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The Adoption of Job Rotation: Testing the Theories

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Abstract

The aim of this paper is to test three theories for why firms introduce job rotation schemes: employee learning, employer learning, and employee motivation. The earlier literature has made use of either information about establishment characteristics or data coming from personnel records of a single firm. In order to improve upon this, we make use of a unique data set constructed by merging information from a fairly detailed survey directed at Danish private sector firms with a linked employer-employee panel data. This allows us to include firm and workforce characteristics as well as firms HRM practices as explanatory variables, and hence to carry out a more comprehensive analysis.

Keywords: Job rotation, employee learning, employer learning, employee motivation

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Why do some firms introduce job rotation while others choose not to? A growing amount of research is using representative surveys of establishments to answer this question (Osterman 1994, 2000; Gittleman, Horrigan and Joyce 1998; OECD 1999). Because their unit of analysis is the establishment, these papers usually provide little evidence about the effect of *employee* characteristics on the probability of adoption. They focus on establishment characteristics instead. Analyses of job rotation based on individual data are more unusual because they often require access to personnel records, which firms are rarely willing to grant. Moreover, such papers are typically able to study merely one firm at a time (Campion, Cheraskin and Stevens 1994; Kusunoki and Numagami 1998), which raises the issue of whether the results that they find are representative. We think that a satisfactory test of the theories should combine a representative sample of establishments with data on employee characteristics. To build such a database, we have merged a representative survey of Danish firms with register data on each of these firms' employees. The resulting database is richer than most surveys of establishments and provides more representative evidence than individual case studies.

We concentrate on three theories of job rotation. The first theory claims that employees who rotate accumulate more human capital because they are exposed to a wider range of experiences. The more an employee moves, the more he learns. We refer to this as the employee learning theory. The second theory is that the firm itself learns more about its own employees if it can observe how they perform at different jobs. To find the job that an employee is best at, the employer needs to move the employee around and observe how he performs at each position. We call this the employer learning theory. The last theory is that job rotation motivates employees who would otherwise become bored and tired of always performing the same tasks. The theories deliver different predictions regarding the types of employees who are more likely to rotate and the types of firms where rotation is more likely.

The remainder of the paper is organized as follows. In section I we describe the three theories in more detail and discuss briefly existing evidence regarding the determinants of the adoption job rotation. The second section starts with a description of the data sources used and a discussion of how the variables used in testing are operationalized. The second half of section II gives the results of the econometric analysis and our interpretation of them. Some concluding remarks are offered in section III.

I. Theories and Empirical Implications

As Champion, Cheraskin and Stevens (1994) point out, the management literature often refers to job rotation as a useful practice, but very few authors have conducted a detailed analysis of its costs and benefits. Nonetheless, three types of arguments are recurrent in job rotation discussions: for some people, rotation is a training device; for others, it is mostly a way to discover which jobs different employees are best at; and for a third group of people, job rotation's main benefit is motivation.

I. A. Employee Learning

The employee learning argument is that job rotation is an effective way to develop employees' abilities. According to Champion, Cheraskin and Stevens (1994), job rotation produces two beneficial effects. First, an employee who rotates accumulates experience more quickly than an employee who does not rotate. Hence job rotation is mentioned as an effective tool for career development. Second, an employee who rotates accumulates experience in more areas than an employee who does not rotate. Hence, if an employee rotates more frequently, it is easier to train him to become a generalist. For example, according to Ouchi (1981), the extensive use of rotation by Japanese companies would explain why Japanese employees are more often generalists than specialists, in particular when compared to U.S. employees. Lazear's (2002) "jack of all trades" theory for entrepreneurship and managerial jobs builds on the same notion.

According to the employee learning argument, we should expect job rotation to be more likely when employees have more need to be trained. First, employees with less tenure in the firm should rotate more frequently than employees with more tenure. Second, for a given level of tenure in the firm, employees who had previous work experience in the same industry are probably better trained, and should therefore rotate less frequently. Last, plants where the levels of on-the-job training are high must be plants where employees have a high need to be trained. Hence, these plants should have higher probabilities of adoption.

I. B. Employer Learning

The employer learning argument is that job rotation provides information that the firm can use to improve the allocation of jobs among employees. If an employee can be observed performing different activities, it may be easier for the firm to find out the most appropriate job

for that employee (Ortega 2001). With a job rotation policy, each time an employee rotates, the employer learns about new dimensions of the employee's ability. On the contrary, if an employee does not rotate, the dimensions of the employee's ability that the firm learns about are always the same, and the returns to learning soon become small.

Ortega (2001) shows that the relative benefits of job rotation increase when the firm knows little about its employees' abilities. The relative benefits are also larger when the firm is engaging in new activities for which the returns are a priori unknown. This has sharp empirical consequences. First, employees with less tenure in the firm are more likely to rotate, because the firm will be more interested in learning about them. This implies that job rotation should be adopted with a higher probability in firms where average employee tenure is lower. Second, any previous work experience that current employees may have accumulated in other, similar firms should have *no* effect on the probability of rotation: only the average tenure in the *current* firm should matter. This is different from what the employee learning theory predicts. Last, if the firm is relatively young or is introducing innovations, we should expect it to use more job rotation.

I. C. Employee Motivation

The employee motivation argument is that job rotation contributes to make work more interesting. This argument was mentioned in the late 1970s literature on the so-called "plateaued" employees -employees with limited prospects of promotion. According to Ference, Stoner and Warren (1977), job rotation is a potential solution to these employees' lack of motivation. More recently, Cosgel and Miceli (1999) have pointed out increased satisfaction as one of the benefits of rotation. In their model, employees prefer to perform a variety of tasks rather than specializing in a single task and, as a consequence, job rotation increases job satisfaction. This is beneficial to the firm because it can afford to pay lower salaries when employees are more satisfied. However, job rotation does not contribute to training: contrary to the employee learning argument, employees learn more by specializing than by rotating.

If job rotation is a motivation tool, we would expect it to be used by firms where employees have poorer prospects of promotion. This stands in sharp contrast with the employee learning story: if employees rotate and become better trained, but there are no prospects of promotion, such employees will leave the firm and will try to find a better job elsewhere. This means that the firm will have little incentive to use job rotation in the first place. On the contrary,

when promotion opportunities abound, job rotation becomes a more valuable human resource policy.

I. D. Existing Evidence

In the last decade, several authors have provided evidence on the adoption of job rotation practices: see *Table 1* for a review of the surveys, their methodology and findings. Considerably fewer studies have been able to test the theories. In fact, as can be seen from the summary in *Table 2*, previous papers analysing the decision to introduce job rotation do not speak to the question why rotation is useful. Earlier work has rather focused on the degree of product market competition, firm strategy (quality versus cost reduction), cultural values in the firm, complementary human resources management (HRM) practices, and the use of advanced technology. Although interesting in their own right, these studies do not inform us about the types of benefits job rotation provides. This is due to the fact that it is difficult to test the theories in this respect without data on employee characteristics. Two exceptions are the case studies of Campion, Cheraskin and Stevens (1994) and Kusunoki and Numagami (1998).

Campion, Cheraskin and Stevens (1994) study job rotation inside the finance department of a large U.S. pharmaceutical company. First, they find that tenure has a negative effect on the rate of job rotation: junior employees rotate more frequently than senior employees. Second, the educational level has no significant effect on the rate of job rotation. Third, individual performance has a significant positive effect on the rate of rotation. Fourth, the rate of rotation has a moderate positive effect on the rate of promotion. Last, the authors use a questionnaire to complete the data that they have collected from personnel records. In that questionnaire employees are asked their opinion about the benefits of job rotation. According to the employees, job rotation provides increased knowledge.

Kusunoki and Numagami (1998) study the patterns of interfunctional mobility of engineers in a large Japanese company. First, they find that employees with fewer years of tenure do not rotate more than more senior employees. In fact, rotation frequencies seem to vary very little during the first fourteen years of an employee's career, contrary to Campion, Cheraskin and Stevens (1994). Second, the educational level has no significant effect on rotation. Third, there is a positive relationship between the employee's speed of promotion and the rate of rotation. Last, they find that the directions and patterns of rotation are complex and vary significantly according to promotion speeds.

An unresolved issue is whether these findings are representative of other firms in the economy. The two studies differ as far as the effect of tenure on job rotation is concerned. It may be that the pharmaceutical company studied by Campion, Cheraskin and Stevens (1994) is special in the way it structures its job rotation programs, or it may be that the Japanese firm is. The only way to shed some light on this issue is to use multi-firm data. Also, both studies consider relatively large companies. Can their results be generalized to smaller companies? This again calls for the use of a more representative database. At the same time, however, the tests of the theories require data on individual employee characteristics, which are usually unavailable in multi-firm surveys. Our database is designed to address these issues.

II. Testing the Theories

II. A. Data Description

The data used in this paper have been constructed by merging information from two different sources. The first is a survey directed to firms and the second is an employer-employee linked panel. The survey (see Eriksson 2000 for details) represents a unique source of information on Danish firms' internal labor markets and changes therein. In addition to some background information about the firm, the firms were asked about their work organization, compensation systems, recruitment, internal training practices and how they evaluate their employees, as well as about recent changes in these. This paper makes use of the firms' answers to questions regarding their use of job rotation schemes.¹ The survey was administered by Statistics Denmark as a mail questionnaire that was sent out in May and June 1999 to 3,150 private sector firms with more than 20 employees. The firms were chosen from a random sample, stratified according to size (as measured by the number of full time employees) and industry. The survey over-sampled large and medium-sized firms: all firms with 50 employees or more were included, and 35 per cent of firms in the 20-49 employee range.

The response rate was 51 per cent, which is relatively high for a long and detailed questionnaire, and provides 1,605 useful observations. The response rates for the size and industry cells vary only little: between 47 and 53 per cent. Concerning organization of work within the company, the firm was asked whether it had adopted the following work practices:

self-managed teams, job rotation, quality circles, total quality management, benchmarking, and project organization. In answering this question, the firm was furthermore asked to distinguish between adoption of the work practices for hourly paid workers and for salaried employees (including managers).

The other data source, the employer-employee linked panel, has been constructed by Statistics Denmark by merging a number of registers utilizing the unique identification numbers of individuals and plants (firms). The panel contains detailed information about all employees and their wage earnings in all Danish firms during the period 1980-98 as well as economic information about the firms since 1992. This data source enables us to create measures describing the composition and other characteristics of firms' workforces.

According to the survey, one out of five firms has implemented job rotation schemes for hourly paid workers. Considerably fewer firms – about 6 per cent – have adopted them for their salaried employees.² As can be seen from *Table 3*, about 20 per cent of the firms had already job rotation schemes (for either hourly paid or salaried workers, or both) before 1990 (most of which had introduced them in the eighties), 40 per cent implemented them during the first half of the nineties and equally many during the second half. The pace of adoption does not differ much between domestic and foreign owned firms.

The share of firms that adopted job rotation schemes varies across industries and by firm size; see *Table 4*. Firms in the services and manufacturing sectors are much more likely than firms in other industries to have implemented them for their hourly paid employees. Firms in the business and finance sector are more likely to have introduced them for the salaried employees. For both categories of workers, the share of adopters clearly increases with firm size.

Table 5 gives some summary statistics for the firms that responded to the survey questionnaire as well as some information concerning their workforces. By construction, the sample firms are, on average, larger than Danish companies in general. Likewise, as the firms are from the private sector, the proportion of female employees is considerably lower than of total employment. Moreover, the workforce turnover rate of firms (which will be explained more below) is relatively high; during a year on average 30 and 24.5 per cent of hourly paid and salaried employees, respectively leave their firms. Seventy per cent of the firms have a local wage agreement for their hourly paid workers, implying a relatively strong presence of unions.

¹ In addition, several of the explanatory variables in our empirical analysis are constructed from the firms' answers to the survey questionnaire.

As for other new work practices, we may note that about one fourth of the firms have self-managed teams, whereas TQM and quality circles are clearly less common.

From the table it can be seen that firms that have adopted job rotation for their workers on hourly pay differ in various ways from those that have not. The adopting firms are slightly younger, considerably larger and faster-growing, and are more likely to be in the manufacturing sector³ and to have a local wage agreement with the trade unions. These firms are also more prone to recruit new personnel from within the company and/or the local labor market. Furthermore, the adopters are much more likely to have implemented new work practices. Adopters have more frequently introduced performance related pay systems than non-adopters. As for the workforce characteristics, the main difference regards the share of female employees in the firms' workforces.

In the main the firms that rotate their salaried employees share many of the characteristics with those that rotate workers on hourly compensation. The only notable differences concern relative training costs, which are higher for adopting firms, and recruitment from sources outside the internal or local labor markets, which is more common among adopters. Finally, we may note that firms with a pronouncedly flat hierarchy are less likely to have job rotation schemes.

II. B. The Empirical Model

We have carried out a set of logit model estimations for whether the firms have adopted job rotation or not. We use two separate dependent variables, one for job rotation adoption for hourly paid workers, and another for the salaried employees. As explanatory variables we use three groups of regressors: (i) firm characteristics, (ii) workforce characteristics, and (iii) other HRM practices and some controls. We next describe them briefly.

Firm Characteristics. Beginning with the firm characteristics, one is *firm size* as measured by the number of employees in the company. Size may matter for two reasons. One is that there are technical constraints to the implementation of job rotation: in order to operate a

² Compared to other new work practices, job rotation is quite common for the hourly paid workers; only teams are more frequently implemented. In contrast, for the salaried workers job rotation is among the least used.

³ Gittleman et al. (1998) also find more of the new work practices in the manufacturing sector and in larger firms. U.S. wholesale and trade firms have adopted new work practices to a considerably higher extent than those in Denmark.

stable job rotation scheme (one that can guarantee periodical job changes to successive employee cohorts), it is necessary that there are a certain minimum number of jobs. This implies that the job rotation probability increases in firm size. The other reason why size may affect the adoption of job rotation, and moreover in the opposite direction, is that multi-tasking and flexibility is less valuable in larger establishments or firms; see Lazear (1998; 445-46, 473-74).

Another firm characteristic we consider is the hierarchical structure of the firm. Our measure for this pertains only to the salaried employees and is the *number of job levels* in the firm within this category.⁴ According to the motivation hypothesis, the fewer the number of levels in the hierarchy, and hence the less promotion opportunities there are, the higher is the likelihood of the firm implementing a job rotation scheme. The less levels in the hierarchy, the more plateaued workers are there. In contrast, the employee and employer learning hypotheses both suggest that a positive hierarchy-job rotation relationship could arise as a result of employers using job rotation as a prerequisite for promotions into higher rung jobs with multiple tasks (Ouchi 1981).

The *age of the firm*, and particularly the extent to which this coincides with the introduction of job rotation, is a potentially important variable. Younger firms that have had job rotation as part of their HRM schemes as from the beginning are likely to have a relatively new technology, and consequently, use job rotation as a means of learning about their employees. Hence, finding a higher probability of job rotation in younger firms is compatible with the employer learning story. In addition to size and age of the firm, we have also included the (5-year average) *growth rate of the* (employment of the) *firm*. This is expected to be positively related to job rotation as expanding firms are in a similar situation as young firms when it comes to learning about new employees in new jobs.

Other features of the companies entered as explanatory variables are the presence of *unions* in the firm, the *relative wage* of the firm and the firm's expenditure on *on-the-job training* of its employees. The presence of unions is proxied by a positive answer to the question whether the firm has signed a local wage agreement with its workers, as this is typically the case when there are particularly active and strong unions in the workplace. Unions occasionally resist more flexible work practices because they are said to increase the pace and stressfulness of work without accompanying higher compensation. On the other hand, unions and collective bargaining

⁴ This information is derived from the survey in which the firms were asked about the number of job levels for non-production workers.

have also been found to facilitate changes involving increased employee involvement. Thus, the impact of the presence of unions is unclear a priori.

We include two alternative measures of the firm's relative wage; the first is relative to local competitors, and the second is relative to industry average.⁵ Of course, as the analysis is cross-sectional, we cannot claim unidirectional causality.⁶ (That is the topic of a fuller and separate analysis.)

The questionnaire asked the firms how much money they spend on training their employees. From the responses to this question we have constructed a variable showing the firm's per capita training costs relative to the average for all firms. In the survey the firms were also asked about the number of hours spent on on-the-job training during ordinary working time. From this a corresponding relative training costs measure (in terms of hours) can be constructed. The advantage of the latter is that it is specifically about training on-the-job, whereas the advantage of the former is that it is in money terms. They are strongly correlated and both yield similar estimation results. Hence in what is presented below, we use the relative per capita training costs variable. A positive relation between training costs and job rotation would indicate that rotation is used as a part of employee training programs, which is in accordance with the employee learning hypothesis.

Other firm characteristics included as controls are the already mentioned average rate of employment growth during 1990-95, and industry dummies. The latter are likely to pick up the influence of competitiveness of market conditions, technology and a variety of other factors.

Workforce Characteristics. Turning next to the workforce characteristics, it should first be noticed that the information emanates from the linked panel data set. Both employer and employee learning explanations would lead us to expect a negative relation between the average *tenure* of the firm's workforce and the probability of having job rotation schemes. Short average tenure may reflect the age of the firm. However, as we control for that, a low average tenure is more likely to be a consequence of a high workforce turnover. The distribution of tenure in firm is typically rather skewed, and so the mean is not necessarily a good measure to characterize it.

⁵ Both are dummies created from questions in the survey asking firms on this. An alternative source to this information is the employer-employee linked data set. From other work on the data, we know that the answers to these questions in the survey are quite accurate.

⁶ A study by Eriksson (2003), which uses the same data source as in this paper, finds that some new work practices, including job rotation schemes, are associated with higher firm average wages also after controlling for differences in skill structures of firms' workforces.

Thus, we have also tried out two alternative workforce turnover measures as explanatory variables: (i) $\frac{1}{2}(\text{hires in year } t + \text{hires in year } t-1)/\text{number of employees in year } t$, and (ii) $\frac{1}{2}(\text{hires in year } t + \text{separations in year } t)/\text{number of employees in year } t$. The measure we use in estimations is an average taken over the annual observations for the period 1985-95. However, neither of these measures yielded any different results than the average tenure, and are therefore reported below.

A third measure used is the share of employees that have been employed less than two years. The motivation for including this variable is that learning does not occur at a constant rate but is mainly concentrated to the first years of an employment relationship after which it declines considerably. All three measures mentioned above refer to tenure in the firm. An additional measure employed is the average *tenure in industry*. This is potentially a key variable, since it allows us to discriminate between the employer and employee learning theories. In the latter, both previous and current tenure matter, whereas in the former previous experience should not affect the firm's use of job rotation.

The *gender* composition of the firm's workforce is included as the proportion of female employees in respective workforce category. In order to control for differences in skill composition we use the proportion of employees in the relevant category with more than compulsory education, i.e., 10 years of schooling.

Beside average characteristics of the firms' workforces, we have computed their standard deviations as measures of the *heterogeneity* of each firm's employees. The idea is that a firm, the workforce of which differs substantially with respect to age, tenure and education, is more likely to benefit more from obtaining information about its employees by rotating them than a firm with a more homogeneous workforce; cf. Lazear (1999), pp. 473-74. Consequently, the employer as well as the employee learning hypotheses imply that the likelihood of job rotation increases with worker heterogeneity.

Other HRM Practices. The HRM practices that are included in our analysis refer to *the firm's recruitment strategy* and to *other new work practices* implemented by the firm. In order to distinguish between the alternative explanations for why firms use job rotation, information about the source of new employees in the firm may be useful. In the survey, the firms were asked about wherefrom they recruited different groups of personnel. Four different sources of

recruitment are of interest here: (i) from within the firm, (ii) the local labour market, (iii) the same industry, and (iv) whole Denmark.

Information about how the firm recruits new personnel can help in distinguishing between competing explanations. In general, one would expect that job rotation is more common in firms that hire their workers from outside. The longer the “distance” between the firm and the recruitment source, the lower is the precision of the knowledge the firm has about its new employees. When the employees are predominantly hired from within, employers need to learn less about them. Consequently, the employer learning hypothesis predicts that job rotation is more common in firms recruiting outside the firm or the local labour market.

Of the other work practices used by the firms, we have entered self-managed teams, TQM and quality circles as additional control variables into the logit models. The motivation for including them is to examine whether these new work practices are complementary as has been argued by e.g. Milgrom and Roberts (1995). As total quality management and quality circles aim at controlling quality at different stages of the production process, it seems natural that employees in firms using these practices need experience of different tasks and in communication with other employees have some familiarity with other jobs and tasks. In addition we have included dummy variables for whether the firm implements the following performance related pay systems: team bonuses, individual bonuses and stock/stock options. The purpose is to examine whether the performance pay schemes provide incentives for employees to engage in job rotations. A summary of the predictions of the different theories regarding the key explanatory variables is given in *Table 6*.

II. C. Econometric Analysis

Separate regressions were estimated for hourly paid and salaried workers, with and without distinguishing by firm size (firms with fewer or more than 100 employees). Estimation results are found in *Table 7*. The distinction between hourly paid and salaried employees is needed because jobs differ substantially from one category of employees to another. The distinction between small and large firms is also important. In companies where there are few employees and few positions, the extent to which employees can rotate may be quite limited, and it may simply be unfeasible for such companies to implement stable job rotation policies. In addition to that, smaller companies know their employees much better, which makes the employer learning motive for rotation irrelevant. In any case, the estimation approach does not constrain the results to be different for each of the four groups: it just allows for that possibility.

In the two first columns of the table, we report the estimates for all firms where we have included firm size as an explanatory variable. We can see that the probability of having job rotation schemes increases with the number of employees in the firm. The next four columns distinguish between small and larger firms. We find, with a few exceptions, a similar pattern as for all firms, but the estimates are more precisely determined for the larger firms.

The number of job levels has a significant effect on the rotation of salaried employees of large firms.⁷ Firms with 3-5 levels are significantly more likely to use job rotation for their salaried employees than firms with fewer levels.⁸ Moreover, the effect goes in the direction predicted by the employee and employer learning theories: when the number of job levels increases, the adoption of job rotation schemes is more likely. This is because both theories view job rotation as a pre-requisite to be promoted to higher level jobs. The greater the possibilities of promotion, the greater the value of job rotation. On the contrary, the result is contrary to the employee motivation theory, according to which, if there are greater promotion opportunities, there should be less need for job rotation.

The age of the firm variable attaches a positive coefficient, but as this does not differ from zero, it yields little support for the employer learning hypothesis.⁹ However, this lack of significance could be due to the fact that we can only distinguish between three periods for firm age (1990s, 1980s and prior to 1980). As an alternative, we can look at the firms' rates of employment growth: according to the employer learning hypothesis, we would expect high growth firms to be in a similar situation as young firms, insofar as they also need to learn about their new employees. Thus, if employees rotate for an employer learning motive, high growth firms should be more likely to implement job rotation schemes. Indeed, the data show that the 5-year average firm growth has a significant effect on job rotation, which is consistent with the employer learning theory.

Other aspects of the firms that are associated with a higher likelihood of job rotation are the presence of unions (for hourly paid workers) and higher than average per capita training costs. The finding that firms spending more on training their employees are more likely to have job rotation schemes is favourable to the employee learning hypothesis.

⁷ As noted before, the number of job levels refers only to the category of salaried employees. Hence the regressions for the hourly paid employees do not include this variable.

⁸ The coefficient corresponding to 6+ levels is not significant, but very few firms have so many levels, which makes it very difficult to obtain precise estimates.

⁹ Note, however, that only 13.6 per cent of the firms have introduced rotation schemes as from the year the firm was established, and 15 per cent during the first ten years of the firm's existence.

Average tenure in the firm obtains significant and negatively signed coefficient estimates for the hourly paid in large firms, which is consistent with both the employer and employee learning hypotheses: firms where average tenure is smaller have a greater need to train their employees (the employee learning argument) or to learn more about them (the employer learning argument).¹⁰ Whereas tenure in the firm has a significant effect on rotation, tenure in the industry has no significant effect. This is consistent with the employer learning theory, and contradicts the employee learning theory.

The employer learning hypothesis receives some support from the results concerning the sources of new personnel recruitment. The hypothesis predicts that firms that chiefly recruit at the national level have a greater need to learn about their new employees than firms that recruit from their own ranks or from the local labour market. Hence, firms with broader recruitment strategies are more likely to use job rotation. Indeed, the regressions show that, for the larger firms, recruiting salaried employees at the national scale has a positive effect on the use of job rotation. The effect of recruiting internally or locally, however, is not significant: this contradicts the employer learning theory (which predicts a negative sign) and maybe the employee learning theory (which would predict a positive sign if internal recruitment implies better promotion opportunities for current employees).

As for other workforce characteristics, we find that the proportion of females in the firm's workforce is positively and strongly correlated with the probability that the firm rotates its workers. We are not able to offer any obvious explanations for this. A potential explanation (consistent with employee and employer learning) is that firms with a large percentage of females have greater rates of turnover. However, we have checked whether the proportion of females is particularly high in some industries or correlated with high workforce turnover, and it turned out not to be. Another possibility is that females and males have different jobs and that the gender dummy is just capturing this "sorting" effect. The estimates to the share of workers with more than compulsory education also have relatively large marginal effects, although the coefficients, which differ in sign between the hourly paid and the salaried employees, carry rather large standard errors. Heterogeneity (with respect to experience, as measured by age) is contrary to the employer and employee learning hypotheses negatively related to job rotation.

¹⁰ However, the share of employees with less than 2 years of tenure with the firm did never obtain a coefficient differing significantly from zero and is therefore omitted from the logit models in table 7.

This is puzzling as one would expect that rotating employees possessing different pieces of knowledge would be useful.

The estimations do indeed provide evidence of the notion of complementarity between different work practices: teams, quality circles and TQM are all positively related to the adoption of job rotation schemes. The fact that rotation is more likely in firms where teams are being used, indicates that the firms are not using the information it learns to re-allocate tasks since their employees work in teams anyway. This would speak against the employer learning hypothesis. However, the firm might use rotation to learn the best way to assign tasks within teams.

The complementarity between job rotation and the other work practices seems to be so strong that it is possible that the inclusion of the latter is capturing the effects of other variables “explaining” the adoption of job rotation. We have therefore also estimated the logit model without the dummies for TQM, quality circles and teams. The results, which are not reported, turned out to be quite close to obtained before; only the explanatory power of the estimated logit model is significantly reduced. The adoption of job rotation does not seem to be associated with firms having implemented performance related pay schemes.

Table 8 reports some of our efforts to check the robustness of the estimation results. To save space we report only the results for all firms. The estimates for small and larger firms, respectively (are available from the authors upon request and) differ only marginally from those in *Table 7* above. The first two columns give estimates based on smaller samples obtained by excluding those firms that have implemented rotation schemes prior to 1990. The motivation for imposing this restriction on the data is that most of the explanatory variables refer to the second half of the nineties. With the exception for one explanatory variable the exclusion of about one fifth of the firms leads to fair small changes in the coefficient estimates and their standard errors. The same applies to the two other restrictions that were enforced in the estimations shown in columns (3) to (6). Here we have excluded the most heterogenous firms in order to have the empirical analysis to conform more to the representative firm assumption. This was implemented by first computing for each firm the standard deviation of education years and age of their workforces, and next excluding the 15 per cent of firms in both tails of the standard deviations distributions. As can be seen from the table, the estimates from these more homogenous firm samples resemble those obtained from the full sample closely and their precision is affected only little.

The only change worth noting is that according to Table 8 the salaried employees are paid more in firms that have adopted job rotation schemes. However, causality can go both ways as firms that are performing well and hence can afford to pay higher salaries, may also have more resources for experimenting with alternative ways of organizing work.¹¹

III. Conclusions

We have used data created by linking a questionnaire concerning firms' HRM and pay practices to a longitudinal matched employer-employee data set to examine the determinants of the adoption of job rotation schemes in Danish firms. Hourly paid workers and salaried employees in small and larger firms, respectively, are studied separately. Our aim is not only to shed further light on who adopts job rotation schemes, but in particular to study why the firms are implementing them. We distinguish between three different explanations, which we label employee learning, employer learning and employee motivation, respectively.

We find strong complementarity between job rotation and other human resource management practices. Rotating employees is not, however, complementing performance pay systems adopted by the employers. Moreover, we find that the likelihood of job rotation increases with firm size, stronger presence of unions, the proportion of females in the firm's workforce and the homogeneity with respect to experience of the workforce. The two first findings are largely expected. A certain size of the workplace is likely to be needed to operate rotation schemes. It is also possible that in smaller firms, employees carry out multiple tasks and there is therefore less need for a formalized rotation scheme. Other studies have also found the presence of unions to facilitate introduction of flexibility-enhancing HRM schemes. The two latter observations regarding the gender composition and the heterogeneity of the firms' workforces are, however, rather puzzling. The gender variable might be capturing a sorting effect (males and females have different types of jobs).

As for the three theories for why firms choose to rotate the workers, we find first of all very limited support for the employee motivation hypothesis. Job rotation schemes are not more

¹¹ The evidence from the small but growing literature on the benefits of new work practices is something of a mixed bag. Black and Lynch (1999) find positive wage effects, whereas Cappelli and Neumark (2001) find only small wage effects, and Osterman (2000) no effects at all. For a recent, comprehensive review, see Ichniowski and Shaw (2003).

likely in firms with long-tenured employees, nor in firms with a relatively flat hierarchy and hence little promotion prospects.

The statistical evidence is more favourable to the employee and the employer learning hypotheses. Regarding the employee learning argument we find that firms that spend relatively much on training their employees are more likely to rotate workers. Moreover, job rotation schemes are more common in less hierarchical firms and in firms with shorter average firm tenure in their workforces. These two observations also lend support to the employer learning story. Two findings speak against employee learning. One is the negative relationship between job rotation and worker heterogeneity. Employee learning predicts the opposite because rotation –and the information transfer associated with it-- is more useful when employees have differing pieces of knowledge. Another is that average industry tenure turns out insignificant (as predicted by the employer learning hypothesis), whereas according to employee learning theory it should be negative.

Other results supporting the employer learning explanation are the positive association between job rotation schemes and firm growth rates and firms using national recruitment sources. On the other hand, firms recruiting from within or from the local labour market are not (as predicted by the employer learning hypothesis) less likely to implement job rotation schemes.

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Table 1
Rates of Adoption of Job Rotation Estimated by Other Authors

SURVEY	Year	Country	SAMPLE	RESP RATE	N	%Rot	DEFINITION
Osterman (1994) National Establishmt Survey	1992	USA	Private sector establishments with +50 employees	65%	875 (694)	26.6	Rate of adoption at 50% rate of penetration.
Educational Quality of Workforce (EQW) Survey (1995)	1994	USA	Private sector establishments with +20 employees	72%	3,347	18.0	Ave. rate of penetration. Ave. rate of penetration for core employees and plants with +50 employees: 21%.
Gittleman, Horrigan and Joyce (1998) [BLS Survey of Employer Provided Training]	1993	USA	Private sector establishments of all sizes	71.3 %	7,895 (5,987)	12.6	Rate of adoption. Rate of adoption for plants with +50 employees: 24.2%
Jenkins and Florida (1999)		USA	US-located Japanese manufacturing transplants	40%		63.2	Rate of adoption at 50% rate of penetration.
Pil and MacDuffie (1996)	1989 and 1993	World (17 countries)	Automobile assembly plants	77% and 79%	43 (39)	3.0 and 3.2	Average rate of penetration on a 1-5 scale.
Osterman (2000) National Establishmt Survey	1997	USA	Establishments with +50 employees	57.7 %	683	55.5	Rate of adoption at 50% rate of penetration.
Nordflex (1999) DISKO	1996	Denmark	Establishments with +10 employees		1,900	38.8 14.7 7.0	Rates of adoption at different rates of penetration: 0%, 25%, and 50%.
Eriksson (2000)	1999	Denmark	Private sector firms with +20 employees	51 %	1,605	20.0 6.0	Rate of adoption for hourly paid and salaried employees.

Rate of adoption = Percentage of establishments using job rotation
Rate of penetration = Percentage of employees involved in job rotation

Table 2

Previous Evidence on the Determinants of Job Rotation

PAPER	DEPENDENT VARIABLE	DETERMINANTS OF ADOPTION	CONCLUSIONS
Osterman (ILRR 1994)	Bundle of new work practices	<ul style="list-style-type: none"> - Product market competition - International competition - Competitive strategy (cost, quality, variety, service) - High skill technology - Worker oriented values. - Time horizon (pressures from investors) - Establishment is part of a larger organization - Establishment size - Union - Pay for performance - Training 	<ul style="list-style-type: none"> No Yes - "High road" strategy (quality, variety, service) Yes Yes No Yes No No Yes Yes
Campion, Cheraskin, and Stevens (AMJ 1994)	Rate of job rotation	<ul style="list-style-type: none"> Career background antecedents: - Tenure - Age - Education - Performance 	<ul style="list-style-type: none"> Yes Yes Yes Yes
Pil and MacDuffie (IR 1996)	Bundle of new work practices	<ul style="list-style-type: none"> - Index of complementary HR practices (criteria for selection and hiring, pay for performance, training, status differentiation of employees). - Flexible automation (number of robots) - Log productivity - Log plant quality - Average tenure (negative effect is predicted: more senior, more reluctant to change) - "Broken trust" (layoffs) - Disruptions: major product or process innovations. 	<ul style="list-style-type: none"> Yes No No No No: positive effect of average managerial tenure No Yes
Gittleman, Horrigan and Joyce (ILRR 1998)	Dummy for the use of job rotation	<ul style="list-style-type: none"> - Establishment size (fixed costs) - Unions - New technology - Supporting HR practices: training, compensation policies, nonmonetary benefits 	<ul style="list-style-type: none"> No No Yes - Wellness programs - Flexible work schedules - Profit sharing - Pay for knowledge - Retention policies (training) - Specific training - Technology-driven training
Kusunoki and Numagami (IEEE T. Eng. Man. 1998)	Frequency of interfunctional transfers	<ul style="list-style-type: none"> - Tenure - Speed of promotion in previous years - Educational level 	<ul style="list-style-type: none"> No (rotations at all times) Yes No

Table 3

Time of Adoption of Job Rotation by Type of Ownership

Group of firms	Before 1991	1991-95	After 1995	Total
<i>Type of ownership:</i>				
Domestic	23.5	39.3	37.2	100.0
Foreign	19.3	42.1	38.6	100.0
All	22.3	40.1	37.6	100.0

Table 4

Percentage of Firms Using Job Rotation by Industry and Size

Group of firms	Hourly paid	Salaried
<i>By industry:</i>		
Manufacturing	28.1	4.4
Construction	4.5	2.2
Wholesale and retail trade	5.7	8.6
Transportation and communication	7.1	6.0
Business and finance	3.1	13.1
Services	50.0	0.0
<i>By firm size (No. of employees):</i>		
-50	10.2	3.1
51-100	21.1	4.2
101-350	23.1	6.6
351-500	33.3	15.4
501-	37.0	18.5
All	19.5	5.7

Table 5

Summary Statistics

Variable	Hourly paid Adopters	Hourly paid Non-adopters	Salaried Adopters	Salaried Non-adopters
<i>Established (%):</i>				
Before 1980	75.1	77.0	75.0	76.6
In 1980s	19.6	20.0	19.0	20.0
In 1990s	5.3	3.0	6.0	3.4
Size (number of employees)	184.8	70.9	238	77.2
Annual employment growth (%)	0.33	0.24	0.24	0.24
<i>Number of job levels (%):</i>				
3-5			46.8	39.2
6 or more			35.7	35.4
Training costs relative to industry	-1.50	-1.56	-0.58	-1.45
Local wage agreement (%)	87.4	70.2	8.2	7.5
Average turnover rate	35.8	32.8	24.0	24.0
Av. tenure in firm (years)	5.2	4.8	5.3	5.3
Av. tenure in industry (years)	5.5	5.4	5.7	5.7
Prop. with more than comp. educ.	78.6	81.4	84.8	81.2
Prop. female employees	29.6	19.1	30.2	22.3
<i>Recruits from (%):</i>				
Within	88.6	65.4	63.1	37.4
Local labor market	18.4	11.8	14.3	14.1
All of Denmark	11.4	14.9	69.0	54.4
Same industry	16.7	17.9	31.0	18.6
<i>Work organization (%):</i>				
Teams	37.6	18.6	57.1	24.8
TQM	11.0	2.8	28.6	7.4
Quality circles	10.6	2.3	14.3	3.3
<i>Pay systems (%):</i>				
Team bonus	29.0	16.2	13.1	6.3
Individual bonus	9.8	7.5	46.4	29.1
Stock/stock options	2.9	1.3	16.7	7.1
<i>Industry (share in %):</i>				
Manufacturing	78.4	41.8	29.8	45.7
Construction	3.3	13.7	4.8	10.7
Wholesale and trade	13.1	33.4	47.6	30.7
Transportation and communication	2.4	5.5	4.7	5.4
Business and finance	1.2	5.4	13.1	6.9
Services	1.6	0.2	0.0	0.6

Table 6

Determinants of Adoption Predicted by the Three Alternative Theories

Variable	Predicted Effects		
	Employee Learning	Employer Learning	Employee Motivation
<i>Firm characteristics:</i>			
Number of job levels	+	+	-
Firm age	0	-	0
The firm's growth rate	0	+	0
Training costs relative to industry	+	0	0
<i>Workforce characteristics:</i>			
Average tenure in the firm	-	-	+
Average tenure in the industry	-	0	0
Heterogeneity of the workforce	+	+	0
<i>Other HRM practices:</i>			
National recruitment	0	+	0
Internal or local recruitment	0	-	0

Table 7

Logit Results for the Adoption of Job Rotation

Explanatory variables	Hourly paid; all firms	Salaried; all firms	Hourly paid; small firms	Hourly paid; larger firms	Salaried; small firms	Salaried; larger firms
Number of employees in the firm:						
51-100	0.0004* (0.0002) (0.00003)	0.0002* (0.0001) (0.00002)				
101-350	0.0008** (0.0004) (0.00006)	0.0005** (0.0002) (0.00003)				
350 or more	0.0011*** (0.0003) (0.00008)	0.0006** (0.0003) (0.00003)				
Established in the 90s	0.165 (0.299) (0.021)	0.298 (0.664) (0.010)	0.139 (0.301) (0.019)	0.178 (0.374) (0.020)	0.307 (0.295) (0.039)	0.343 (0.578) (0.034)
Established in the 80s	-0.028 (0.211) (-0.005)	-0.013 (0.313) (-0.001)	0.047 (0.219) (0.008)	-0.057 (0.101) (-0.010)	-0.011 (0.298) (-0.001)	-0.027 (0.434) (-0.002)
3-5 job levels		0.574** (0.229) (0.026)			0.139 (0.277) (0.008)	0.845*** (0.183) (0.033)
6+ levels		0.104 (0.331) (0.007)			-0.019 (0.347) (-0.001)	0.154 (0.279) (0.010)
Local wage agreement	0.537*** (0.194) (0.070)	0.121 (0.533) (0.006)	0.299 (0.212) (0.035)	0.548*** (0.163) (0.070)	0.087 (0.445) (0.015)	0.103 (0.393) (0.006)
Wage above local competitors	-0.104 (0.270) (-0.013)	-0.124 (0.533) (-0.007)	-0.114 (0.315) (-0.012)	-0.154 (0.294) (-0.016)	-0.125 (0.444) (-0.015)	-0.098 (0.273) (-0.011)
Wage above industry mean	0.099 (0.238) (0.014)	0.427 (0.454) (0.014)	0.087 (0.214) (0.014)	0.079 (0.188) (0.013)	0.379 (0.401) (0.026)	0.275 (0.574) (0.024)
Training costs relative to industry	0.179*** (0.057) (0.022)	0.180** (0.087) (0.009)	0.164* (0.081) (0.056)	0.245*** (0.079) (0.026)	0.111* (0.060) (0.018)	0.212*** (0.065) (0.029)
The firm's growth rate (5-year average) in employment	0.411*** (0.143) (0.013)	0.424*** (0.138) (0.014)	0.306** (0.151) (0.010)	0.584*** (0.148) (0.016)	0.311** (0.147) (0.011)	0.696*** (0.127) (0.017)
Average tenure in the firm	-0.024 (0.037) (-0.005)	0.026 (0.087) (0.001)	-0.019 (0.038) (-0.003)	-0.036** (0.018) (-0.009)	0.028 (0.094) (0.004)	0.014 (0.057) (0.005)
Average tenure in the industry	0.011 (0.049) (0.001)	0.020 (0.059) (0.0009)	0.009 (0.050) (0.001)	0.012 (0.052) (0.001)	0.031 (0.067) (0.010)	-0.037 (0.041) (-0.001)
Proportion of females	1.599*** (0.382) (0.224)	1.386*** (0.543) (0.055)	0.887*** (0.332) (0.156)	1.614** (0.832) (0.217)	1.478*** (0.363) (0.207)	1.596*** (0.544) (0.229)
Proportion with education > 10 years	-1.393 (1.456) (-0.177)	2.012* (1.114) (0.101)	-0.978 (1.584) (-0.144)	-1.485 (1.937) (-0.166)	-1.856* (1.014) (-0.165)	2.437** (1.215) (0.132)
Teams	0.543*** (0.212) (0.133)	0.811*** (0.241) (0.032)	0.343* (0.179) (0.098)	0.609*** (0.214) (0.140)	0.797*** (0.216) (0.149)	0.847*** (0.304) (0.147)
TQM	0.988*** (0.337) (0.179)	0.927*** (0.315) (0.057)	0.314 (0.4249) (0.060)	1.245*** (0.299) (0.199)	1.434 (0.945) (0.231)	1.613*** (0.679) (0.231)

Quality circles	1.253*** (0.360) (0.212)	0.954** (0.448) (0.050)	0.303* (0.159) (0.055)	0.979*** (0.283) (0.204)	0.714 (0.434) (0.169)	0.993** (0.393) (0.183)
Team bonus schemes	0.290 (0.222) (0.040)	0.300 (0.414) (0.012)	0.097 (0.453) (0.012)	0.194 (0.245) (0.036)	0.144 (0.241) (0.020)	0.127 (0.259) (0.021)
Individual bonus schemes	0.061 (0.307) (0.009)	0.098 (0.354) (0.004)	0.057 (0.214) (0.008)	0.039 (0.299) (0.004)	0.113 (0.274) (0.017)	0.051 (0.265) (0.003)
Stock and stock option plans	0.066 (0.547) (0.009)	0.198 (0.653) (0.010)	0.014 (0.797) (0.002)	0.088 (0.393) (0.011)	0.041 (0.173) (0.007)	0.015 (0.191) (0.002)
Recruitment: From within	0.214 (0.143) (0.050)	0.384 (0.244) (0.015)	0.089 (0.367) (0.023)	-0.067 (0.089) (-0.012)	0.396 (0.445) (0.059)	0.094 (0.115) (0.017)
Local labor market	0.311 (0.227) (0.039)	-0.575 (0.499) (0.019)	0.167 (0.305) (0.017)	0.143 (0.279) (0.015)	-0.274 (0.389) (-0.034)	-0.433 (0.344) (-0.015)
All of Denmark	-0.114 (0.207) (-0.019)	0.018 (0.302) (0.001)	-0.024 (0.654) (-0.004)	0.207 (0.156) (0.023)	0.015 (0.095) (0.001)	0.064* (0.033) (0.015)
Same industry	-0.098 (0.164) (-0.011)	0.008 (0.214) (0.001)	-0.147 (0.212) (-0.018)	-0.037 (0.198) (-0.003)	0.043 (0.105) (0.005)	-0.009 (0.064) (-0.001)
Std dev of experience of employees	-0.357*** (0.096) (-0.026)	-0.396** (0.123) (-0.030)	-0.137 (0.145) (-0.012)	-0.456** (0.229) (-0.030)	-0.243 (0.156) (-0.020)	-0.357* (0.189) (-0.021)
Industry dummies	yes	yes	Yes	yes	yes	Yes
Pseudo R-squared	0.212	0.174	0.132	0.244	0.142	0.196
Log likelihood	-375.43	-221.37	-656.79	-593.17	-254.33	-497.10
Observations	1,076	1,261	347	729	427	834

The numbers in parenthesis are the standard errors and the numbers in curly brackets are the marginal effects (evaluated at the mean for continuous variables, and for a discrete change for the discrete variables). The 10, 5 and 1 per cent significance levels are denoted by *, ** and ***, respectively.

Table 8
Some Robustness Checks

	Hourly paid; firms adopting since 1990	Salaried employees; firms adopting since 1990	Hourly paid; homogenous firms wrt education of employees	Salaried; Homogenous firms wrt education of employees	Hourly paid; homogenous firms wrt experience of employees	Salaried; Homogenous firms wrt experience of employees
Number of employees in the firm:						
51-100	0.0003 (0.0002) (0.0002)	0.0001 (0.0002) (0.0001)	0.0004* (0.0002) (0.0003)	0.0002 (0.0002) (0.0001)	0.0003** (0.0001) (0.0002)	0.0001 (0.0003) (0.0001)
101-350	0.0006** (0.0003) (0.0004)	0.0005** (0.0002) (0.0003)	0.0007** (0.0003) (0.0005)	0.0004* (0.0002) (0.0002)	0.0006** (0.0003) (0.0004)	0.0005** (0.0002) (0.0003)
350 or more	0.0013*** (0.0004) (0.0001)	0.0008** (0.0004) (0.0004)	0.0012*** (0.0003) (0.0005)	0.0008** (0.0004) (0.0005)	0.0011*** (0.0004) (0.0007)	0.0009*** (0.0004) (0.0005)
Established in the 90s	0.103 (0.254) (0.020)	0.112 (0.475) (0.050)	0.113 (0.302) (0.019)	0.209 (0.199) (0.065)	0.089 (0.317) (0.014)	0.111 (0.439) (0.046)
Established in the 80s	0.030 (0.199) (0.003)	-0.034 (0.284) (-0.002)	0.009 (0.166) (0.002)	0.027 (0.213) (0.003)	0.008 (0.212) (0.001)	-0.018 (0.214) (0.001)
Hierarchy: 3-5 job levels		0.479*** (0.163) (0.025)		0.401** (0.196) (0.023)		0.463*** (0.208) (0.024)
6+ levels		0.151 (0.243) (0.008)		0.330 (0.289) (0.014)		0.274 (0.276) (0.011)
Local wage agreement	0.574* (0.333) (0.067)	0.118 (0.645) (0.003)	0.556 (0.389) (0.061)	0.087 (0.557) (0.001)	0.604** (0.295) (0.069)	0.088 (0.603) (0.001)
Wage above local competitors	-0.050 (0.373) (-0.009)	-0.036 (0.290) (-0.002)	-0.029 (0.214) (-0.007)	-0.020 (0.357) (0.002)	0.012 (0.198) (0.001)	-0.031 (0.242) (0.002)
Wage above industry mean	0.077 (0.188) (0.013)	0.879** (0.346) (0.030)	0.081 (0.231) (0.009)	1.043** (0.492) (0.039)	0.053 (0.207) (0.010)	0.836 (0.501) (0.027)
Training costs rel. to industry	0.189*** (0.071) (0.024)	0.160* (0.082) (0.010)	0.219*** (0.088) (0.026)	0.112 (0.089) (0.008)	0.207** (0.104) (0.026)	0.158* (0.080) (0.010)
Firm growth (5-year average)	0.423*** (0.145) (0.050)	0.323** (0.157) (0.011)	0.389** (0.179) (0.046)	0.274* (0.138) (0.009)	0.307* (0.159) (0.044)	0.327*** (0.104) (0.012)
Average tenure in the firm	-0.045 (0.049) (-0.006)	0.033 (0.101) (0.001)	-0.027* (0.014) (-0.004)	0.029 (0.112) (0.001)	-0.028 (0.016) (-0.004)	0.041 (0.145) (0.001)
Average tenure in the industry	0.009 (0.061) (0.001)	-0.019 (0.096) (-0.001)	0.022 (0.077) (0.002)	-0.033 (0.184) (-0.002)	0.014 (0.057) (0.001)	-0.020 (0.084) (-0.001)
Proportion of females	1.624*** (0.488) (0.193)	2.468*** (1.117) (0.064)	2.094*** (0.597) (0.300)	1.988** (0.917) (0.053)	1.574*** (0.503) (0.243)	2.227*** (0.979) (0.059)
Prop. with education > 10 years	-0.887 (2.110) (-0.126)	1.004*** (0.323) (0.029)	-2.190 (1.501) (-0.024)	2.003* (1.009) (0.035)	-1.054 (2.337) (-0.143)	1.116*** (0.311) (0.031)

Teams	0.433* (0.224) (0.088)	0.652* (0.354) (0.017)	0.336* (0.191) (0.070)	0.964*** (0.310) (0.033)	0.474** (0.225) (0.090)	0.743** (0.365) (0.020)
TQM	1.157*** (0.400) (0.124)	0.903* (0.504) (0.023)	1.438*** (0.447) (0.160)	0.823** (0.376) (0.023)	0.997*** (0.289) (0.105)	0.796 (0.424) (0.017)
Quality circles	1.447*** (0.512) (0.175)	0.785 (0.469) (0.039)	0.996** (0.414) (0.126)	0.560 (0.381) (0.052)	1.328*** (0.513) (0.159)	0.519 (0.607) (0.033)
Team bonus schemes	0.197 (0.201) (0.031)	0.199 (0.477) (0.009)	0.133 (0.376) (0.024)	0.122 (0.378) (0.006)	0.124 (0.198) (0.027)	0.128 (0.369) (0.024)
Individual bonus schemes	0.029 (0.576) (0.003)	-0.011 (0.343) (-0.001)	-0.007 (0.398) (-0.0005)	0.020 (0.244) (0.001)	-0.005 (0.289) (-0.001)	0.015 (0.187) (0.001)
Stock and stock option plans	-0.029 (0.778) (-0.004)	0.097 (0.898) (0.003)	0.014 (0.667) (0.001)	-0.017 (0.555) (-0.001)	0.004 (0.456) (0.001)	0.076 (0.658) (0.001)
Recruitment: From within	0.649** (0.297) (0.086)	0.331 (0.285) (0.012)	0.601* (0.298) (0.077)	0.227 (0.301) (0.008)	0.568*** (0.217) (0.081)	0.231 (0.356) (0.011)
The local labour market	0.267 (0.325) (0.030)	-0.689 (0.477) (-0.024)	0.188 (0.234) (0.022)	-0.988 (0.656) (-0.032)	0.208 (0.436) (0.029)	-0.683 (0.742) (-0.029)
All of Denmark	-0.056 (0.183) (-0.016)	0.055 (0.189) (0.003)	-0.479 (0.386) (-0.029)	0.064 (0.212) (0.004)	-0.039 (0.165) (-0.018)	0.088 (0.279) (0.004)
Std dev of age of employees	-0.175 (0.166) (-0.021)	-0.557*** (0.130) (-0.016)	-0.314*** (0.108) (-0.040)	-0.421* (0.224) (-0.011)	-0.298** (0.149) (-0.026)	-0.483** (0.237) (-0.014)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.211	0.182	0.194	0.186	0.179	0.190
N of observations	728	1,026	509	718	509	718

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