated somewhat, but an average running time was about 30 minutes. The most common reason for non-participation was that respondents were too busy and/or uninterested (86% of the non-respondents).[5] When our sample is compared with the underlying population, the characteristics of sample companies are found to be very similar to the population in terms of size and industry distributions (Mäkinen and Kalmi 2006).

B) Employee involvement in decision-making and financial participation

To provide the reader with a better understanding of HRM practices in sample firms, we briefly describe the incidence of employee participation. To assess the incidence of *employee involvement in firm decision making (EI)*, and drawing on earlier literature (e.g. Chi *et al.* 2007; Freeman and Kleiner 2000), we focus on the following practices: 1) employee board representation, 2) joint consultation committee, 3) quality circles, 4) self-managed teams, 5) job rotation, 6)

suggestion scheme, 7) job satisfaction survey, and 8) total quality management (TQM). For *financial participation (FP)*, we focus on the following practices: 1) performance-based pay[6], 2) personnel funds[7], and 3) stock option schemes. For ease of interpretation, we follow Black *et al*. (2004) and use binary measures for the incidence of a single practice (=1 if a firm has adopted a given practice, 0 otherwise).

Figure 1 shows the incidence of employee involvement between 2002 and 2005 and indicates significant heterogeneity among firms in the popularity of these practices. For instance, in 2005 the most common practices are the use of job satisfaction surveys (82%) and suggestion schemes (76%), whereas TQM (41%), self-managed teams (35%) and board representation (12%) occur much less frequently among sample firms. Figure 1 also shows that the incidence of many of these practices has increased significantly from 2002 to 2005. For example, 46% of firms have joint consultation committee in 2002 but by 2005 the figure has jumped to 55%.

(FIGURE 1 ABOUT HERE)

Figure 2 shows the incidence of financial participation. The most popular form of financial participation is performance-based pay. Furthermore, the incidence of performance-based pay grew from 58% in 2002 to 67% in 2005, and this growth is consistent with findings from other Finnish surveys (e.g. as reported by the Confederation of Finnish Industries in their wage surveys, EK 2006). The incidence of stock option schemes has been relatively stable at 9% over the period, whereas the share of firms with personnel funds has decreased slightly from 6% in 2002 to 5% in 2005.[8]

(FIGURE 2 ABOUT HERE)

3.2. Company data

Company financial statement data are obtained from a firm that specializes in business and credit rationing information and provides firm-level data (including income statements, balance sheets and key financial figures) for from 60-80,000 firms per year. This data base constitutes one of the largest data sets including financial statement information in Finland, and the data have been used in many previous empirical studies. We were able to successfully merge financial statements and HRM surveys for about 90% of sample firms, thus producing a rich panel for the period 2002-2005.

In the empirical analysis that follows our production function variables (i.e. output, capital, labor, and materials) come from the financial statement data. Annual turnover is used to proxy firm output, while labor is the (mean) number of employees, and capital is the sum of tangible and intangible assets. When using panel data, value variables are deflated to constant 2000 Euros. To take into account heterogeneity among firms, we use the following firm characteristics: age of firm; 10 region dummies; two-digit manufacturing industry dummies; a dummy for foreign majority owner; a dummy for family ownership (a member of the Finnish Family Firms Association); computer use; a dummy for a multi-plant firm; and a dummy for intensive product market competition.[9] Table 1 presents summary statistics.

(TABLE 1 ABOUT HERE)

4. Empirical strategy

Our strategy is to estimate augmented Cobb-Douglas production functions, where firm turnover is explained by labor, capital, materials, HRM practices, and a large set of covariates that have been found to be important factors in explaining firm performance in previous studies. We assume a Cobb-Douglas form of production technology, since it has been used in the related literature such as the evaluation of the effects of ESOPs on firm productivity (e.g. Jones and Kato 1995) and when analyzing the impact of stock options on firm performance (e.g. Conyon and

Freeman 2004; Jones et al. 2010b; Mäkinen 2010). Our estimation strategy partially follows Black and Lynch (2001) in the sense that we also use the OLS estimator in cross sectional estimates, and the fixed effects estimator to estimate the average of total factor productivity (*avTFP*) and then explain *avTFP* by various HRM practices using the OLS estimator (i.e. the two-step estimation approach). However, our preferred approach has two important differences from that adopted in the influential Black and Lynch (2001) study. First, we apply robust regression methods in the second step of the two-step approach (besides OLS). Second, we directly use the fixed effects estimator with panel data and HRM practices. More specifically, we consider the augmented Cobb-Douglas production function

$$(1) \qquad \ln(Y/L)_i = c + \alpha \ln(K/L)_i + \beta \ln(M/L)_i + \delta' X_i + \lambda' HRM_i + \varepsilon_i,$$

where the dependent variable ln(*Y/L*) is the natural logarithm of firm turnover per worker (labor productivity), *c* is a constant term, ln(*K/L*) is capital per worker, ln(*M/L*) is intermediate inputs per worker (materials), *X* is a vector of firm characteristics, and *HRM* is a vector of HRM practices. Our key variable of interest is *HRM*. As explained earlier we use eight practices for employee involvement (*joint consultation committee, quality circles, self-managed teams, board representation, job rotation, suggestion scheme, job satisfaction survey, and total quality management*) and three for financial participation (*performance-based pay, personnel fund, and stock option scheme*). These variables measure the presence of a practice in a firm (=1 if a firm has a practice, 0 otherwise).

Despite the fact that we can account for several HRM practices and also include a rich set of firm characteristics, our cross-sectional estimates of Eq. (1) may be biased if capital, labor, and materials are be correlated with unobserved firm characteristics. To deal with this potential problem, and to bring more information to estimating capital, material and labor coefficients, we apply the two-step estimation procedure suggested by Black and Lynch (2001). In the first step we use panel

data and the fixed effects estimator[10] to generate firm specific average residuals (*time average of total factor productivity; avTFP*), and then in the second step we explain *avTFP* on HRM practices and firm characteristics in the cross section:

(2) (first stage; panel data 2002-2005) $\ln(Y/L)_{it} = \mu_i + \alpha \ln(K/L)_{it} + \beta \ln(M/L)_{it} + \varepsilon_{it}$.

(3) (second stage; cross section 2005) $avTFP_i = c + \delta' X_i + \lambda' HRM_i + v_i$.

While the two-step method has undoubted advantages (compared to many alternative approaches), nevertheless the second step estimates might still be biased. For example, severe outlier observations can bias the second stage OLS estimates, since the estimator tends to attach excessive importance to observations with very large residuals, possibly leading to unreliable results.[11] To deal with outlying observations, as a novel to literature we apply three different robust-to-outliers estimators: the Median regression (or the Quantile regression for the 0.5 quantile), the M-estimator, and the MM-estimator. The median regression (the 0.5 quantile) estimator protects against vertical outliers (only in the y dimension) but not against bad leverage points (both in the y and the x dimensions). Similarly, the M-estimator (`rreg` in Stata) is also robust to vertical outliers, but compared to the median regression it is more efficient. The key feature of the M-estimator is that it gives less weight to outlying observations. The MM- estimator (`mmregress` in Stata) of Yohai (1987) that we apply also gives less importance to outlying observations, but it is more robust and efficient compared to the M-estimator.[12]

Finally, one of the key benefits of our data is that we have access to panel data on HRM practices. Therefore, we can directly apply the standard fixed effects estimator to assess the association of HRM practices with firm performance while simultaneously controlling for omitted variable bias.

5. Empirical findings

Table 2 investigates the association between HRM practices and firm performance using a cross section for 2005. In all columns the dependent variable is labor productivity ln(*Y/L*), and the covariates are a constant term, capital, labor, a broad set of HRM practices, 10 region dummies, two-digit manufacturing industry dummies, a rich set of firm characteristics, and survey noise controls (see notes in Table 3). Column (1) reports OLS estimates. Among the broad set of EI practices we find that only joint consultation committee (0.06) and job satisfaction survey (-0.07) are statistically significant, both at the 10% level. On the other hand, FP estimates are insignificant (though all positive). In column (2), where we report findings having applied the median regression approach to mitigate biases related to vertical outliers, the previously significant estimates of joint consultation committees and job satisfaction surveys become statistically insignificant at customary levels and other EI practices remain insignificant. Performance-based pay is positively significant (0.05) at the 10% level. In column (3), we report findings based on the M-estimator that is more robust to vertical outliers compared to results detailed in column (2). In line with our previous results, almost all EI estimates are insignificant, while performance-based pay remains positively significant (0.06) but now at the 5% level. In column (4), we apply the MM-estimator to further increase robustness and efficiency. Most of the employee involvement practices continue to have statistically insignificant relationships with productivity, though job satisfaction surveys (-0.06) and TQM (-0.07) are now found to be significant at a 10% level. Performance-based pay continues to be positive (0.06) and the significance level increases to the1% level. Overall, our HRM findings in columns (1)-(4) suggest that it is performance-based pay that is positively and more consistently associated with firm performance and that only selected EI practices are sometimes found to matter for firm performance.

In addition to HRM practices, from Table 2 we see that other firm characteristics often affect performance. The results are strongest for computer use (a proxy for firm technology), indicating that production technology matters for firm performance. Column (4) suggests that the type of firm ownership also has a role in accounting for differences in firm performance and both foreign majority ownership and family firm variables are found to be positive and significant. However, the extent of product market competition is consistently found to be statistically insignificant. Finally, it seems that over time firms lose some of their ability to compete, since in most columns firm age is negatively associated with performance.

(TABLE 2 ABOUT HERE)

In Table 3, we provide evidence on how firms' overall HRM activity is related to firm performance by using the summated rating indices of employee involvement and financial participation practices. We find that the estimates of financial participation index are always positive, and in columns (3) and (4) where we use our preferred estimators, they are also clearly significant. On the other hand, the estimates of employee involvement index are consistently insignificant. We also examined (not reported here but available upon request) possible complementarities between the indices of employee involvement and financial participation but did not find any evidence of this.

(TABLE 3 ABOUT HERE)

In Table 4, we report the second-step estimation results for the two-step estimation method. The first-step estimations (not reported) are based on the fixed effects estimator. Though the method has some advantages over cross section estimation, since it allows us to take into account omitted variable bias in the first-step, as discussed in Section 4, the two-step estimation strategy may be problematic by itself. In Column (1) we report findings based on the OLS specification, the method that, to the best of our knowledge, has always been used in previous studies of this sort. The results are clear-- we do not find significant association between HRM practices and firm

characteristics and firm performance (the average of total factor productivity). In column (2), where we use the median regression, an estimator that is more robust to vertical outliers than the OLS, we continue to find insignificant associations with firm performance. In column (3) we present the estimates of the M-estimator that is also robust to vertical outliers but more efficient compared to the median regression. Now we find a significant and positive coefficient on performance-based pay, whereas coefficients for almost all of the EI practices are insignificant (TQM is the only exception). Our controls for family firm and computer use are both positive and significant. In the final column of Table 4 we show the estimates of the MM-estimator. The estimator is more robust and efficient compared to the M-estimator. In contrast to previous columns, now we do find evidence of a significant association between HRM practices and firm performance. This supports the view that it may be beneficial to use robust estimators in the second-step of the two-step approach, in addition to the OLS estimator. Of the eight EI practices, only job satisfaction surveys is positively associated with firm performance. The point estimate (standard error) is 0.08 (0.04). On the other hand, board representation, job rotation and TQM are significantly negative. The point estimates (standard errors) are the following: board representation -0.06 (0.03); job rotation -0.04 (0.02); and TQM -0.05 (0.03). The remaining four practices, i.e. joint consultation committee, quality circles, self-managed teams, and suggestion scheme, are each found to be insignificant. Turning to FP, as in most previous estimates, we find that the coefficient on performance-based pay is positive and statistically significant. The coefficient (standard error) is 0.08 (0.03). We also find significant but negative coefficients on personnel funds (-0.06) and stock option schemes (-0.06), both at the10% level.

(TABLE 4 ABOUT HERE)

Since we have an access to panel data on HRM practices and firm characteristics, in Table 5 we directly apply the standard fixed effects estimator. The benefit of using this estimator is that we can assess the association of HRM practices with firm performance, and simultaneously are

able to control for omitted variable bias caused by time-invariant unobserved heterogeneity of firms such as managerial quality and style, corporate culture, and worker quality. Column (1) shows that the most EI practices are insignificant, except job rotation (-0.06) and suggestion schemes (-0.04) which are found to be significant and negatively associated with firm performance, both at the 5% level.[13] Consistent with our previous findings, performance-based pay (0.06) is again found to be positive and statistically significantly related to output. In column (2), we attempt to measure overall HRM activity over time, and use the summated rating indices of EI and FP practices. We find that the summated rating index of FP is significant but that the EI index is insignificant.

(TABLE 5 ABOUT HERE)

6. Conclusions

This paper investigates the relationships between employee involvement in firm decision making and employee financial participation with firm performance. One contribution is that we provide the most reliable evidence on these matters for the interesting case of manufacturing in Finland. As such we extend the range of geographical evidence. But most of our contributions spring from our attempting to respond to some of potential limitations of previous work. We use novel data on Finnish manufacturing firms that has many advantages over data typically used in previous work. Our survey covers an unusually broad range of HRM practices and is for a representative random sample from the population of the firms with 50 or more employees --38% of the firms in the population and almost 50% of the survey respondents. By combining our new HRM survey with firm financial statements we construct a rich panel. This allows us to use a production function approach that is well grounded in economic theory. Our rich data enable us to take into account many control variables that have been found to be important for firm performance in previous work, notably computer use, product market competition, and family and foreign majority ownership. Most unusually, we control for survey measurement errors. Finally, we estimate diverse

specifications including robust regression methods in the second step of a two step approach and also make direct use of fixed effects estimators.

Our HRM survey evidence suggests that the presence of employee involvement and financial participation practices in Finnish manufacturing has increased between 2002 and 2005 , thus indicating a change in a way of a work is organized, managed and rewarded in that sector. This development towards more participatory HRM systems is also consistent with previous studies from other institutional environments (e.g. Kruse *et al.* 2010 for the US; Bryson and Freeman 2010 for the UK). We also find substantial heterogeneity in the presence of HRM practices across firms. In other words, and also consistent with other institutional contexts (e.g. Freeman and Rogers 1999 for the US), there appears to be lots of managerial discretion in selecting particular HR practices, including EI and FP practices.

In investigating the association between HRM practices and firm performance, the most consistent and robust evidence is that firms with performance-based pay schemes have about 5-8% higher productivity compared to firms without these schemes. This is finding is largely consistent with earlier literature for other forms of financial participation, including findings for profit-sharing firms (e.g. Cable and Wilson 1990; Kruse 1992), though our performance-based pay measure is a broader concept than profit-sharing (as it is usually defined). Furthermore, we find that business performance is enhanced only by performance-based pay; we find no evidence that other forms of FP in Finland, namely personnel funds or stock option schemes, enhance firm performance. However, this result is in line with previous Finnish studies that have focused on these particular forms of FP notably Kalmi and Sweins (2010) for personnel funds and Jones *et al.* (2010b) and Mäkinen (2010) for stock option schemes.

When using an index of EI, we do not find evidence of a positive association between EI and firm performance. Also, when we look at individual EI practices, only occasionally do we

find evidence that EI is positively related to firm performance. As such these findings tend to be at odds with much of previous literature, including influential contributions both in the fields of strategic HRM (e.g. Huselid 1995) and labor economics (e.g. Ichniowski et al. 1997; Black and Lynch 2001). In accounting for these differences in findings, we are reminded yet again of the complexities surrounding investigations of the links between HR practices and firm performance. For instance, Kaufman (2010) notes that a positive coefficient on HRM variables means that some firms are undersupplying HRM and therefore are in a disequilbrium position. Our mostly insignificant results suggest that the variation in HRM practices may indicate that different firms benefit from different configurations. Alternatively, one consideration is that the benefits of HRM practices may not be directly transmitted to better firm performance but rather it takes time before expected gains are realized (e.g. Kato and Morishima 2002). This is perhaps of particular relevance in our case, when many practices had only recently been introduced. Also, for firm performance, it is important to know not only whether a particular practice has been adopted but also how it has been implemented within the firm (Black and Lynch 2001). Another possible factor is that the potential economic gains from increased employee involvement may be transferred largely to employees rather than firms (Freeman and Kleiner 2000).

Our remaining findings suggest evidence of a positive association between foreign majority ownership, family firm, computer use and firm performance in cross section. These all are consistent with previous studies (see e.g. Brynjolfsson and Hitt 1997 for computers; Griffith 1999 for foreign ownership; Bennedsen *et al.* 2007 for family ownership).

In closing, we note again the sensitivity of findings to different specifications and that the use of the OLS estimator in the second-step may lead to flawed conclusions, particularly when the underlying company data are noisy, include outlying observations, and when the sample size is

relatively small and for a short time-period. In future work, it might be useful to apply estimators similar to those we use since to some extent they are robust to outlying observations.

Figures

Figure 1. The incidence of employee involvement in firm decision-making.

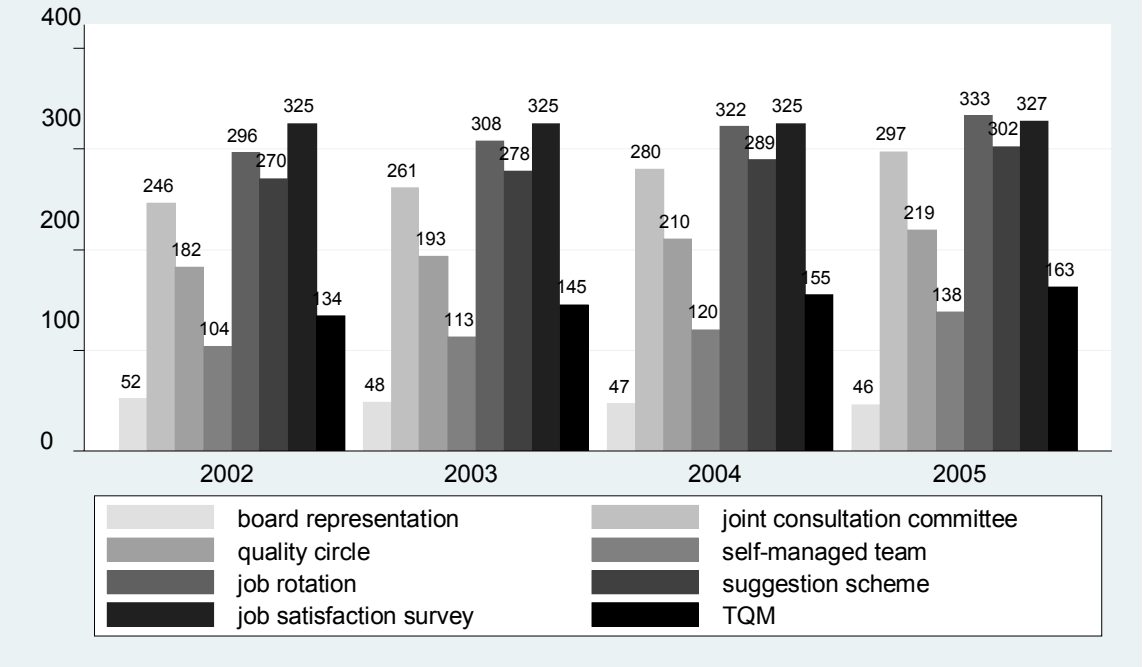
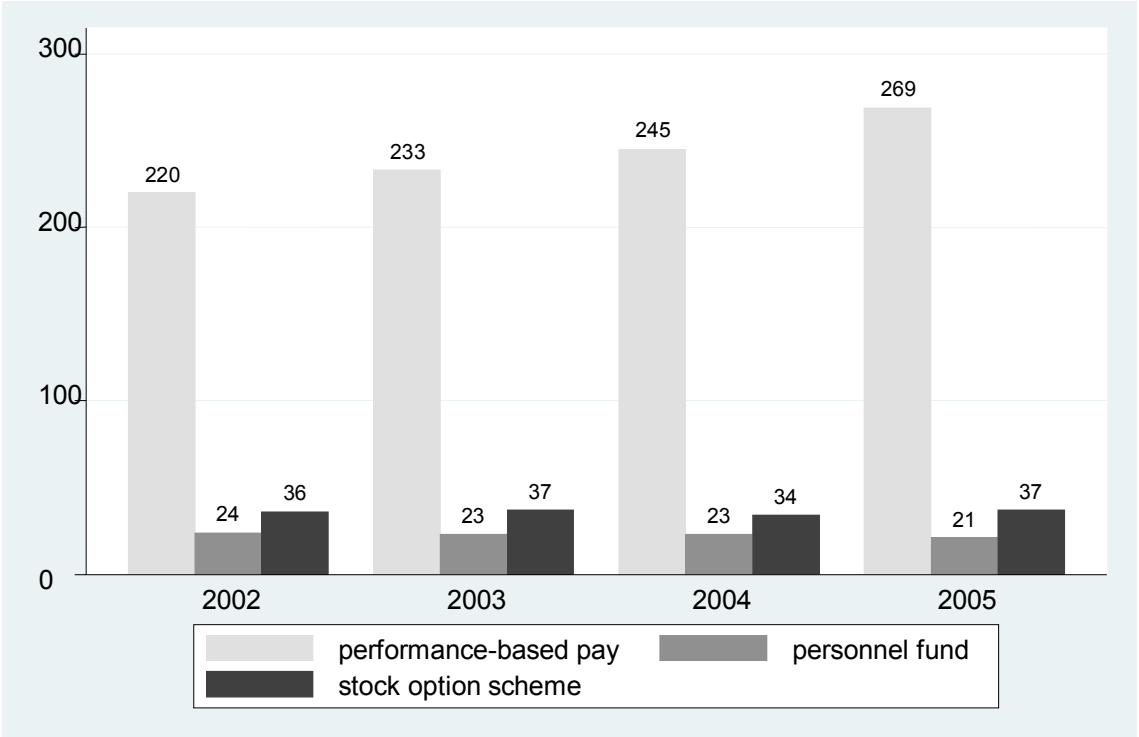


Figure 2. The incidence of employee financial participation.



Tables

Table 1. Summary statistics 2005

Variable	Definition	N	mean	std.dev.
Key production variables				
Sales	firm sales (€1000)	363	79269.4	216534.7
Labor	# employees in the firm	400	328.9	943.4
Capital	sum of the intangible and tangible fixed assets (€1000)	364	27935	124879.7
Materials	materials (€1000)	364	46329.9	131197.5
HRM practices				
	Employee participation in decision making			
Joint consultation committee	=1 if joint consultation committee, 0 otherwise	399	0.74	0.44
Self-managed teams	=1 if self-managed teams, 0 otherwise	400	0.35	0.48
Board representation	=1 if employee representative in the board, 0 otherwise	400	0.12	0.32
Quality circles	=1 if quality circles, 0 otherwise	396	0.55	0.50
Job rotation	=1 if job rotation, 0 otherwise	399	0.84	0.37
Suggestion scheme	=1 if suggestion scheme, 0 otherwise	398	0.76	0.43
Job satisfaction survey	=1 if job satisfaction survey, 0 otherwise	397	0.83	0.38
Total quality management (TQM)	=1 if total quality management, 0 otherwise	395	0.41	0.49
	Employee financial participation			
Performance-based pay	=1 if performance-based pay scheme, 0 otherwise	399	0.67	0.47
Stock option scheme	=1 if stock option scheme, 0 otherwise	397	0.09	0.29
Personnel fund	=1 if personnel fund, 0 otherwise	398	0.05	0.22
Firm characteristics				
Computer use	Share of employees using computers almost daily	397	0.58	0.30
Foreign majority owner	=1 if a firm's major owner is foreign, 0 otherwise	400	0.21	0.40
Family firm	=1 if a firm is a member of the Finnish Family Firms Association, 0 otherwise	400	0.12	0.33
Multi-plant	=1 if a firm has more than one plant, 0 otherwise	400	0.54	0.50
Very hard competition	=1 if product market competition very high (if scored 5 on the scale 1-5), 0 otherwise	400	0.40	0.49
Firm age	Age of the firm	400	16.39	12.36

Table 2. Labor productivity: cross section 2005 estimates with single HRM practices.

	(1) OLS	(2) Median regression	(3) M-estimator	(4) MM-estimator
Ln(K/L)	0.050 ***	0.026	0.030 ***	0.029 *
	(0.017)	(0.018)	(0.010)	(0.015)
Ln(M/L)	0.597 ***	0.637 ***	0.631 ***	0.638 ***
	(0.044)	(0.028)	(0.014)	(0.018)
Joint consultation committee	0.055 *	0.045	0.041 *	-0.019
	(0.029)	(0.033)	(0.024)	(0.017)
Quality circle	-0.010	0.000	0.019	0.028
	(0.028)	(0.028)	(0.021)	(0.024)
Self-managed team	0.011	0.002	-0.005	0.017
	(0.027)	(0.030)	(0.021)	(0.023)
Board representation	0.052	0.057	0.053	0.005
	(0.046)	(0.053)	(0.032)	(0.019)
Job rotation	-0.017	-0.012	-0.019	0.009
	(0.045)	(0.041	(0.027)	(0.025)
Suggestion scheme	-0.028	-0.006	-0.002	0.011
	(0.032)	(0.034)	(0.024)	(0.022)
Job satisfaction survey	-0.066 *	-0.041	-0.032	-0.055*
	(0.038)	(0.041)	(0.029)	(0.030)
TQM	-0.002	-0.019	-0.017	-0.068 **
	(0.025)	(0.033)	(0.022)	(0.027)
Personnel fund	0.051	-0.047	-0.010	-0.012
	(0.077)	(0.092)	(0.046)	(0.034)
Performance-based pay	0.034	0.051 *	0.059 **	0.056 ***
	(0.028)	(0.031)	(0.023)	(0.015)
Stock option scheme	0.055	0.024	0.009	0.023
	(0.055)	(0.062)	(0.036)	(0.070)
Multiplant	0.055*	0.033	0.022	-0.029
	(0.029)	(0.030)	(0.022)	(0.022)
Foreign majority ownership	0.057	0.028	0.029	0.068 **
	(0.040)	(0.040)	(0.027)	(0.032)
Family firm	0.019	-0.012	0.033	0.046 **
	(0.034)	(0.042)	(0.031)	(0.018)
Computer use	0.103 **	0.087	0.100 ***	0.073 *
	(0.046)	(0.054)	(0.037)	(0.042)
Ln(firm age)	-0.032	-0.034 *	-0.028 **	-0.059 ***
	(0.021)	(0.020)	(0.013)	(0.010)
Very hard product market competition	-0.021	0.004	0.006	-0.016
	(0.024)	(0.030)	(0.020)	(0.026)
N	344	344	344	344
R^2	0.86	-	0.936	-

Notes: In Table 3 the dependent variable is labor productivity ln(*Y/L*) in all models. Standard errors in parentheses: in columns (1)-(2) bootstrapped standard errors with 500 replications, in column (3) using the pseudovalues approach (default in Stata), and in column (4) robust standard errors. ***/**/* reports significance at 1/5/10% level. All models include a constant term, 10 region dummies, two-digit manufacturing industry dummies, and survey noise controls (a respondent's position is a firm, gender, the day of the week the interview was conducted, the duration of the interview, and three interview dummies (interview fixed effects)).

Table 3. Labor productivity: cross section 2005 estimates with the summated rating indices of EI8 and FP3.

	(1) OLS	(2) Median regression	(3) M-estimator	(4) MM-estimator
Ln(K/L)	0.048 ***	0.025	0.030 **	0.028*
	(0.017)	(0.016)	(0.010)	(0.014)
Ln(M/L)	0.599 ***	0.632 ***	0.630 ***	0.642 ***
	(0.044)	(0.029)	(0.014)	(0.024)
Employee participation in decision-making index (EI8)	-0.003	-0.001	0.002	-0.004
	(0.009)	(0.009)	(0.007)	(0.011)
Financial participation index (FP3)	0.037	0.038	0.045 **	0.048 **
	(0.025)	(0.027)	(0.018)	(0.023)
Multiplant	0.051*	0.022	0.028	-0.003
	(0.028)	(0.027)	(0.021)	(0.036)
Foreign majority ownership	0.060	0.019	0.029	0.037
	(0.038)	(0.040)	(0.027)	(0.016)
Family firm	0.023	-0.005	0.032	0.016
	(0.033)	(0.038)	(0.031)	(0.047)
Computer use	0.091 **	0.072	0.095 **	0.062
	(0.045)	(0.054)	(0.037)	(0.095)
Ln(firm age)	-0.023	-0.025	-0.023 *	-0.046
	(0.020)	(0.019)	(0.013)	(0.029)
Very hard product market competition	-0.023	-0.013	0.006	-0.008
	(0.024)	(0.027)	(0.020)	(0.029)
N	344	344	344	344
R^2	0.86	-	0.93	-

Notes: In Table 4 the dependent variable is labor productivity ln(*Y/L*) in all models. Standard errors in parentheses: in columns (1)-(2) bootstrapped standard errors with 500 replications, in column (3) using the pseudovalues approach (default in Stata), and in column (4) robust standard errors. ***/**/* reports significance at 1/5/10% level. All models include a constant term, 10 region dummies, two-digit manufacturing industry dummies, and survey noise controls (a respondent's position is a firm, gender, the day of the week the interview was conducted, the duration of the interview, and three interview dummies (interview fixed effects)).

Table 4. Labor productivity: Two-step estimates.

	(1) OLS	(2) Median regression	(3) M-estimator	(4) MM-estimator
Joint consultation committee	-0.000	0.008	-0.016	-0.022
	(0.028)	(0.033)	(0.024)	(0.018)
Quality circle	-0.004	0.006	0.004	0.002
	(0.026)	(0.029)	(0.020)	(0.017)
Self-managed team	0.008	-0.004	0.009	-0.014
	(0.026)	(0.029)	(0.021)	(0.026)
Board representation	-0.001	-0.052	-0.038	-0.061 **
	(0.048)	(0.048)	(0.032)	(0.025)
Job rotation	-0.042	-0.019	-0.028	-0.041 *
	(0.045)	(0.039)	(0.026)	(0.021)
Suggestion scheme	-0.039	0.014	0.008	0.013
	(0.033)	(0.033)	(0.023)	(0.035)
Job satisfaction survey	-0.078	-0.006	0.001	0.075 **
	(0.048)	(0.043)	(0.028)	(0.035)
TQM	-0.000	-0.030	-0.039 *	-0.048 *
	(0.028)	(0.030)	(0.021)	(0.029)
Personnel fund	0.049	0.015	-0.040	-0.059 *
	(0.059)	(0.061)	(0.045)	(0.033)
Performance-based pay	0.029	0.055	0.052 **	0.082 **
	(0.031)	(0.036)	(0.023)	(0.033)
Stock option scheme	0.031	-0.048	0.035	-0.056 *
	(0.059)	(0.080)	(0.035)	(0.033)
Foreign majority ownership	0.019	0.017	-0.006	-0.011
	(0.036)	(0.039)	(0.026)	(0.038)
Family firm	0.012	0.015	0.051 *	0.029
	(0.037)	(0.044)	(0.031)	(0.030)
Computer use	0.009	0.033	0.067 *	0.045
	(0.054)	(0.047)	(0.036)	(0.034)
Ln(firm age)	-0.014	-0.006	-0.006	-0.008
	(0.018)	(0.020)	(0.013)	(0.017)
Very hard product market competition	-0.027	0.013	0.006	0.019
	(0.024)	(0.028)	(0.020)	(0.027)
N	334	334	334	334
R^2	0.11	-	0.14	-

Notes: In Table 5 the dependent variable is average total factor productivity *avTFP*=the time-average of residual for each firm obtained by the fixed effects model using the balanced panel data over the period of 2002-2005 in the first step (not reported). The first-step model includes also a constant term, year dummies, and two-digit manufacturing industry dummies interacted with the year dummies. Standard errors in parentheses: in columns (1)-(2) bootstrapped standard errors with 500 replications, in column (3) using the pseudovalues approach (default in Stata), and in column (4) robust standard errors. ***/**/* reports significance at 1/5/10% level. All models include a constant term, 10 region dummies, two-digit manufacturing industry dummies, and survey noise controls (a respondent's position is a firm, gender, the day of the week the interview was conducted, the duration of the interview, and three interview dummies (interview fixed effects)).

Table 5. Labor productivity: The fixed effects panel data estimates.

	(1) Fixed effects estimator	(2) Fixed effects estimator
Ln(K/L)	0.072 ** (0.037)	0.068 * (0.037)
Ln(M/L)	0.713 *** (0.068)	0.718 *** (0.064)
Employee participation in decision-making index (EI7)	-	-0.005 (0.010)
Financial participation index (FP3)	-	0.035 * (0.020)
Joint consultation committee	0.002 (0.023)	-
Quality circle	0.002 (0.028)	-
Self-managed team	0.000 (0.028)	-
Board representation	-0.026 (0.038)	-
Job rotation	-0.063 ** (0.031)	-
Suggestion scheme	-0.044 ** (0.021)	-
TQM	0.106 (0.134)	-
Personnel fund	0.023 (0.072)	-
Performance-based pay	0.056 ** (0.024)	-
Stock option scheme	-0.018 (0.033)	-
N	1182 (341 firms)	1255 (366 firms)
R^2 (within)	0.76	0.75

Notes: In Table 6 the dependent variable is ln(*Y/L*). Bootstrapped standard errors with 500 replications in parentheses. The model also includes a constant term, and two-digit manufacturing industry dummies interacted with the year dummies. All firms have at least two observations. EI7 is the summated rating index of seven employee participation practices and, respectively, FP3 is the summated rating index of employee financial participation practices used in column (1). The variables measure overall firm HRM activity over time (separately for employee participation in decision making and financial participation).

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Endnotes

[1] An important issue is how accurate are survey respondents' answers on HRM practices. For one thing, as Bloom and van Reenen (2007) remark, a range of background characteristics that are potentially correlated with bad and good HRM practices may generate systematic bias in the survey data. Second, a respondent's answer might be biased towards those answers the respondent believes are correct or more generally expected (e.g. Bertrand and Mullainathan 2001). In order to mitigate these concerns, we follow Bloom and van Reenen (2007) to control for possible interview biases (survey noise controls): on the interviewer (three interviewer dummies to remove possible interviewer fixed effects), on the respondent (gender and position within a firm), and on the interview process itself (the day of a week the interview was conducted and the duration of the interview).

[2] Because of our budget constraint, our target number of participating firms was 400. Two interviews were interrupted during the survey because respondents noticed that they did not belong to the manufacturing firm population.

[3] However, in recent studies a large part of differences in average productivity is attributable to differences between multinationals and non-multinationals rather than to "the origin of ownership of a country" (Criscuolo and Martin 2009).

[4] Specifically we use TOL 2002 categories 15-37 based on the SIC/NACE 2002 classification.

[5] After ending each survey we asked the interviewers to immediately assess how reliable they viewed the responses. Based on their subjective assessments, about 99% of the responses can be categorized as reliable.

[6] Our measure of performance-based pay is a broader concept than profit sharing as it is usually understood. In the HRM survey, a performance-based pay scheme question was defined as follows: "*... by performance-based pay schemes we mean a financial reward system, where a part of person's wage is tied to performance, either on the level of company, subsidiary, plant or other group. I will later ask on possible personnel funds and share or stock option schemes, since they are not defied here as performance-based pay schemes.*" The question that followed right away after this definition was simply: "*Do you have performance-based pay schemes, other than personnel fund, share or stock option scheme, in your firm at the moment?* [yes/no/cannot say]". We do not make a distinction between managerial and workers performance-based pay schemes, since over 70% of schemes in the sample cover all employees.

[7] Personnel funds are a form of deferred profit-sharing, where profit-shares are further invested either to the stock of the sponsoring firm or divested in the financial market. If a company sponsors a personnel fund, all employees belong to it during their entire employment contract. Further analysis on personnel funds can be found in Sweins et al. (2009).

[8] A more detailed analysis of the determinants of the financial participation in Finland can be found in Jones *et al.* (2010a).

[9] Note that since our computer use variable measures the share of employees using computers almost daily in their work, this variable captures the outcomes of past and present ICT investments in a firm, and is thus a more comprehensive measure than an ICT investment that captures only current ICT investment activities.

[10] Because the system GMM estimator á la Blundell and Bond (2000) performed unsatisfactorily with our data, we decided to apply only the fixed-effects estimator in the first step. Therefore, we cannot address the potential simultaneity concerns in the paper, especially related to the endogeneity of capital and labor.

[11] Based on Rousseeuw and Leroy (2003), we can recognize three types of outliers that affect the OLS estimator: vertical outliers, good leverage points, and bad leverage points. *Vertical outliers* are defined as those observations that have outlying values in the y dimension (error term) but not in the x dimension (explanatory variables). The existence of vertical outliers especially affects the estimated intercept. *Good leverage points* are those observations that have outlying values in the x dimension but are located near to the regression line. The presence of *bad leverage points* deflates standard errors affecting statistical inference. Bad leverage points are outlying observations in the both the y and the x dimensions, and affect notably both the intercept and the slope. Based on our graphical outlier detection analysis (not reported), we find that our data include all three classes of outlying observations. The second issue that might generate bias is the fact that the dependent variable in the second step (*avTFP)* can be subject to measurement errors. One reasons for this is that measurement errors may arise when noisy firm panel data are used in the first step to calculate *avTFPs*, since *avTFPs* are the time-average of residuals and these averages are sensitive to large outliers (especially if the time-period is short). Another channel that may generate measurement errors in *avTFP*s is directly related to the fixed effects estimator in the two-step approach; the fixed effects estimates are inconsistent. And, as it is well-known, the measurement error in the dependent variable contributes to standard errors in the explanatory variables (the estimated standard errors are less precise) in a straightforward regression analysis under classical assumptions.

[12] Initial values of the MM-estimator are obtained from the MS-estimator suggested by Maronna and Yohai (2000). See Verardi and Croux (2009) for a more detailed description of robust regression methods in Stata.

[13] Cappelli and Neumark (2001) and Black and Lynch (2004) also report similar negative associations between HRMPs and performance in their fixed effect estimates.