I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11889

Employee Absence: An Organizational Perspective

Jacob Kjær Eskildsen
Anders Frederiksen
Ann-Kristina Løkke

OCTOBER 2018

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11889

Employee Absence: An Organizational Perspective

Jacob Kjær Eskildsen
Aarhus University

Anders Frederiksen
Aarhus University and IZA

Ann-Kristina Løkke
Aarhus University

OCTOBER 2018

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Employee Absence: An Organizational Perspective*

We study employee absence in Danish organizations. In contrast to Steers and Rhodes (1978), who stress the importance of individual and organizational characteristics in shaping employees' motivation to attend work, we show that absence is predominantly an individualized phenomenon. Because the within-group variation in absence clearly dominates the between-group variation in absence, we argue that companies need to invoke individualized policies to reduce employee absence and demonstrate that HR Analytics is a useful tool in the process; policies targeting particular employee groups such as women or senior workers are inefficient. An additional intriguing finding is that incentives (through promotions and dismissals) are linked to individual absence.

JEL Classification: M12, M54

Keywords: absence, absenteeism, HR Analytics, person-effects, incentives, personnel management

Corresponding author:
Anders Frederiksen
Aarhus University
Department of Business Development and Technology
Birk Center Park 15, 7400
Herning
Denmark

E-mail: afr@btech.au.dk

* We thank the participating organizations for providing the data and for the time and resources they have allocated to the project and Center for Corporate Performance (CCP) for infrastructure. Daniel Baltzer Schjødt Hansen provided valuable research assistance.

1. Introduction

The typical employment contract specifies labor input and compensation. Despite such arrangements, most employees have actual labor supply different from the contracted labor supply due to absence. It follows immediately that such deviations are costly to organizations because of lost productivity and induced variation in the production process. Furthermore, workforce planning becomes a challenge. In this paper we use absence data from eight large organizations in Denmark—four private organizations and four public organizations—to shed light on within- and between-organization differences in absence rates and patterns.

A contemporary definition of absence is the failure to report for work as scheduled (Johns 2008). This definition is relevant across organizations and professions as, among other things, it does not assume any physical presence at the work place; thus, absence from scheduled work from home is also included. This absence may be driven by a complex interplay between demand and supply factors, and some may be voluntary (shirking) and others involuntary (sickness, funeral service, etc.). In this analysis we rely on the organizations' definition and registration of absence.

In a Danish context it is tempting to study absence using public administrative registers, and prior research has relied on such sources (cf. Lund and Labriola 2009). As recognized by these studies, the absence rates registered in public records predominantly reflect reported absences for which organizations have claimed and obtained reimbursement from public sources. Refunds are typically only granted for absence periods exceeding 30 days. Hence, register data may be contaminated by underreporting if organizations fail to report absences that are not subject to a refund, and they will for sure lack short absence spells. Our study is based on organization level registrations of absence and thus contains both short and long spells of absence.

The first goal of this paper is to shed light on differences in absence rates between organizations and employees. We document that absence rates tend to be relatively high in public organizations, but not uniformly so. Furthermore, we also establish that absence rates are associated with observable characteristics and are higher for women and older and more tenured employees.

While between-group variation is informative, it has to be assessed relative to the within-group variation because policy implications depend on the source of variation. Large between-group variation would promote policies targeting particular individual characteristics such as age, gender, and tenure, whereas large within-group variation makes the individual the focal point in policies. Our

fixed-effects estimations reveal that the within group variation clearly dominates the between-group variation. In fact, in our fixed-effects models, most observable variables become insignificant and most of the variation in absences is explained by individual fixed effects. A decomposition reveals that in the private companies we study, the variation in the individual fixed effects is between 1.4 and 3.5 times higher than the variation produced by observable characteristics. We also find that the variation in fixed effects is lowest for managers, at an intermediate level for white collar workers, and at a high level for production workers. In the public organizations we study, fixed effects play an even bigger role and the ratio of the variances in individual effects to observable characteristics is between 7.2 and 7.5. Hence, our first set of results reveals that a reduction in absence is best achieved by policies targeting individuals in the critical part of the absence distribution rather than groups of individuals with particular characteristics. We demonstrate that companies have a better chance at identifying such individuals if they make use of HR Analytics rather than just relying on past information about absence.

An additional way to curb absence is to create incentives for employees to work. Using multinomial regression models, we find that absence is linked to higher separation, quit, and dismissal rates. We also establish that absence may reduce promotion options. Hence, individual absence rates are clearly linked to career progression.

The reminder of the paper is organized as follows. In the next section we present the institutional context. This is followed by the theoretical model that guides our empirical analysis. In Section 4 we present the empirical model, and in Section 5 we introduce the eight organizations included in the study. In Section 6 we report results on within and between organization differences in absence and address the relation between absence and employee sorting and selection. In Section 7 we discuss the implications of our empirical findings and recommend policies to reduce absence. Section 8 concludes.

2. Institutional Context

The typical employee in Denmark is compensated when absent from work. If the employee is not paid a full salary from the employer, as many are, they are eligible for absence benefits. When the employee loses the right to salary or absence benefit from the employer, they can apply for absence benefit from the municipality. The absence benefits amount to a maximum of DKK 4,300 (≈ € 575) per week or DKK 116.22 per hour (2018 figures). As a general rule, it is possible to receive sickness benefits for up to 22 weeks within a 9-month period.

The employer must pay absence benefit for the first 30 calendar days. After 30 days of absence, the employer can apply for a refund from the Danish Social Security system for salaries paid during absence. If the employer pays a full salary during absence, the employer has the right to receive the sickness benefits that the employee could have received from the municipality.

Public and private employers have an option to take out insurance such that they are entitled to reimbursement from the first day of absence when an employee's risk of absence is significantly increased due to a long-term or chronic disorder. Private employers furthermore have the opportunity to take out insurance such that they for *all* absence in the organization are entitled to reimbursement from the second day of absence.

In general, it is legal to terminate the employee because of absence. However, a number of agreements prohibit terminating employees when they are sick. Some agreements state that the so-called 120-day rule applies[1], meaning that the employer can terminate an employee with one month's notice conditionally on the employee being absent for at least 120 days within the last 12 months and that the employee is on absence leave at the time of termination.

3. Theory

In this section we present a stylized model for absence, which will guide the empirical analysis presented below. Central to the model is that employees have T days available during the year and they can split their time between working (h) and being absent (A) such that $T = h + A$. When working the employee receives a wage (w) and when absent the employee receives transfer (τ). Furthermore, we formulate the cost of effort function in terms of h: $C(h) = \frac{1}{2}h^2$. Assuming that employees are risk neutral, they maximize utility, (U):

$$U = wh + \tau A - \frac{1}{2}h^2. \tag{1}$$

Hence, optimal labor supply is:

$$\mathrm{h}^* = w - \tau. \tag{2}$$

[1] This rule only applies to private sector organizations in our data because it has not been used in the public sector since 1999.

This preliminary model is clearly too simple to explain labor supply in a Danish context. The reason is that almost all employees are fully compensated while absent, which implies that optimal labor supply is zero.

A more involved model includes incentives and individual preferences for absence. First, incentives arise if promotions and dismissals are contingent on work hours (Landers, Rebitzer and Taylor 1996; Gicheva, 2013; and Frederiksen, Kato, and Smith 2018). To accommodate this, we denote the promotion and dismissal probabilities by π_P and π_D, respectively, and the promotion premium by P and the dismissal costs by D. Second, individual preferences for absence may also play a role. Mas and Moretti (2009) discuss how such preferences may arise due to social pressure from shame, sanctions, and reputational concerns or from prosocial preferences due to altruistic behavior or feelings for guilt. In our analysis we will be agnostic about the underlying cause but will assume that workers derive disutility (K) from absence. Hence, employees maximize:

$$U = wh + \tau A - \frac{1}{2}h^2 + \pi_P P - \pi_D D - KA. \tag{3}$$

It follows that optimal labor supply is:

$$\mathrm{h}^* = w - \tau + \frac{d\pi_P}{dh}P - \frac{d\pi_D}{dh}D + K. \tag{4}$$

From equation (4) it is clear that work hours are determined by the gap between wages and absence compensation, promotion and dismissal incentives, and individual preferences for absence.

In a Danish context it is generally the case that $w = \tau$. Hence, labor supply is determined by promotion and dismissal incentives that may vary across organizations and employee subgroups within organizations together with individual preferences. These observations imply that our empirical analysis will focus on both individual and organizational effects on absence.

4. Empirical Model

The theoretical model is formulated as a standard labor supply model of h, but we express our empirical model in terms of absence A using $h = T - A$. Our preferred model for absence is:

$$A_{it} = \alpha_i + \beta' X_{it} + \gamma' Z_{it} + \varepsilon_{it} \tag{5}$$

Where A_{it} is person $i's$ absence measured in days in year t, α_i is the individual's fixed effect, X_{it} is a matrix of individual characteristics (woman, quadratics in age and tenure and dummies for white collar and manager), Z_{it} is a matrix of workplace characteristics (organizational structure and geographical location) and year fixed effects.[2] $\alpha, \beta, \gamma,$ and δ are parameters and ε is an error term. The econometric models will be estimated separately for each organization because the structure of the variables included in Z_{it}, vary across organizations.

The empirical model is derived from equation (4). The permanent part of individual preferences for absence is captured through α_i and the variable part of such preferences through $\beta' X_{it}$. Organizational effects including variation in how absence is linked to promotion and dismissal incentives in a given organization are together with time effects captured by $\gamma' Z_{it}$. ε_{it} is a random component uncorrelated with α_i, $\beta' X_{it}$, and $\gamma' Z_{it}$. This ε_{it} can be thought of as randomly occurring absence.

The nature of the data implies that there may be an issue of measurement error in the dependent variable. Employers are not compensated for short-term absence, which implies that there are no economic motives to accurately register short and randomly occurring spells of absence. If our absence data is measured with error, then $A_{it} = \widetilde{A_{it}} + e_{it}$, where $\widetilde{A_{it}}$ is true absence and e_{it} is the measurement error. In this case, the error term in the regression will be a function of ε_{it} and e_{it} which implies less precision in estimated parameters but otherwise unbiased estimates.

5. The Eight Organizations

The data used in the analysis stem from eight Danish organizations. The four private organizations (Velux A/S, Novozymes A/S, ISS A/S, and Chr. Hansen A/S) are global leaders in roof window production, enzyme production, facility service operations, and the production of natural ingredients for, for instance, food production. The public organizations are Herning and Holstebro municipalities, a public hospital (Hospitalsenheden Vest) and the Royal Danish Police. In the following we present these organizations. Additional detail is provided in Appendix A.

For each organization we have obtained detailed information on absence, demographics, and organizational variables for all individuals. For the private organizations we have obtained data from

[2] We also include dummies indicating if a person is in the first or last year with the organization, as we do not observe a "full year" of absence for these individuals.

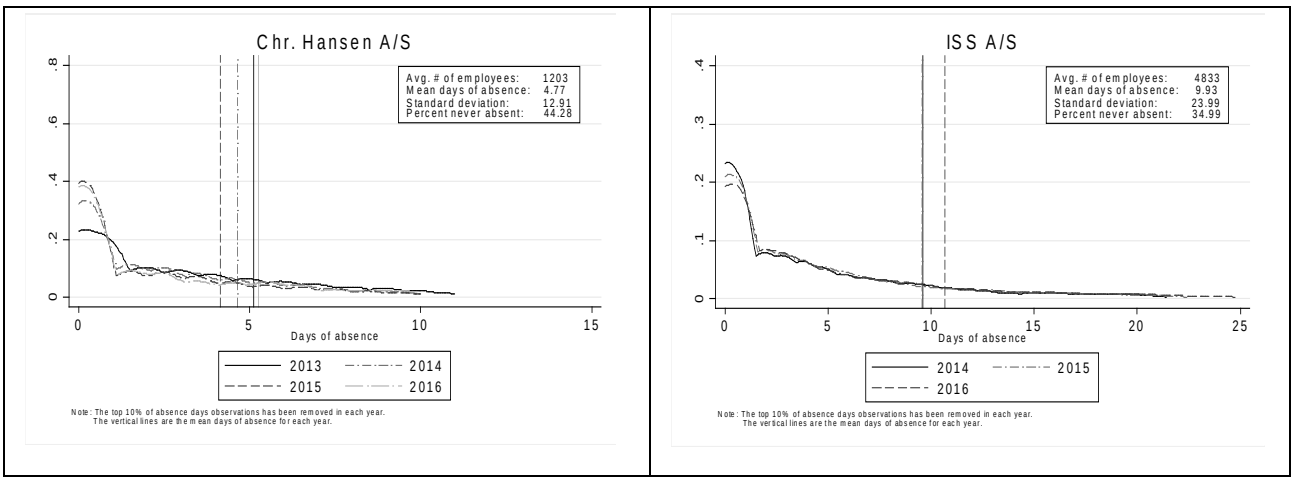
2016 and between 3 and 10 years back in time. For the police and the hospital we have data from 2010 to 2013, and for the two municipalities we have data from 2013.

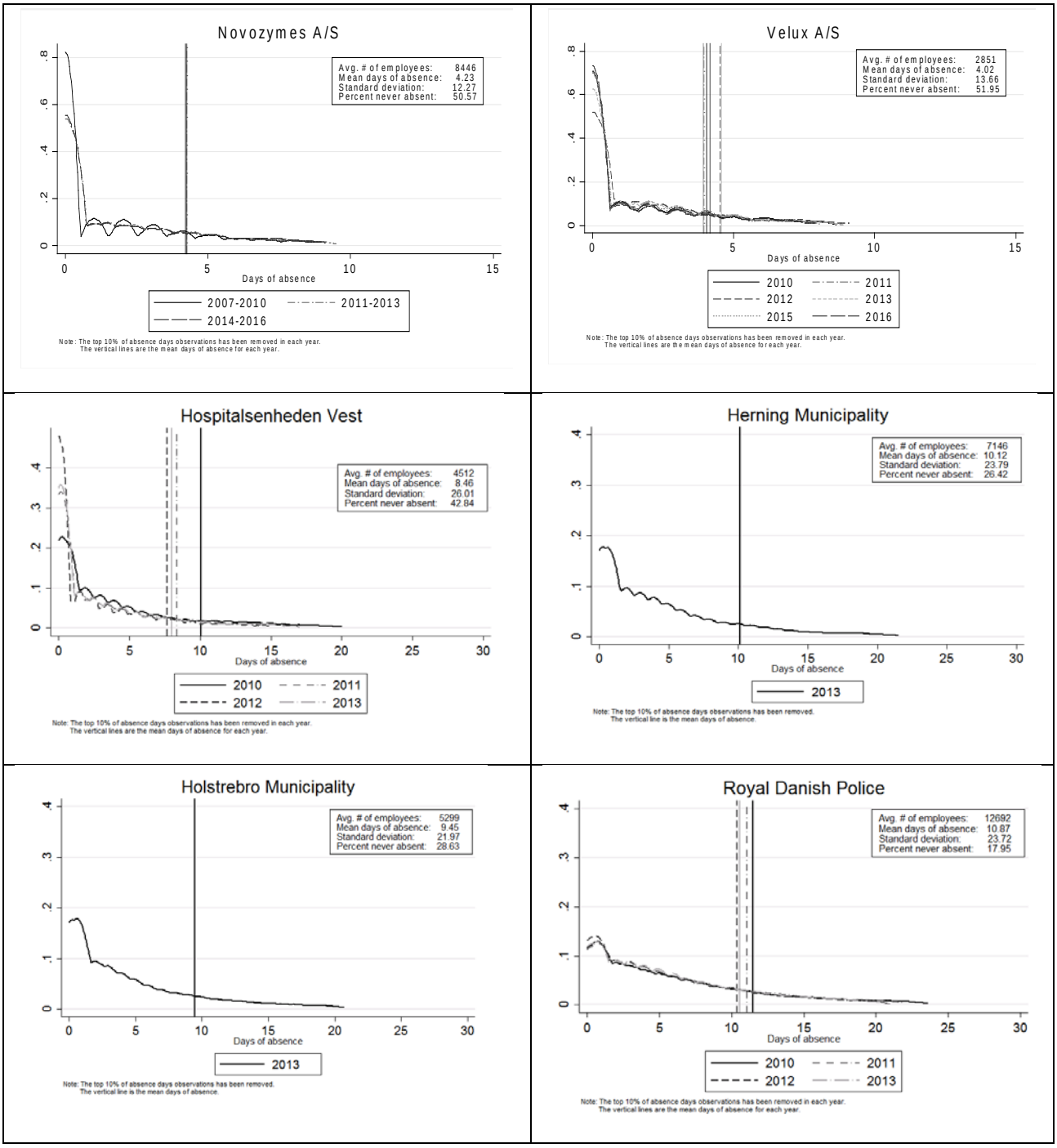
Descriptive statistics on absence

Our dependent variable is the yearly absence rate. We present descriptive statistics for this variable across the eight organizations in Figure 1. The four private organizations have average yearly absence rates of between 4.02 and 9.93 days with substantial standard deviations (12.27 to 23.99). Notable is that between 34.99 percent and 51.95 percent of employees are not registered as absent in a given year. Further, it is uncommon to see employees with ten or more days of absence.

Absence distributions across the public organizations are somewhat different, with average yearly absence rates between 8.46 and 10.87 days. In these organizations it is common to see individuals with more than 10 days of absence, and only 17.95–42.84 percent of the employees are not absent in a given year. Hence, average absence appear systematically higher in public organizations and they cover a larger proportion of employees.

Figure 1. Absence by organization



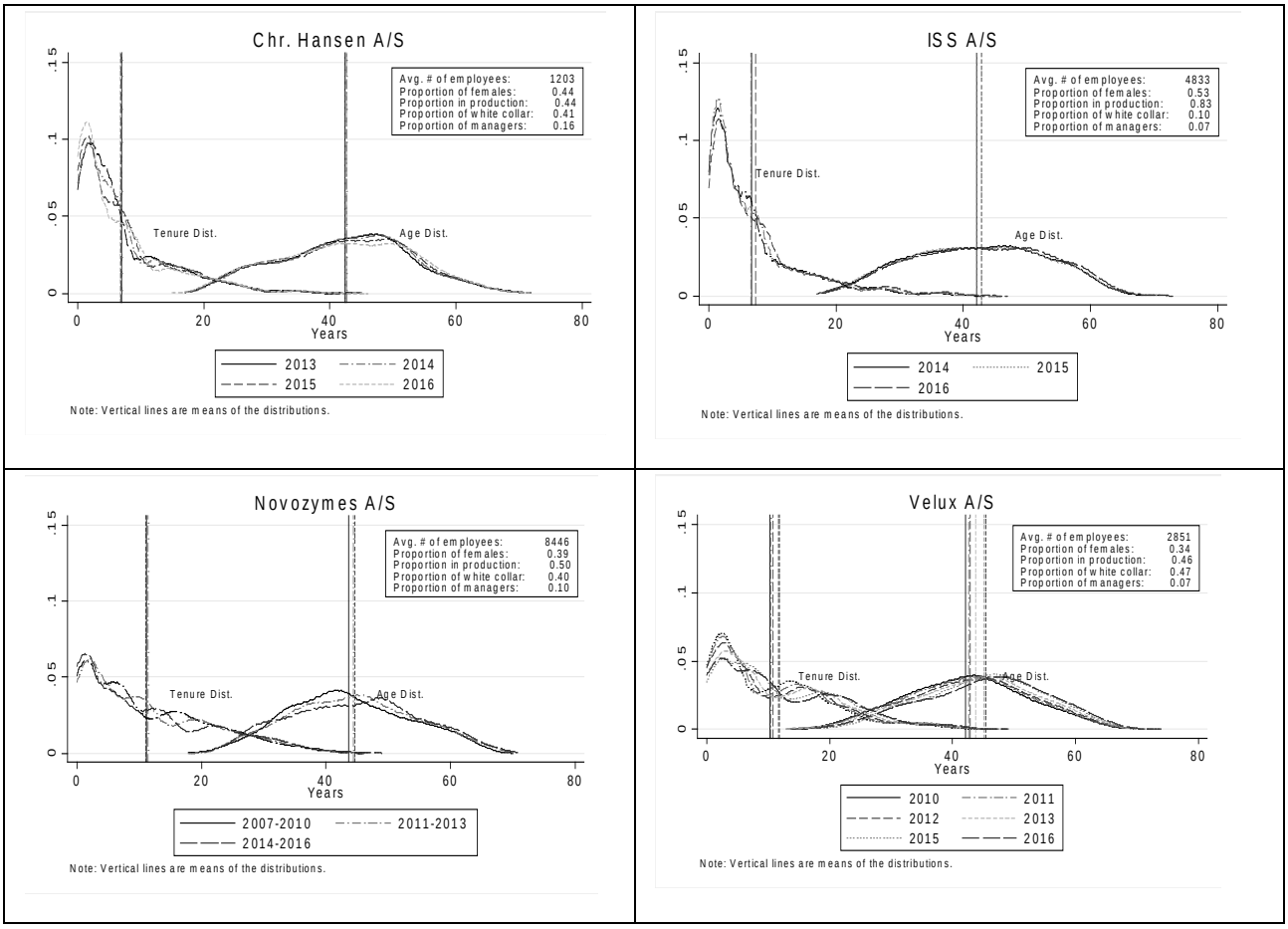


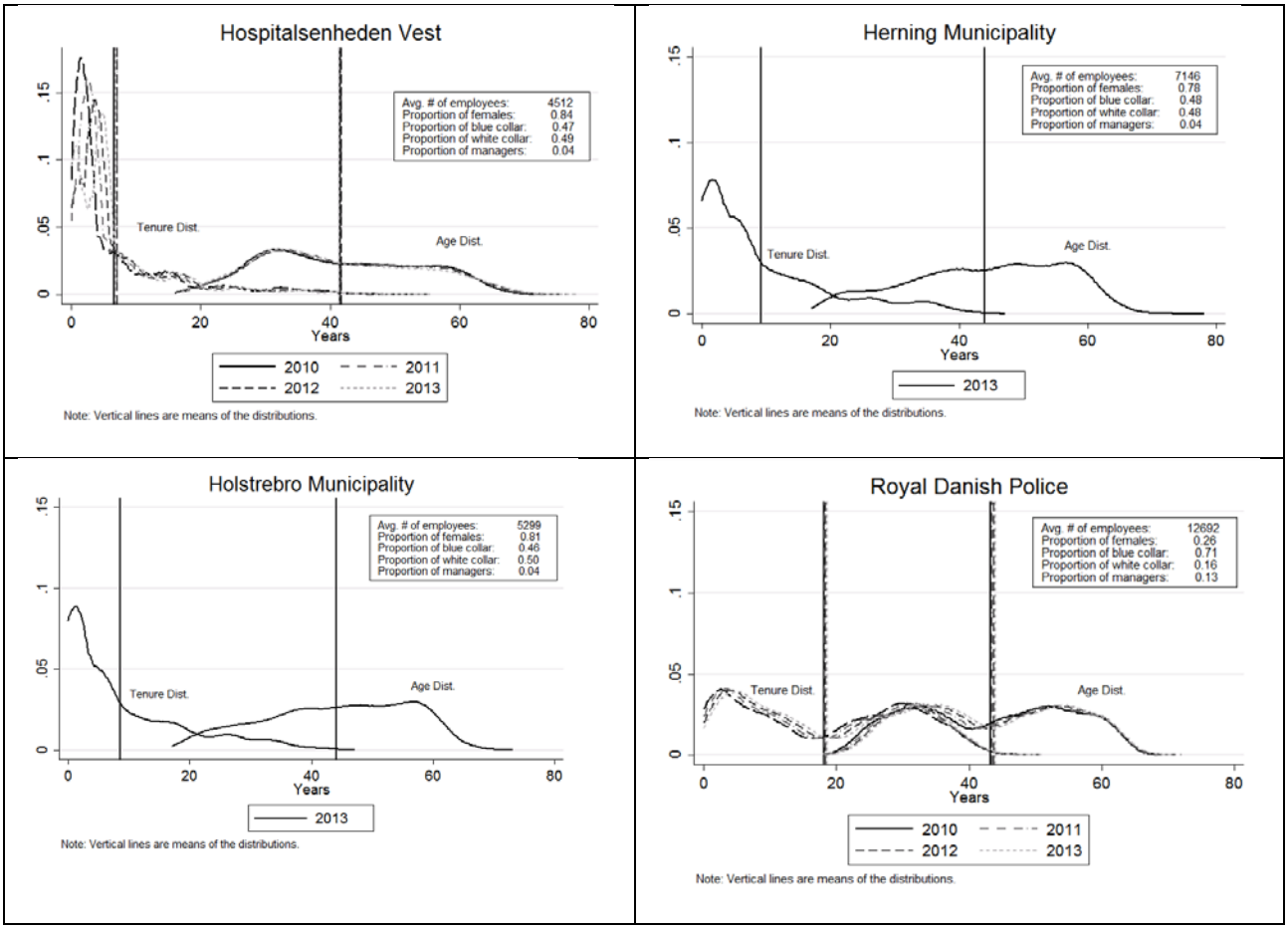
Descriptive statistics on employee compositions

In Figure 2 we present descriptive statistics for the organizations. There are interesting differences between the private and public organizations. The age distributions in private organizations resemble normal distributions with peaks between age 40 and 45. The public organizations have age distributions that are more uniform. Some even have mass increasing in age with a significant drop

in mass around the retirement age. The gender differences are also notable. The proportion of women in private organizations ranges between 34 and 53 percent. In the public organizations the proportion of women is 78 to 84 percent, with the exception of the police, where only 26 percent are women. In this perspective of public-private differences, it is interesting that the tenure distributions in all organizations take the conventional shape with a peak very early and then a declining profile (Farber 1999). Finally, organizational structures vary considerably across all organizations, where some are dominated by production workers (denoted blue collar in public organizations) and others have an equal division between production and white collar workers. In all organizations managers constitute the smallest group.

Figure 2. Employee compositions by organization





6. Results

In this section we present results. The first set of results focuses on the private organizations. This is followed by an investigation of public-private differences. The last part of the analysis focuses on the relation between absence and employee sorting and selection. The implications of the results are discussed in the next section.

6.1 Private organizations

The first set of absence regressions is presented in Table 1. The OLS results show that across the four organizations women have higher absence rates than men. In two organizations the age profile is increasing in a concave way and tenure profiles have a tendency to follow the same pattern. Across all organizations, white collar workers have lower absence rates than production workers and managers have the lowest absence rates. Although gender, age, tenure, and occupation are statistically significant variables in most models, R-squares remain low.

Table 1. Absence regressions, private sector

	Chr. Hansen A/S		ISS A/S		Novozymes A/S		Velux A/S	
	OLS	FE[1]	OLS	FE[1]	OLS	FE	OLS	FE
Woman	1.464***	-	1.831***	-	1.593***	-	1.306***	-
	(0.390)		(0.394)		(0.179)		(0.249)	
Age	0.460***	0.741	0.407***	1.659	0.048	0.414***	0.032	0.673
	(0.140)	(0.779)	(0.130)	(1.081)	(0.069)	(0.149)	(0.068)	(0.353)
Age squared	-0.004***	0.000	-0.004**	0.012	-0.000	0.000	0.000	-0.001
	(0.002)	(0.009)	(0.002)	(0.013)	(0.001)	(0.002)	(0.001)	(0.004)
Tenure	0.130*	-	0.268***	-	0.059**	-	-0.083**	-0.435**
	(0.072)		(0.089)		(0.025)		(0.039)	(0.180)
Tenure squared	-0.003	-	-0.007**	-	-0.002**	-	0.001	0.004
	(0.002)		(0.003)		(0.001)		(0.001)	(0.004)
Production	-	-	-	-	-	-	-	-
White collar	-3.106***	-	-2.707***	-	-3.314***	-0.804	-2.648***	-
	(0.465)		(0.609)		(0.190)	(0.654)	(0.386)	
Manager	-4.397***	-	-4.253***	-	-4.714***	-1.135*	-3.044***	-
	(0.528)		(0.663)		(0.213)	(0.675)	(0.522)	
F-statistic on FEs		1.247		2.663		2.988		1.598
p-value		0.000		0.000		0.000		0.000
# observations	4,813	4,813	14,501	14,501	25,338	25,338	17,108	17,108
R-squared	0.040	0.440	0.037	0.772	0.039	0.416	0.023	0.370

Note: Significance levels: *** 1 percent, ** 5 percent, * 10 percent. All regressions control for year fixed effects. To account for the fact that people leave or enter the organization within the year we include dummies for leaving or entering in all regressions. [1]The organizations only provided information on job type in the last sample year.

In a next step we estimate the fixed-effects model presented in equation (5). In these models the covariates have low explanatory power, but individual fixed effects are important. In all organizations, F-tests for the fixed effects being zero are rejected with p-values of 0.000.

To shed light on the relative importance of the model's components, we use the decomposition:

$$Var(A_{it}) = Var(\alpha_{it}) + Var(\beta' X_{it}) + Var(\gamma' Z_{it}) + 2cov(\alpha_i, \beta' X_{it}) + 2cov(\alpha_i, \gamma' Z_{it}) + 2cov(\beta' X_{it}, \gamma' Z_{it}) + Var(\varepsilon_{it}) \quad (6)$$

The results of the decomposition are presented in Table 2 and they confirm the importance of the individual fixed effects for absence. The variance in fixed effects (α_i) is typically 1.4 to 3.5 times higher than the variance resulting from observable characteristics ($\beta' X_{it}$) and substantially more important than the organizational variables ($\gamma' Z_{it}$). Furthermore, fixed effects are negatively correlated with both the individual and organizational characteristics, which is not surprising since an increase in the individual fixed effect will result in diminished effects of the individual and organizational characteristics, all other things equal.

Table 2. Variance decomposition

	Variance					Covariances		
	A_{it}	α_i	$\beta' X_{it}$	$\gamma' Z_{it}$	ε_{it}	$(\alpha_i, \beta' X_{it})$	$(\alpha_i, \gamma' Z_{it})$	$(\beta' X_{it}, \gamma' Z_{it})$
Chr. Hansen A/S	166.63	127.51	71.75	5.98	93.28	-60.90	-5.07	0.03
ISS A/S	575.98	1183.02	830.10	0.17	131.24	-784.22	-0.13	0.07
Novozymes A/S	150.53	75.27	21.59	1.20	87.93	-17.21	-0.57	0.05
Velux A/S	186.55	92.63	31.43	0.18	117.48	-27.50	0.06	-0.14

Note: The decomposition is based on the regressions presented in Table 1.

To gain a deeper understanding of the composition of absence across employee groups and organizations, we present, in Table 3, the mean yearly absence rate and the variance in the absence fixed effects by occupation and organization. Two important results stand out. First, absence rates are higher for production workers than for white collar workers, and managers have the lowest absence rates. Second, we obtain the same ranking—manager, white collar, and production—when looking at the variance in the individual fixed effects. Hence, managers are low-mean-low-variance while production workers are high-mean-high-variance, with white collars having intermediate levels.

Table 3. Absence rates and fixed effects by employee group

	Mean	Variance	Observations
	A_{it}	α_i	
Chr. Hansen A/S			
Managers	2.93	52.12	756
White collar	3.80	115.02	1,962
Production	6.35	162.36	2,095
ISS A/S			
Managers	6.16	759.53	1,012
White collar	7.08	1073,42	1,469
Production	10.59	1221,45	12,020
Novozymes A/S			
Managers	1.15	18.21	2,458
White collar	2.56	54.81	10,124
Production	6.16	100.74	12,756
Velux A/S			
Managers	2.71	55.51	1,210
White collar	3.02	67.83	8,047
Production	5.63	121.19	7,851

Note: Fixed effects obtained from the regressions in Table 1.

6.2 Private-public differences

The descriptive statistics alluded to significant differences in absence rates and workforce compositions across public and private organizations. In this section we make the benchmark based on regression analysis.

Comparing the OLS estimation results from the public organizations in Table 4 to the results for the four private organizations in Table 1, we are picking up very similar effects from gender, age, and tenure. A striking difference pertains to white collar workers, who have significantly lower absence rates when compared to production workers in private organizations but are largely indistinguishable from blue collar workers in two of the public organizations and we even estimate a positive coefficient for white collar workers in Holstebro municipality. This is intriguing and alludes to profound sector differences for this group of employees.

We can estimate fixed-effects models for Hospitalsenheden Vest (the hospital) and the Royal Danish Police. In the fixed-effects regressions for the Hospitalsenheden Vest all explanatory variables are insignificant; for the police only the age variables are significant and exhibit a convex relationship with absence. As for the private-sector organizations, the individual fixed effects are highly significant (p-value of zero).

Table 4. Absence regressions, public sector

	Herning municipality	Holstebro municipality	Hospitalsenheden Vest[x]		Royal Danish Police	
	OLS	OLS	OLS	FE	OLS	FE
Woman	2.541***	3.173***	3.293***		5.163***	
	(0.607)	(0.650)	(0.458)		(0.324)	
Age	0.483***	0.504***	0.765***	-0.213	0.410***	-0.642**
	(0.165)	(0.153)	(0.103)	(0.632)	(0.120)	(0.290)
Age squared	-0.005***	-0.005***	-0.007***	0.010	-0.002	0.014***
	(0.002)	(0.002)	(0.001)	(0.009)	(0.002)	(0.003)
Tenure	0.276**	0.343**	0.526***	-	0.227***	-
	(0.111)	(0.136)	(0.080)		(0.055)	
Tenure squared	-0.009***	-0.011***	-0.015***	-	-0.006***	-
	(0.003)	(0.004)	(0.002)		(0.002)	
Blue collar	-	-	-	-	-	-
White collar	-0.088	1.286**	-2.335***	-	0.686*	1.730
	(0.598)	(0.621)	(0.428)		(0.411)	(4.667)
Manager	-5.347***	-4.748***	-6.460***	-	-5.013***	-1.554
	(1.348)	(1.189)	(0.962)		(0.335)	(1.609)
F-statistic on FEs				2.284		4.218
p-value				0.000		0.000
# observations	7,146	5,299	17,564	17,564	50,768	50,768
R-squared	0.013	0.022	0.039	0.566	0.039	0.635

Note: Significance levels: *** 1 percent, ** 5 percent, * 10 percent. All regressions control for the same set of covariates as in Table 1. [x] The sample is reduced by 486 observations due to missing information on tenure.

Table 5 presents the decomposition of absence. Similar to our findings for the private organizations, the variance in individual fixed effects is substantially higher than the variance produced by observable characteristics in the public organization. In fact, individual fixed effects appear even more important in public organizations, with variance ratios of 7.2 and 7.5.

When the mean of absence and the variance in individual fixed effects are broken down by employee groups, the hospital resembles the findings from the private organizations (Table 6). White collar workers in the police break the conventional pattern by having the highest mean of absence in the organization and also the highest variance in the individual fixed effects.

Table 5. Variance decomposition, public sector

	Variance					Covariances		
	A_{it}	α_i	$\beta' X_{it}$	$\gamma' Z_{it}$	ε_{it}	$(\alpha_i, \beta' X_{it})$	$(\alpha_i, \gamma' Z_{it})$	$(\beta' X_{it}, \gamma' Z_{it})$
Hospitalsenheden Vest	676.28	395.37	54.60	0.26	293.63	-33.77	0.11	-0.12
Royal Danish Police	562.83	385.19	51.13	4.06	205.26	-37.36	-3.70	-0.36

Note: The decomposition is based on the regressions presented in Table 4.

Table 6. Absence rates and fixed effects by employee group

	Mean	Variance	Observations
	A_{it}	α_i	
Hospitalenhed Vest			
Managers	5.67	394.95	615
White collar	6.73	335.15	8,641
Blue collar	10.46	450.85	8,308
Royal Danish Police			
Managers	7.45	353.06	6,511
White collar	15.25	505.35	8,081
Blue collar	10.51	354.95	36,171

Note: Fixed effects obtained from the regressions in Table 4.

6.3 Absence and employee sorting and selection

Above we identified individual fixed effects as a main determinant for absence, while individual characteristics and organizational variables were less important. In the following we focus on the remaining two components of the labor supply equation (4), namely the relation between absence and promotions and employee turnover. We use the following multinomial logit models to establish such a relationship:

$$\Pr(Destination_{it \to t+1} = j) = \Lambda\left(\alpha_j + \rho_j A_{it} + \beta_j' X_{it} + \gamma_j Z_{it}\right), \qquad (7)$$

where all variables and parameters are as in (5) but where the parameters are indexed by destination state j. ρ_j is the effect of absence (A_{it}) on the probability of moving to a particular destination j. We use $j = \{1: Separation, 2: Stay, \ 3: Promotion\}$. "Separation" is split into "Dismissal" and "Quit" when possible.

The multinomial logit results are presented in Table 7 for the four organizations where estimation is possible. In all organizations absence is linked to employee turnover. In the organization where separations can be split into dismissal and quit the coefficients are of similar magnitude. In three

organizations we can estimate the effect of absence on promotion and for two of the companies we find a negative effect of absence on the probability of promotion.

Table 7. Multinomial logit (length of absence)

	Chr. Hansen	Novozymes	Velux	Police
Dismissal	0.018**	-		
	(0.008)			
Quit	0.015***			
	(0.005)			
Separation		0.008***	0.017***	0.018***
		(0.002)	(0.002)	(0.007)
Stay	-	-	-	-
Promotion		-0.030**	-0.092**	0.007*
		(0.015)	(0.037)	(0.004)
Controls	YES	YES	YES	YES
# observations	2,996	20,651	10,542	36,460
R-squared	0.057	0.069	0.159	0.253

Note: Significance levels: *** 1 percent, ** 5 percent, * 10 percent. All regressions control for the same set of covariates as in Table 1.

Table 8. Multinomial logit (being in top 1% in a given year)

	Chr. Hansen	Novozymes	Velux	Police
Dismissed	1.540**	-		
	(0.778)			
Quit	1.381***			
	(0.471)			
Separation		0.659***	1.544***	3.271***
		(0.205)	(0.216)	(0.169)
Stay	-	-	-	-
Promotion		-1.314	2.283*	0.960
		(1.017)	(1.277)	(0.997)
Controls	YES	YES	YES	YES
# observations	2,996	20,651	10,303	36,460
R-squared	0.055	0.073	0.159	0.243

Note: Significance levels: *** 1 percent, ** 5 percent, * 10 percent. All regressions control for the same set of covariates as in Table 1.

One concern could be that the effects are non-linear and only extreme cases of absence influence sorting and selection. For this reason, we reestimate the model where "absence" is replaced by a dummy for having "absence in the top 1 percent in the organization in a given year." The results are presented in Table 8 and they mirror the earlier results from Table 7. This is also the case when we consider absence in the top 5 or 10 percent (not shown). Hence, there is a clear link between absence and employee turnover and some evidence that absence also is linked to promotion decisions.

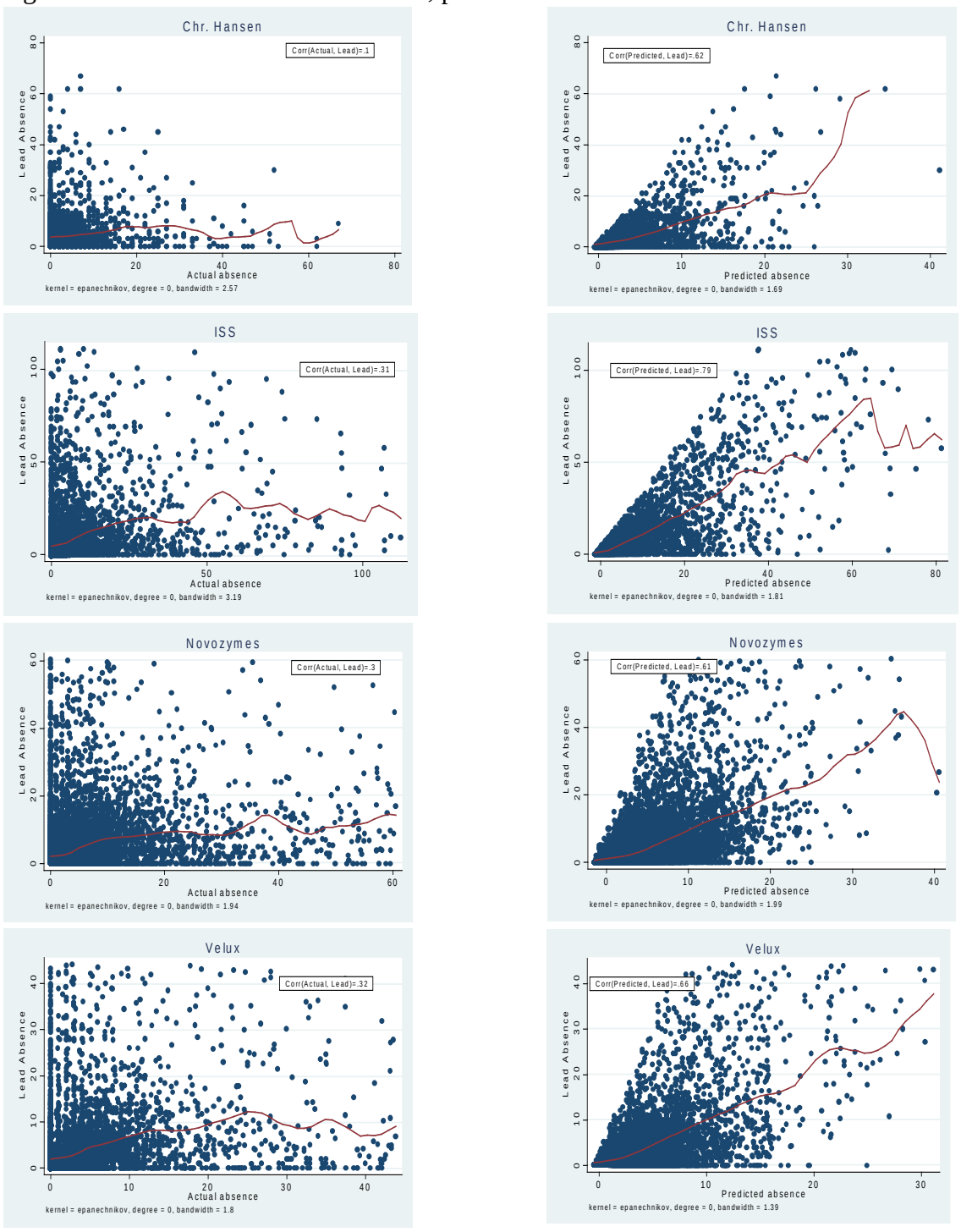
7. Implications

Our empirical analysis indicates that absence is a complicated issue to handle. In contrast to classical models of employee attendance, such as Steers and Rhodes (1978), who stress the importance of individual and organizational characteristics in shaping employees' motivation to attend work, we show that absence is a much more individualized phenomenon. This means that general HR initiatives aimed at specific groups of employees (such as women or senior employees) will have a limited effect on employee absence.

One illustrative example is production workers in ISS, who have a mean yearly absence of 10.59 days. In the fixed-effects regression for ISS there are no significant observable variables but a substantial variance in the individual fixed effects of 1221.45 (std. dev of 34.94). Hence, within this group of production workers some are rarely absent while others have substantial absence rates, and such absence rates cannot be identified through observable characteristics. This implies that in a company like ISS it will be ineffective to target a given group of employees defined by certain characteristics. Instead the organization needs to work on the distribution.

A direct approach to reducing absence is to define a cut-off point where absence is perceived as being incompatible with continued employment. There are indications in our data that such policies are already installed in the companies that we study, as high levels of absence are associated with higher levels of turnover (quits and dismissals). A less extreme policy is for companies to pay particular attention to individuals in the critical part of the absence distribution. For instance, MacLean (2008) shows that return-to-work interviews can reduce the level of absence. Managers as role models has also been emphasized in this process (Nieuwenhuijsen et al. 2004; Kristensen et al. 2006; Løkke Nielsen 2008).

Figure 3. Correlations between absence, predicted absence and lead absence



Employees in the "extreme" part of the absence distribution can be identified by using information on lagged absence. In Figure 3 column 1 we show scatter plots of actual absence in year t and lead absence (year t+1) for the private organizations. These autocorrelations are between 0.1 and 0.32, but typically 0.3. An alternative is to make use of the fixed-effects model. Predicted absence from

this model (column 2) correlates more highly with lead absence (0.61 to 0.79). Hence, future absence is predicted better using our statistical toolbox rather than direct information on absence.

An alternative to focusing on the upper part of the absence distribution is to target the mean. For instance, Green, Savin, and Savva (2013) discuss how working conditions can influence absence rates; Martocchio and Judge (1995) and Rentsch and Steel (2003) argue for cultural influences on absence rates. Looking across production workers in the private-sector companies we study, average yearly absence rates range from 5 days to 10 days. The work content clearly differs across those employees and consists of providing services such as cleaning for some and working in production or a laboratory for others. Whether variation in working conditions or absence culture can explain such differences in yearly absence means is unclear, and our study has little to offer on this issue. However, it is interesting to see that the gaps and ranking of absence across firms also exist for white collar workers (2.5 to 7 days) and managers (1 to 6 days), where job content likely is more similar across organizations.

The result that absence is linked to incentives provided through career concerns (promotions) is intriguing. Earlier research has analyzed the relationship between hours of work and promotions (Landers et al. 1996; Gicheva 2013; Frederiksen et al. 2018). Our work adds to this literature by linking an alternative measure of labor supply (or lack thereof) to promotions. In this context it is important to recognize the profound difference between hours worked and absence: workers exhibit flexibility through overtime hours, while workers induce problems for the firms through absence as they stay away from planned tasks.

8. Conclusion

Private and public organizations experience significant employee absence, which drives a wedge between contractual and actual work hours and disrupts the production process. In this paper we show large differences in absence rates within and between organizations. However, in contrast to the seminal paper by Steers and Rhodes (1978), who argue that individual and organizational characteristics determine absence rates, we find that absence is an individualized phenomenon, where variation in absence within employee groups clearly exceeds variation between employee groups.

Because absence is to a large extent individualized, it is inefficient for companies to target employees based on observable characteristics such as gender or age, as there is much variation in absence within such groups. A better approach is to have policies that focus on the critical part of the absence

distribution or on shifting the overall mean. Importantly, we demonstrate that the HR Analytics toolbox is useful for making better predictions about future absence, and hence can be used to improve decisions when policies are implemented.

An intriguing result is that absence is linked to the way organizations sort and select employees. Our results show that an individual's absence rate influences quits, dismissals, and promotions. Hence, an interesting area of future research is to establish how broader company policies that are typically used for other purposes such as inducing effort or creating career incentives for workers interact with employee absence.

References

Farber HS (1999) Mobility and stability: the dynamics of job change in labor markets. *Handbook of Labor Economics* 3(B):2439–2483.

Frederiksen A, Kato T, Smith N (2018) Working Hours and Top Management Appointments: Evience from Linked Employer-Employee Data. IZA DB # 11675.

Gicheva D (2013) Working long hours and early career outcomes in the high-end labor market. *J.. Labor Econ.* 31(4):785–824.

Green LV, Savin S, Savva N (2013) Nursevendor problem: personnel staffing in the presence of endogenous absence. *Manage. Science* 59(10):2237–2256.

Johns G (2008) Absence and presenteeism: not a work or not working well. Barling N, Cooper CL, eds. The *SAGE Handbook of Organizational Behavior, Vol. 1: Micro Approaches* (SAGE, London), 160–177).

Kristensen K, Juhl HJ, Eskildsen JK, Frederiksen N, Møller-Bisgaard C (2006) Determinants of absence in a large Danish bank. *Int. J. Hum. Resour. Man.* 17(9):1645–1658.

Landers RM, Rebitzer JB, Taylor JL (1996) Rat race redux: adverse selection in the determination of work hours in law firms. *Am. Econ. Rev.* 86:329–348.

Lund T, Labriola M (2009) Sickness absence in Denmark—research, results, and reflections. *Scand. J. Work Env. Hea.* 7:5–14.

Løkke Nielsen A-K (2008) Determinants of absence in a public organization: a unit-level analysis of work absence in a large Danish municipality. *Int. J. Hum. Resour. Man.* 19(7):1330–1348.

MacLean ADB (2008) The management of absence: why it matters: an analysis of absence management issues, with a case study based in a UK academic library. *Library Management* 29(4/5):392–413.

Martocchio JJ, Judge TA (1995) When we don't see eye to eye: discrepancies between supervisors and subordinates in absence disciplinary decisions. *J. Manage.* 21(2):251–278.

Mas A, Moretti E (2009) Peers at work. *Am. Econ. Rev.* 99(1):112–145.

Nieuwenhuijsen K, Verbeek JHAM, de Boer AGEM, Blonk RWB, van Dijk FJH (2004) Supervisory behaviour as a predictor of return to work in employees absent from work due to mental health problems. *Occup. Environ. Med.* 61:817–823.

Rentsch JR, Steel RP (2003) What does unit-level absence mean? Issues for future unit-level absence research. *Hum. Resour. Manage. Rev.* 13:185–202.

Steers RM, Rhodes SR (1978) Major influences on employee attitudes: a process model. *J. Appl. Psychol.* 53(4):391–407.

Appendix A: The eight organizations.

Chr. Hansen A/S is a global bioscience organization with headquarters in Denmark that develops natural ingredient solutions for the food, nutritional, pharmaceutical, and agricultural industries.[3] Chr. Hansen has more than 2,800 employees in 30 countries. In our analysis we make use of all employees in Denmark and our dataset covers the years 2012 to 2016. Chr. Hansen A/S uses September-to-September reporting, so we make use of the four years of (January-to-January) data from 2013 to 2016 for consistency. Our dataset contains 4,813 employee-year observations, 1,203 employees on average per year, and 1,796 unique individuals across years. When analyzing the data we split the employees into the three groups: Production (43.53%), white collar (40.76%), and managers (15.71%). Production workers are typically process operators and technicians.

ISS A/S is a world-leading facility service operator.[4] Worldwide it has more than half a million employees. The data we have available contains absence observations from 2014 to 2016 for Danish employees. We limit the dataset to employees working at least 1,000 hours (corresponding to roughly 20 hours a week or more). This gives us a total of 14,507 employee-year observations, 4,833 employees on average per year, and 7,989 unique individuals in total. We split the employees into production (82.90%), white collar (10.13%), and managers (6.98%). Production workers at ISS A/S work mainly as cleaners and security personnel.

Novozymes A/S produces a wide range of industrial enzymes and microorganisms.[5] In 2016 there were 6,441 employees at Novozymes A/S. The absence data covers the years 2007 through 2016 for Danish employees. We have access to 25,336 employee-year observations with an average of 2,533 employees per year and 4,528 unique individuals across all years. Similar to the other organizations we divided the sample into production (50.34%), white collar (39.96%), and managers (9.70%). Production workers at Novozymes A/S are typically laboratory personnel and other skilled workers.

Velux A/S is a world-leading producer of roof windows with more than 10,000 employees.[6] The corporate facilities are located in Denmark but production is spread across 9 countries. In our analysis we make use of all employees in Denmark, and our dataset covers the years 2010 to 2013 and, after an update, also 2015 and 2016. The data consists of a total of 16,903 employee-year observations, 2,817 employees on average per year, and 4,516 unique individuals in total. When analyzing the data

[3] https://www.chr-hansen.com/en
[4] https://www.dk.issworld.com/
[5] https://www.novozymes.com/en
[6] http://www.velux.com/

we split the employees into three groups: production (45.89%), white collar (47.04%), and managers (7.07%). Production workers at Velux A/S work on the production floor.[7]

Hospitalsenheden Vest is a regional hospital located in Mid-Western part of Denmark (covering Herning, Holstebro, Lemvig, Ringkøbing and Tarm) providing public health care service to the population in the western part of Denmark.[8] Our dataset covers the years 2010 to 2013 and contains a total of 18,050 employee-year observations, an average of 4,512 employee per year, and 6,178 unique individuals across all years. When analyzing the data we split the employees into three groups: health care personnel (will be referred to as blue collar) (47.46%), white collar (49.13%), and managers (3.41%). The health care personnel comprise nurses, occupational therapists, etc. Physicians are grouped with white collar.

Herning municipality is located in the mid-western part of Denmark and has 88,386 inhabitants.[9] Our dataset covers the year 2013 and contains 7,146 observations. When analyzing the data we split the employees into three groups: "blue collar" (48.32%), "white collar" (48.26%), and managers (3.41%). Blue collar workers are defined as individuals that work less than 37 hours (public definition of full time in Denmark). Meanwhile, white collar employees work full time or more and are not managers. Managers are reported as managers in the dataset.

Holstebro municipality neighbors Herning municipality and has 58,125 inhabitants.[10] As for Herning we have data from 2013, which contains 5,299 observations. When analyzing the data we split the employees into three groups: "blue collar" (45.95%), "white collar" (50.18%), and managers (3.87%). These are defined similar to those of Herning municipality.

The Royal Danish Police comprises the entire Danish police force.[11] Our dataset covers the years 2010 to 2013 and contains a total of 50,768 employee-year observations, an average of 12,692 employees per year, and 14,255 unique individuals across all years. When analyzing the data we split the employees into three groups: police officers (71.25%), white collar (15.92%), and managers

[7] In Velux and some of the other organizations we can identify a highly heterogeneous residual group of employees ranging from specially trained employees and lawyers to interns and temp workers. In all cases they are separated out and omitted from analysis.
[8] http://www.vest.rm.dk/
[9] The number of inhabitants are as of 2017, and the sources are: http://www.herning.dk/ and http://www.statistikbanken.dk/BY1 .
[10] The number of inhabitants are as of 2017, and the sources are: https://www.holstebro.dk/Default.aspx and http://www.statistikbanken.dk/BY1 .
[11] https://www.politi.dk/en/servicemenu/home/

(12.83%). Police officers (will be referred to as blue collar) are operational personnel directly involved in day-to-day police affairs.