The Effects of Human Resource Management on workers' wages and firms' productivity

The Effects of Human Resource Management on Workers' Wages and Firm Productivity

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Abstract

We analyze whether the effects of human resource practices on workers' wages and firm productivity are similar or different. We find that firms' wage policies overestimate the relevance of sector-specific skills and underestimate the productivity enhancing effect of computer skills. Moreover, only the firm benefits from performance related pay, whereas only the workers benefit from performance evaluation interviews. Finally, our estimation results show that in small firms a more advanced HRM system may not result in a convergence of interests between workers and the firm.

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1 Introduction

In this study we examine to what extent human resource practices affect workers' wages and firm level productivity. This investigation allows us to examine the extent to which the firm as well as its workforce benefit from particular human resource management (HRM) practices. Or to put it in different terms: Whether the wage policy of the firm stimulates a convergence of the interests of the workforce with firm interests.

We will present an "insider-econometric analysis" (Ichniowski & Shaw, 2003) of the effects of HRM practices in Dutch pharmacies at the individual firm level, controlling for both workforce and firm characteristics. Our analysis focuses on the "core" workers in the pharmacies: the pharmacist's assistants.[1] The advantage of this "jobs-based approach" (Lazear, 1995) is that we are able to analyze a category of workers that is homogeneous with respect to their occupation as well as their educational background.[2]

We will analyze the effects of specific HRM practices as well as the effects of more consistent HRM systems, ranging from traditional workplace relations to a "High Involvement Management" (HIM) system. We distinguish between various HRM policies related to recruitment, human capital (i.e. human resource development), employability, incentive pay and fringe-benefits offered to employees.

We constructed linked employer-employee data, relating the data of an employers survey we conducted among pharmacies in the Netherlands to administrative data on the workforce and the productivity of the firms. The administrative data enable us to use a physical measure of productivity related to the pharmacies sector.[3] the number of prescription-lines delivered to customers. These prescription-lines directly measure a pharmacy's production, as there are only minor differences in the workload between delivering different medicines.

Our study contributes to the literature on the effects of HRM in several ways. First, our study is the first to systematically analyze linked employer-employee data to determine whether the effects of various HRM practices on firm performance differ from the effects on the remuneration of the workforce. Second, our analysis allows us to test whether workers' wages are more affected by institutionalized practices in salary scales than by workers' real contribution to firm performance. From this perspective, we can examine whether traditional proxies of workers' skills acquired on the job, such as workers' age and job tenure, really affect workers'

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1. See Arthur (1992), Osterman (1994, 2000) and Batt (2002) for a similar approach. Osterman defines these 'core workers' as the largest group of non-supervisory, non-managerial workers at the establishment of a firm who are directly involved in making the product or providing the service.
2. In the Netherlands a person is only allowed to work as a pharmacist's assistant if he or she is a graduate from a pharmacist's assistants school.
3. Arthur (1994), MacDuffie (1995) and Ichniowski et al. (1997) also use physical measures of productivity related to the branch they analyze. These kind of sector specific performance measures can be considered as relatively 'hard' data on the performance of a firm (Ichniowski, Kochan, Levine, Olson & Strauss, 1996).

productivity or merely reflect institutionalized practices in salary scales. Third, with respect to the human capital of the workforce, other studies of the effects of HRM practices merely focus on workers' participation in training. In this study we will also take account of the actual "stock" of skills (i.e. workers' scores on the various relevant competences) by which the human capital embedded in a firm's workforce may contribute to firm performance and workers' wages. Fourth, the linked employer-employee data facilitates an analysis of the extent to which the skills of the workers are rewarded according to their relevance to the firm. This allows us to analyze whether firms could gain from aligning their wage policies with a worker's contribution to firm performance. Fifth, our analysis of the effectiveness of more advanced HRM systems in pharmacies contributes to the extension of the findings on the effects of HIM/High Performance systems in manufacturing plants to the service sector, where a growing majority of the working population is employed (cf. Batt, 2002). Finally, we focus on the core workers in small firms, whereas almost all studies of the effectiveness of HRM practices are set in large firms. Therefore, our analysis contributes to the understanding of the thresholds in the diffusion of more advanced HRM system among smaller firms.

2 Prior Research

In the literature on the effects of HRM practices at the firm level, two avenues of research exist. First, the human capital literature focuses on the effects of training at the firm level. Although empirical human capital research traditionally focuses on the earnings function of the individual worker, a stream of research is emerging that analyzes the effects of human capital investments at the firm level. The second line of research has developed from the HRM or personnel economics literature (see Wood, 1999; Ichniowski & Shaw, 2003 for an overview of these studies). In this literature, the effects of miscellaneous HRM practices are analyzed, although most authors attempt to focus on the effects of consistent 'HRM systems' (e.g. Arthur, 1994; Ichniowski, Shaw & Prennushi, 1997), with a special interest in the so-called High Performance Workplace (Ichniowski & Shaw, 2003).

2.1 Studies of the Effects of Human Resource Development

In the human capital literature, many studies have analyzed the effects of training on workers' wages. Several studies found considerable returns on workers' participation in training (e.g. Lynch, 1994). However, after controlling for selectivity, Goux & Maurin (2000) found that training has no real effect on workers' wages. It should be noted, however, that studies analyzing the effects of training on wages could underestimate the effect of training on productivity. As human capital theory has shown, the productivity effects of training are only fully reflected in workers' wages when the training is general, and assuming a perfectly competitive labor market.

The relationship between wage increases and productivity increases varies based on whether the firm or the worker pays the costs of training, which is related to the structure of the labor market. If the labor market is characterized by imperfect competition, bargaining and rent-sharing may occur (cf. Stevens, 1994; Acemoglu & Pischke, 1999). Moreover, apart from their wages, workers may receive some kind of non-financial remuneration, and part of the returns to their human capital may be 'backloaded' towards the end of their careers to ensure their loyalty to the firm (Lazear, 1979).

In the human capital literature, it is broadly recognized that apart from workers' participation in training, workers acquire many work-related skills by means of informal on-the-job training or 'experience' (cf. Mincer, 1974). In empirical analyses this informal human resource development is measured by proxies such as a worker's tenure (an indicator of the firm-specific skills a worker has acquired on the job) and a worker's age (an indicator of the general skills a worker has acquired on the job) (e.g. Brown, 1989; Acemoglu & Pischke, 1998). These empirical studies generally show that workers' experience contributes to their productivity, in as far as this is indicated by the wages they earn. One might, however, wonder whether workers' experience really contributes to their productivity. This question was already posed in the early human capital literature (Mincer, 1974). Workers' life-cycle earnings growth might reflect institutional arrangements in salary-scales rather than productivity gains, and need not necessarily reflect the productivity enhancing effects of the various skills workers have (cf. Medoff & Abraham, 1980, 1991; Brown, 1989).

The studies mentioned above analyze the effects of training and informal human resource development on workers' wages. Far fewer studies exist that analyze the effects of these factors on the productivity of the firm. Moreover, the results of these studies are highly dependent on the estimation technique, the definition of training and the measure of productivity (cf. Ballot, Fakhfakh & Taymaz, 2001). Some authors have found positive effects of training on the productivity of the firm Holtzer, Block, Cheatham & Knott (1993), Bartel (1994) and Dearden, Reed & Van Reenen (2000). Black & Lynch (2001), however, did not find an effect of the number of employees trained on the productivity of the firm, whereas Barrett & O'Connell (2001) found that general training has a positive effect on productivity growth whereas specific training has no effect. Dearden, et al. (2000), meanwhile, found that the effects of training on wages are about half the size of the effects on industrial productivity. However, they did not focus on the productivity of individual firms, but on the productivity of the sector of industry.[4]

It is important to note that, with respect to the human capital embedded in the workforce of a firm, studies of the effects of human resource development (HRD) on firms' productivity merely focus on participation in training, and do not include aggregate measures of workers' stock of training investments nor the level of the relevant skills of the workers (cf. Lynch, 1998).

4. They combine Labor Force Survey data on individual workers with data on the value added per sector of industry in manufacturing.

As the existing human capital literature is not conclusive regarding the effects of HRD on workers' wages and firm productivity, the following alternative hypotheses can be stated:

- *Hypothesis 1a: Human Resource Development will have positive effects on both firm productivity and workers' wages.*
- *Hypothesis 1b: Human Resource Development will have different effects for workers and the firm that employs them.*

2.2 Studies on the Effects of Human Resource Management

In the HRM or personnel economics literature, several arguments can be found for the expected positive relation between HRM practices and a firm's productivity (cf. Wolf & Zwick, 2002). First, as has been discussed above, investments in the human capital of the workforce may increase the productivity of workers (e.g. Bartel, 1994). Second, as the literature on the High Performance Workplace emphasizes, 'good' HRM policies may increase the motivation of workers (Ichniowski et al., 1997; Wood, 1999). Third, increasing the autonomy and responsibilities of the workers may diminish waste and inefficiencies because it enables the firm to take advantage of the specific knowledge of non-managerial workers (Appelbaum, Berg, Bailey & Kalleberg, 2000; Preuss, 2003). Fourth, 'good' HRM policies may contribute to workers' commitment to their tasks and willingness to do a better job (Ichniowski et al., 1997). Batt (2002) supports this argument and its application to the service sector. She found that high commitment of the workforce contributes to the effectiveness of employee-customer interaction in service-sector firms. Fifth, good HRM policies reduce quit rates, which, in turn, decreases recruitment and selection costs, and increases the benefits of investments in firm-specific skills. Moreover, in the service sector, employee turnover might induce customer turnover (Arthur, 1994; Huselid, 1995; Batt, 2002). Finally, giving more responsibility to the work floor enables the firm to delayer the organization, thereby reducing the costs of the middle management (Appelbaum et al., 2000).

Several studies have found that HRM practices have a positive effect on a firm's productivity, although there is usually no clear effect attributable to specific practices (Youndt, Snell, Dean & Lepak, 1996; Ichniowski et al., 1997). The latter might be due to multicollinearity among the various HRM practices, as several practices are strongly correlated (Wolf & Zwick, 2002), or may reflect the argument that only consistent bundles of HRM practices are effective (Arthur, 1994; MacDuffie, 1995; Ichniowski, Shaw & Prennushi, 1997). Many studies have emphasized the complementariness of various HRM practices. Milgrom & Roberts (1995) developed a formal model in which the various HRM practices of a firm are seen as symmetric Edgeworth complements, in the sense that doing more of any one of these practices increases the returns of doing additional practices. The emerging literature on High Involvement Management (HIM) or the High Performance Workplace (HPW) focuses particularly on the internal fit of the various HRM practices. A HIM strategy focuses on increasing the commitment of the personnel

to the firm in which they work. The focus of HPW is broader and highly related to Total Quality Management (TQM), which is based on both the internal and organizational fit of a firm's HRM policies.[5]

Arthur (1994) found that steel mills that use an HRM 'commitment system' have higher productivity levels than those that do not. Others have found that the HPW has significant positive effects on firm productivity (Huselid, 1995; Ichniowski, et al., 1997; Batt, 2002; Wolf & Zwick, 2002). Other studies, however, did not find clear effects of HRM systems or bundles of HRM practices on productivity (e.g. Delaney & Huselid, 1996).[6] Kelley (1996) found that HPW practices do not affect the performance of single-plant firms, whereas Batt (2002) found that HIM practices do not pay off in small firms that operate on local markets with a restricted scope of their market. Cappelli & Neumark (2001) found no consistent effects of HPW practices on firm performance. Wood (1999) stated that the inconsistent findings from the studies on the effects of HRM might also be due to the fact that it is crucial for the effectiveness of HIM that there are no "Taylorist jobs" that restrict workers' autonomy. If workers are merely involved in perfecting the design of a routinized job, this will not increase a firm's performance.

In the literature, only a few studies investigate to what extent employees benefit from more advanced HRM systems. Osterman (2000) addressed the question of whether firms with a HPW are "mutual gain enterprises". However, he did not find any benefits of HPW practices for a firm's core workforce, in terms of a lower layoffs rates and/or higher average real wage increase. He also found that firms with a HPW have higher layoff rates of regular employees. Black & Lynch (2000) found that reengineering a workplace to incorporate high performance practices increases workers' wages, whereas profit sharing or stock option plans result in lower regular wages. Bauer & Bender (2001) found that especially the flattening of the hierarchy structure of an establishment and the introduction of self-managed teams positively affect the wages of employees. Meanwhile, Cappelli & Neumark (2001) also analyzed the effects of HPW practices on both the sales of the firm and labor costs (cf. Batt, 2001). The latter can, however, not be considered as benefits of these HPW practices for the workforce, as the analysis of labor costs does not control for the effects of workers' characteristics, such as their level and field of education and work experience.

As we discussed above, the empirical literature on the effects of HRM is quite inconclusive regarding the effects of particular HRM practices and systems for workers as well as the firms that employ them. Particularly for the small firms in the service sector we analyze, it is not clear whether these firms and their workers will benefit from a more advanced HRM system. We will, therefore, test the following two sets of alternative hypotheses:

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5. However, the HPW is sometimes used as a synonym of HIM and definitions overlap (cf. Lawler, Mohrman & Ledford, 1995).
6. Wood (1999) concludes in his overview study that the effects of HRM systems found vary between performance indicators.

- *Hypothesis 2a: Human Resource Management practices will have positive effects on both firm productivity and workers' wages.*
- *Hypothesis 2b: Human Resource Management practices will have different effects for workers and the firm that employs them.*
- *Hypothesis 3a: A more advanced Human Resource Management system will have positive effects on both firm productivity and workers' wages.*
- *Hypothesis 3b: A more advanced Human Resource Management system will have different effects for workers and the firm that employs them.*

2.3 Measures of Productivity

In studies of the effects of HRM practices, various indicators of a firm's performance have been used: perceptual measures of firms' performance (Delany & Huselid, 1996), financial measures such as firms' profits (e.g. Terpstra & Rozell, 1993) or Tobin's q (e.g. Huselid, 1995)[7], the value added or sales of the firm per employee (Black & Lynch, 2001; Cappelli & Neumark 2001), or physical measures of firms' productivity (e.g. Arthur, 1994).

A disadvantage of a perceptual measure is that it can be highly subjective both in the judgment of firm performance itself, and in the selection of a comparator firm one selects to benchmark the performance of one's own firm. Other measures - financial measures and value added - are affected by many systematic and ad hoc factors for which it is very difficult to control. Moreover, these measures, in practice, are often highly volatile. Physical measures of productivity do not have these disadvantages because they are straightforward in measuring productivity given the specific production process in a sector of industry (cf. Ichniowski & Shaw, 2003).

In this study we will therefore use a physical measure of productivity, following the research of other studies that focus on a particular industry (Arthur, 1994; MacDuffie, 1995; Ichniowski, et al., 1997). We measure the productivity of pharmacies by the number of prescription lines delivered to customers. Each prescription line refers to a particular medicine delivered to a customer. Family doctors write these prescription lines, this being the only way in which registered medicines can be obtained in the Netherlands. The average number of prescription lines per assistant is a good indicator of the productivity of a pharmacy, since it determines the quantity of medicines delivered to customers: Although some differences may exist in the time it takes to deliver different medicines, no substantial differences in the composition of the medicines delivered by the various pharmacies exist.[8] Moreover, the pharmacies are paid a fixed amount of money for each prescription line (€ 5.08) by the health

7. i.e. the ratio of the market value of a firm to the replacement value of its assets.
8. It should be noted that in the Netherlands non-registered medicines are almost always bought in commercial drugstores and hardly contribute to the sales of the pharmacies.

insurance companies.[9] In this way our measure of physical productivity is directly related to the value added of the firm.

3 Data

We conducted an employers survey among pharmacies in the Netherlands in November 2001.[10] A written questionnaire was mailed to 1,319 pharmacists of whom 549 responded. The response appeared to be unbiased with respect to region and pharmacy size. We were able to link the survey data with the available administrative data on the number of prescription lines worked up in the various pharmacies and with administrative data on workers' wages and other worker characteristics.[11] The latter data source was used to calculate the assistants' average gross wages per month[12], as well as workers' average age and tenure for each pharmacy.

Table 1 shows the means and standard deviations of the variables in the data set used. The average gross wage per month for assistants working in a pharmacy is € 1,770. On average, an assistant in a pharmacy handles 13,630 prescription lines per year. The table also includes some controls for firm and workforce characteristics we will use in our analysis: 70 percent of the pharmacies are independent firms; the remaining ones are part of a chain. 53 percent of the pharmacies has more than 10 employees. The "core" workers on which we focus our analysis (i.e. the pharmacist's assistants) represent 80 percent of the total workforce in the pharmacies. The rest of the workforce consist of two other groups of workers: the 'second pharmacists'[13] and 'other workers' (usually cleaning personnel and administrative staff). Technological innovations, in the form of the introduction of a new computer system, took place in 17 percent of all pharmacies. Organizational innovations are more common. 56 percent of the pharmacies had to deal with organizational changes. In addition, 15 percent introduced new products in the shop, and 60 percent mentioned that customer orientation had increased.

The HRM practices we include in the analyses can be classified as recruitment practices, human capital or HRD, employability practices, incentive pay and benefits offered to the pharmacist's assistants. The *recruitment policy* variables show that few assistants have temporary contracts (on average 13 percent in a pharmacy). Although the labor market for

9. Although pharmacies in the Netherlands have to deal with all kinds of government regulations, they are truly independent, for-profit firms.
10. In the tradition of "insider econometrics", we based this survey on extensive fieldwork to get a detailed understanding of the production process in the Dutch pharmacies.
11. All pharmacist's assistants are registered at the pension fund (*Pensioenfonds Medewerkers Apotheken*).
12. The gross wages per month are based on fulltime jobs (36 hours per week).
13. Second pharmacists are pharmacists employed by the managing pharmacist who usually owns the firm.

pharmacy assistants was tight at the moment of the survey, only 13 percent of the pharmacies offered higher wages to new assistants in the case of vacancies

Table 1
Description of the variables*

Variable	Mean	Standard deviation
Wages and Productivity		
• Assistants' average gross wages per month in euros (x 1,000)	1.77	.11
• Number of prescription lines per assistant per year (x 1,000)	13.63	4.89
Firm characteristics		
• Type of pharmacy		
- Independent (yes/no)	.70	.46
- Chain of less than 5 pharmacies (yes/no)	.18	.38
- Chain of 5 or more pharmacies (yes/no)	.13	.33
• More than 10 employees (yes/no)	.53	.50
• Share of second pharmacists in total number of employees	.05	.08
• Share of other employees in total number of employees	.15	.11
Workforce characteristics		
• Assistants' average age in years	36.61	4.39
• Assistants' average job tenure in years	6.89	2.73
Technological and organizational innovations		
• New computer system (yes/no)	.17	.37
• Organizational changes (yes/no)	.56	.50
• New products (yes/no)	.15	.36
• Increased customer orientation (yes/no)	.60	.49
Recruitment policy		
• Assistants with temporary contracts (%)	12.60	16.58
• Offering higher wages to new assistants in case of vacancies (yes/no)	.13	.34
Human capital (HRD)		
• Assistants' average score on general skills higher than 7.5 (yes/no)	.63	.48
• Assistants' average score on specific skills higher than 7.5 (yes/no)	.28	.45
• Assistants' average score on computer skills higher than 7.5 (yes/no)	.34	.48
• Number of general courses enrolled in per assistant per year	.15	.38
• Number of specific courses enrolled in per assistant per year	.75	.76
• Number of computer courses enrolled in per assistant per year	.07	.20
• Assistants take courses during work hours		
- No courses (yes/no)	.50	.50
- Few courses (yes/no)	.29	.56
- Most courses (yes.no)	.17	.38
- All courses (yes/no)	.04	.19
• Training of employees in case of vacancies (yes/no)	.10	.30
• Worker performance evaluation interview (yes/no)	.75	.43
• Personal development plan for assistants (yes/no)	.07	.25
Employability		
• Assistants performing tasks of pharmacist (yes/no)	.55	.50
• Assistants performing tasks of lower-level jobs (yes/no)	.34	.48

Table 1 (continued)
Description of the variables*

Variable	Mean	Standard deviation
• Assistants working overtime (yes/no)	.74	.44
Incentive pay		
• Performance pay (yes/no)	.16	.36
Additional benefits		
• Additional childcare facilities (yes/no)	.19	.39
• Flexible working hours (yes/no)	.43	.50
• Number of 'fringe benefits'**		
- low: 0 to 2 benefits (yes/no)	.34	.48
- medium: 3 or 4 benefits (yes/no)	.55	.50
- high: 5 or more benefits (yes/no)	.11	.31

* n = 549
** subsidy for commuting expenses, product discounts, a free bicycle or car, a subsidy for a home computer, a clothing allowance, tax free savings.

For *human capital* development we include variables that measure the competences of the workforce, and the participation in training, as well as facilities that may increase the quality of human capital investments like worker performance evaluation interviews. Moreover we distinguish between general skills, sector-specific skills and computer skills. The skills of assistants can be interpreted as the assistants' stock of human capital. Because all the assistants have attended the same government required education program, their skills will, to a large extent indicate workers' stock of training investments during their working career (cf. Lynch, 1998). The *human capital* variables show that assistants have a high score on general competencies, such as social skills, independence, and dealing with responsibility. They score somewhat lower on specific competences, such as knowledge of medicines and preparation of medicines, and on computer competences.[14] Assistants follow quite a few courses, mainly in the pharmaceutical field. About half of them followed one or more courses during work time in the last twelve months. 10 percent of the pharmacies train their employees in response to vacancy problems. 75 percent hold worker performance evaluation interviews, but only 7 percent use personal development plans for assistants.

The *employability measures* indicate whether pharmacists consider their assistants to be flexible in their tasks and working hours. 55 percent of the assistants perform tasks of the pharmacist, 34 percent perform tasks of lower-level jobs. 74 percent (occasionally) work overtime. *Performance pay* is used by 16 percent of the pharmacies. Finally, Table 1 gives an

14. The competence scores refer to the score scales from 1 to 10 common in Dutch education, in which a score of 6 is a passing grade. A score of 7.5 is in between "amply sufficient" (7) and "good" (8).

overview of the additional benefits pharmacies offer their personnel. 19 percent of the pharmacies offer additional childcare facilities, whereas 43 percent of pharmacies offer the option of flexible working hours to their assistants. 11 percent of the pharmacies offer more than five other fringe benefits, such as a subsidy for commuting expenses, subsidized transportation in the form of a free bicycle or a car, product discounts, a clothing allowance, a subsidy for a home computer project, and tax free savings.

4 Econometric specifications and estimation results

To analyze the effects of the various HRM practices on workers' wages and the productivity of the firm (Hypotheses 1a & 1b and 2a & 2b), we estimate the effects of the various practices in a wage equation as well as a production function. We estimate these two equations as a set of 'seemingly unrelated regression equations' (Zellner, 1962). By using EGLS estimators we are able to use the information on the explanatory variables that are only included in the second equation when estimating the first equation and allow for correlation between the two error terms:

$$In(W/L)_i = \alpha_1 + \beta_1^{'} H_i + \delta_1^{'} OI_i + \gamma_1 TI_i + \mu_1^{'} X_i + \varepsilon_{1i} \quad (1)$$

$$In(P/L)_i = \alpha_2 + \beta_2^{'} H_i + \delta_2^{'} OI_i + \gamma_2 TI_i + \mu_2^{'} X_i + \phi_2^{'} In(Z/L)_i + \varepsilon_{2i} \quad (2)$$

W_i = total wages of pharmacist's assistants in firm i; L_i = number of full-time assistants in firm i; P_i= number of prescription lines delivered in firm i; H_i= use of various HRM-practices in firm i; OI_i = organizational innovations in firm i; TI_i = technological innovations in firm i; X_i = control variables; Z_i = additional staff; α, β', δ', γ, μ', ϕ' = (vectors of) coefficients; ε_{1i} , ε_{2i} = error terms.

In the first equation we analyze the effect of HRM practices on the wage level of the pharmacist's assistants. Although in human capital literature workers' wages are often used to measure their productivity, we will use the average wage level of the pharmacist's assistants merely as a measure of the extent to which they benefit themselves from their human capital and the various HRM practices of the firm. The second equation is a production function in which we estimate the effects of HRM practices on the average productivity of the pharmacist's assistants assuming constant returns to scale (cf. Black & Lynch, 2001). As mentioned above, we measure the productivity of the firm by the average number of prescription lines delivered by pharmacist's assistants to the firm's customers.

We do not include data on the physical capital used in the pharmacies in the production function. However, as the production process in the various pharmacies is rather similar, the capital stock invested in the firm will be strongly related to the size of the workforce. Moreover,

in both equations we include variables that take into account the technological (TI) and organizational innovations (OI) that may have taken place in the pharmacy. Both technological and organizational innovations have been found to contribute to higher levels of firm productivity (Bresnahan, Brynjolfsson & Hitt, 2002), and may also result in an increase in workers' wages (Bauer & Bender, 2001).

As mentioned, in our analysis we distinguish between several categories of HRM practices: recruitment practices, human capital development, employability practices, incentive pay, and benefits. It should be noted, however, that fringe-benefits might have a positive effect on workers' productivity, but at the same time may result in a negative effect on wages in so far as there are hedonic or "compensating wages". Finally, we include some control variables related to firm and workforce characteristics (see table 2). These controls differ between the two equations, since in the production function (equation 2) we have to add additional controls for the other categories of workers in the pharmacies (cf. Black & Lynch, 2001), i.e. the ratio between other staff employed, and pharmacist's assistants. In order to impose constant returns to scale, we take the log transformation of the latter term.

Table 2 shows the estimation results of the equations 1 and 2. Wages are strongly related to the age and job tenure of workers; a result that is usually found when earnings functions are estimated and, following Mincer (1962), is usually interpreted as the productivity effect of general and job or firm-specific experience or 'on-the-job training'. However, our estimation results show that age and tenure do not have a positive effect on the productivity of the firm. This indicates that the effects of age and experience on earnings merely reflect institutionalized salary-scale effects[15] rather than real productivity effects.

The results show that only some of the various HRM variables affect the average wage level and/or average productivity. Moreover, there are remarkable differences between the determinants of the wage level, and the determinants of productivity. With respect to the human-capital variables, we find that assistants with high scores on computer skills have a higher productivity, whereas these computer skills do not affect the wage level. Conversely, high scores on sector-specific skills have a positive effect on the wage level, whereas these skills do not have a similar effect on productivity. This probably indicates that such occupational skills are highly valued by pharmacists, since these skills are thought to affect the quality of work, even though this is not reflected in the productivity of the firm. Moreover, we find that participation in additional training courses does not add anything to the effects of workers' skill levels. Training of employees in the case of vacancies, however, seems to be an adequate HRM policy, since it increases the productivity of the pharmacy.

15. These salary scales are defined in the *Collectieve Arbeidsovereenkomst Apotheken 2001* (Collective Bargaining Agreement Pharmacies 2001).

Table 2
Results of Zellner's seemingly unrelated regression analysis

Variable	Average wage level (ln) B		t-value	Prescription lines (ln) B		t-value
Constant	.291	***	10.11	2.703	***	14.86
Firm characteristics						
• Type of pharmacy						
- Independent (yes/no)	-.002		-.19	.069		1.39
- Chain of less than 5 pharmacies (yes/no)	.021	**	2.12	-.022		-.37
- Chain of 5 or more pharmacies (ref.)	-		-	-		-
• More than 10 employees (yes/no)	.010	*	1.64	-.102	**	-2.74
• Employment share of second pharmacists (ln)	-		-	.022	**	3.08
• Employment share of other employees (ln)	-		-	.025	**	2.73
Workforce characteristics						
• Assistants' average age in years	.006	***	7.66	.001		.10
• Assistants' average job tenure in years	.004	***	3.83	-.002		-.25
Technological and organizational innovations						
• New computer system (yes/no)	.005		.69	-.018		-.39
• Organizational changes (yes/no)	.012	**	1.99	.055		1.56
• New products (yes/no)	-.009		-1.07	-.079		-1.59
• Increased customer orientation (yes/no)	-.004		-.70	-.007		-.21
Recruitment practices						
• Assistants with temporary contracts (%)	-.001		-.65	-.003	**	-3.02
• Offering higher wages to new assistants in case of vacancies (yes/no)	.019	**	2.25	.013		.26
Human capital (*HRD*)						
• Assistants' score on general skills > 7.5 (yes/no)	.001		.04	.023		.600
• Assistants' score on specific skills > 7.5 (yes/no)	.014	**	1.99	-.041		-.99
• Assistants' score computer skills > 7.5 (yes/no)	-.007		-1.22	.083	**	2.21
• Number of general courses per assistant per year	-.010		-1.14	.006		.12
• Number of specific courses per assistant per year	-.006		-1.50	.029		1.20
• Number of computer courses per assistant per year	.009		.60	-.055		-.65

Table 2 (continued)
Results of Zellner's seemingly unrelated regression analysis

	Average wage level (ln)			Prescription lines (ln)		
	B		t-value	B		t-value
• Assistants follow courses in work time						
- No courses (ref.)	-		-	-		-
- Few courses (yes/no)	.001		.19	.005		.11
- Most courses (yes.no)	.004		.44	-.034		-.71
- All courses (yes/no)	.002		.15	-.121		-1.31
• Training of employees in case of vacancies (yes/no)	.009		.95	.112	**	2.03
• Worker performance evaluation interview (yes/no)	.017	**	2.51	-.030		-.78
• Personal development plan for assistants (yes/no)	-.016		-1.37	-.111		-1.57
Employability						
• Assistants performing tasks of pharmacist (yes/no)	.006		1.00	.026		.70
• Assistants performing tasks of lower-level jobs (yes/no)	-.001		-.05	-.007		-.19
• Assistants working overtime (yes/no)	.010		1.49	.054		1.33
Incentives						
• Performance pay (yes/no)	.004		.43	.093	*	1.89
Additional benefits						
• Additional childcare facilities (yes/no)	.010		1.36	-.065		-1.51
• Flexible working hours (yes/no)	.003		.47	.019		.58
• Number of 'fringe benefits'						
- low (ref.)	-		-	-		-
- medium (yes/no)	-.009		-1.42	-.048		-1.30
- high (yes/no)	-.005		-.52	-.048		-.81
Adjusted R^2	.388			.193		
n	345			345		

* p < 0.10 ; ** p < 0.05 ; *** p < 0.01

Another remarkable finding is that performance evaluation interviews have a positive effect on the wage level of assistants, but do not affect productivity. This indicates that these interviews are more favorable for workers than for the firm. Moreover, we find that pharmacies, which offer a higher wage to newly, recruited assistants in order to cope with their vacancy problems also have a higher wage level on average. This shows that higher wages for newly recruited assistants also increase the wages of the other workers, although this does not have a positive effect on productivity. Temporary contracts appear to have a negative effect on productivity, whereas there is no effect on the wage level. The latter could be expected because for workers with

temporary contracts, the limited duration of their contract is already a negative aspect of their contract.

Moreover, we find that performance pay has a positive effect on the productivity of the firm, but does not affect the average wage level of the pharmacist's assistants. Other HRM practices neither significantly affect wages nor productivity. This holds for task flexibility, the participation in training, childcare facilities as well as the miscellaneous "fringe benefits" offered to assistants by firms. The above-mentioned results obviously contradict our hypotheses 1a and 2a and confirm the alternative hypotheses 1b and 2b, i.e.: the wage policies of the firms do not optimally result in the convergence of the interests of the workforce with firm interests.

Our estimation results also show that technological developments neither affect wages nor productivity in the pharmacies, whereas organizational innovations have a weak significant positive effect on workers' wages, although they do not affect the productivity of the firm. Finally, we find some effects of firm size characteristics: Apart from the control variables in equation 2 that take into account the additional workforce in the pharmacy, we find that in larger pharmacies (more than 10 employees) assistants are on average significantly less productive, although these larger pharmacies pay higher wages. Pharmacies that are part of a small chain of pharmacies also appear to pay higher wages to their pharmacy assistants.

4.1 Human Resource Management Systems

To analyze the effects of a more advanced HRM system on firm productivity and workers' wages (Hypotheses 3a & 3b), we identify four HRM systems that map out a hierarchy from 'traditional' to a HIM system (cf. Ichniowski et al., 1997). Table 3 describes the HRM practices included in the four systems. The first HRM system is the traditional system of personnel management in smaller firms in which no visible practices exist that focus on improving the performance of the assistants. 26 percent of the pharmacies belong to this group. The second HRM system refers to a 'basic' system that merely incorporates the practice of worker performance evaluation interviews. 30 percent of the pharmacies belong to this group. In the "intermediate" HRM system (the third system) more practices are included. Apart from the performance evaluation interviews, assistants in these pharmacies take courses to continually upgrade their knowledge and skills. Moreover, these pharmacies do not employ many assistants with temporary contracts, thereby increasing the commitment of the assistants to the organization. 41 percent of the pharmacies belong to this group. The fourth HRM system can be classified as a HIM system. Only 3 percent of the pharmacies have such a HIM system. Apart from the HRM practices incorporated in the third HRM system, these pharmacies employ assistants with a high average skill level (i.e. an average score of 7.5 or higher on a 10-point scale for all 10 skills distinguished). In these pharmacies, (some) assistants also perform tasks of the pharmacist. Moreover, the assistants in these pharmacies have a higher participation in additional training: on average they take at least one course a year. These pharmacies also

stimulate training participation by allowing assistants to work on their coursework during work hours.

It should be noted, however, that we did not include variables on the presence of teamwork, job rotation, and quality circles in the survey, since these HPW practices are not relevant for Dutch pharmacies where all assistants work together in a small team without any hierarchy apart from the role of the pharmacists. For this reason we qualify the most advanced HRM system in the Dutch pharmacies as a HIM system.

Table 3
Description of indicators included in the four HRM systems distinguished

Indicator	%
HRM system 1: *Traditional system*	26
• No HRM practices that focus on improving performance	
HRM system 2: *Basic HRM system*	30
•Worker performance evaluation interviews	
HRM system 3: *Intermediate HRM system*	41
•Worker performance evaluation interviews	
•Assistants follow courses	
•Percentage of assistants with temporary contracts lower than 20%	
HRM system 4: *High Involvement Management*	3
Worker performance evaluation interviews	
•Percentage of assistants with temporary contracts lower than 20%	
•Assistants follow on average 1 course a year	
•Assistants follow courses in work time	
•Assistants' average score on skills higher than 7.5	
•Assistants perform tasks of pharmacist	

Equation 3 and 4, that are again considered as a set of Zellner's 'seemingly unrelated regression equations', include the HRM system applied by the firm instead of the various individual HRM practices:

$$\ln(W/L)_i = \alpha_3 + \beta_3^{'} HRMS_i + \gamma_3 TI_i + \mu_3^{'} X_i + \varepsilon_{3i} \quad (3)$$

$$\ln(P/L)_i = \alpha_4 + \beta_4^{'} HRMS_i + \gamma_4 TI_i + \mu_4^{'} X_i + \phi_4^{'} \ln(Z/L)_i + \varepsilon_{4i} \quad (4)$$

$HRMS_i$ = Human Resource Management System in firm i

Table 4
Results of Zellner's seemingly unrelated regression analysis on the effects of HRM systems

Variable	Average wage level (ln) B		t-value	Recipe lines (ln) B		t-value
Constant	.270	***	10.27	2.688	***	15.39
Firm characteristics						
• Type of pharmacy						
- Independent (yes/no)	.001		.12	.096	*	1.88
- Chain of less than 5 pharmacies (yes/no)	.020	*	1.96	-.010		-.155
- Chain of 5 or more pharmacies (ref.)	-		-	-		-
• More than 10 employees (yes/no)	.009		1.59	-.123	**	-3.42
• Employment share of second pharmacists (ln)	-		-	.026	***	3.50
• Employment share of other employees (ln)	-		-	.022	**	2.34
Workforce characteristics						
• Assistants' average age in years	.007	***	9.08	.002		.43
• Assistants' average job tenure in years	.004	***	3.62	-.003		-.46
Technological and organizational innovations						
• New computer system (yes/no)	.006		.80	-.041		-0.89
• Organizational changes (yes/no)	.008		1.37	.037		1.06
HRM system						
- HRM system 1 – Traditional system (ref.)	-		-	-		-
- HRM system 2 – Basic system	.023	**	3.03	-.018		-.38
- HRM system 3 – Intermediate system	.010		1.47	-.022		-.53
- HRM system 4 – HIM	.045	**	2.44	.140		1.26
Adjusted R^2		.35			.10	
n		345			345	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 4 shows the estimation results of the equations 4 and 5. We find that assistants benefit from more advanced HRM systems by means of higher wages. Our estimation results show there are two significant thresholds. Worker performance evaluation interviews are a first step, whereas assistants benefit the most from a HIM system.

However, the estimation results show that pharmacies with a more advanced HRM system do experience higher productivity. This indicates that a more advanced HRM system has different effects for the assistants, and the pharmacy that employs them (Hypothesis 3b). In this sense, a more advanced HRM system does not stimulate the convergence of the interests of workers with firm interests. This indicates an important threshold in the diffusion of more advanced HRM systems among the pharmacies.

5 Conclusions and discussion

In this study, we analyzed the effects of HRM policies in Dutch pharmacies. We focused on the question of whether the effects of HRM practices on workers' wages and firm productivity are similar or different. We found considerable differences between the determinants of pharmacist's assistants' wages, and the determinants of the productivity of the pharmacies. Wages appeared to be strongly related to job tenure and age; a result that is usually interpreted as the productivity effect of on-the-job training. However, we found that both age and tenure do not have a positive effect on the productivity of the firm. This indicates that the effects of experience and age on earnings in Dutch pharmacies merely reflect institutionalized salary-scale effects rather than real productivity effects.

Similar to the results of other studies, we found that most specific HRM practices neither affect workers' wages nor the productivity of the firm. However, our estimation results show interesting differences between the effects of workers' performance evaluation interviews on the two performance measures, since these interviews have a positive effect on workers' wages, but do not affect the productivity of the firm. Apparently workers profit more from these interviews than does the firm itself. For performance pay we find the opposite pattern. It has a positive effect on the productivity of the firm, whereas it does not affect the average wage level of the workers.

In addition, the skills of the workers are not rewarded according to their relevance for the productivity of the firm. We found a positive effect of workers' computer skills on the productivity of the firm, whereas this is not reflected in workers' wages. Conversely, high scores on sector-specific skills have a positive effect on the wage level, whereas these skills do not affect workers' productivity.

These results contradict our hypotheses 1a and 2a, and confirm the alternative hypotheses 1b and 2b. The remarkable differences we found between the determinants of the wage level of the assistants, and the determinants of productivity of the firm clearly indicate that the wage policy of the pharmacies does not stimulate a convergence of interests between the firm and its workforce. To a large extent this is due to the fact that workers' earnings merely reflect institutionalized salary-scale effects rather than real productivity effects. This indicates that pharmacies could gain from aligning their wage policies with a worker's contribution to firm performance.

Our results on the effects of a more advanced HRM system confirm hypothesis 3b. As in some other studies we do not find any effect of an advanced HRM system on firm performance. More remarkable, however, is our result that workers benefit more from an advanced HRM system than does the firm itself. The former might indicate that more advanced HRM policies increase the effects of the institutionalized salary-scales. This could be an important threshold in the diffusion of a more advanced HRM system. This may particularly hold for smaller firms for which the salary-scales are determined by collective bargaining at the sector level.

Our finding that firm performance does not benefit from a more advanced HRM system might, however, also be due to time lags between the implementation of a more advanced HRM system, and any subsequent change in firm performance (Huselid & Becker, 1996). Since some of the pharmacies might have introduced particular HRM practices more recently our estimation results might underestimate the effect on these firms' productivity. However, in that case it is still remarkable that the workers benefit from a more advanced HRM system without any delay.

Since the data we used are cross-sectional, our estimation results may suffer from a negative selectivity effect for which we could not control. As shown by Wolf & Zwick (2002) a negative selectivity effect may occur because less productive firms have an incentive to introduce a more productive HRM strategy. However, it should be noted that pharmacies are small firms that serve a local market that offers few opportunities to increase their level of production by means of a more advanced HRM system (Batt, 2002). Small firms also have no possibilities to profit from delayering the organization, which is one of the reasons why a HIM/HPW system might increase productivity in large firms. More generally, our finding that firm performance does not benefit from a more advanced HRM system could be explained on the grounds that, in small firms, formal HRM policies are less important for workers' productivity levels than the personal relations between employer and employees. An alternative explanation might be that it may be very difficult to create a real HPW in a pharmacy setting. Although the assistants are professionals who usually work in a team, the pharmacist will not only act as a manager, but also is the 'dominant' professional. Therefore, although the assistants obviously do not have 'Taylorist jobs', their autonomy will, to some extent, be restricted by the professional authority of the pharmacist, which may limit the potential effects of a HIM/HPW system on the performance of the firm.

Our estimation results show that pharmacies could gain from aligning their wage policies with workers' contribution to firm performance. This indicates that employers are not well informed regarding the impact of the various HRD/HRM practices on firm performance. Research in this field can therefore be very worthwhile for the employers concerned. This probably mainy holds for small and medium sized firms. Unfortunately, sector studies on the effects of HRM practices cannot be conclusive regarding the extent to which the results found can be generalized to other sectors in the economy. This raises the need for more empirical research on the effects of HRM policies in small or medium size firms. Moreover, as the majority of the working population in the Western world is employed in these smaller firms, further empirical research on the effects of HRM practices in these firms may also significantly contribute to our understanding of the thresholds in the diffusion of more advanced HRM systems in the various sectors of the economy.

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