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Economic incentives and gender differences in work absence behavior

Göran Broström, Per Johansson and Mårten Palme*

Summary

■ We estimate a labor supply model on a random sample of Swedish male and female blue-collar workers to study the effect of economic incentives on work absence behavior. Work absence is observed for each day during 1990 and 1991 for each worker in the sample. An exogenous change in the cost of being absent due to a reform of the sickness insurance, which took place during the time period covered by the data, is used as identifying information. The empirical analysis is focused on explaining gender differences in work absence behavior. We find that about one third of this difference in our sample can be attributed to differences in the costs of being absent.■

JEL classification: C41, J22, J28, H53.
Keywords: Worker absenteeism, survival analysis, Cox proportional hazard models, stratified Cox regression.

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The large fluctuations in the work absence rate in most European countries in recent decades have attracted considerable attention. Most workers, in most countries, are covered by some form of sickness insurance, regulated by labor market legislation.[1] As a result, the coinsurance in these insurance schemes, and the extent to which economic incentives affect work absence in general, have been scrutinized in the public policy debate.[2] The impacts of the unemployment rate and the business cycle on health and work-absence behavior in general have also been discussed extensively. A further issue that has been considered in the literature is that on average, females have a higher work-absence rate as compared to men. This is regarded as a more or less "stylized fact" in empirical studies on worker absenteeism (see e.g. VandenHeuvel and Wooden, 1995; or Vistnes, 1997). Can this gender difference in observed work-absence behavior be explained by differences in economic incentives for being absent, preferences or differences in health and work environment?

To gain an understanding of this issue, we examine microdata from a sample of 1,396 blue-collar workers obtained from the Swedish Level of Living Survey (LNU) matched with information on work absence for each day during the years 1990 and 1991. The data on work absence were obtained from registers of actual transactions compiled by the National Social Insurance Board.

Two important policy changes, which radically altered the cost and benefits underlying workers' work absence decision, took place during the time period covered by the data. First, as of March 1, 1991, the

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[1] See Kangas (1991) for an international overview.

[2] See Lantto (1991) for a theoretical analysis of the coinsurance in the sickness insurance.

replacement rate was decreased from 90 percent of the labor earnings below the social security ceiling to 65 percent for the first three days of a sickness spell, to 80 percent from day 4 to day 89, and remained unchanged at 90 percent after day 90. Second, an income tax reform, whereby marginal tax rates were drastically reduced, was implemented on January 1, 1991.

The effect of economic incentives on work absence has been studied in a number of papers (see e.g. Allen, 1981a; Barmby, Orme and Treble, 1996; or Henreksson and Persson, 2004). In particular, two previous papers, Johansson and Palme (1996, 2002) analyze the effect of economic incentives generated by the Swedish compulsory sickness insurance on work absence. As in this study, a labor supply model is used to derive the empirical specification of work absence. There are, however, several differences, both in the empirical focus and methodology, between these papers and the present study. Here, we focus on gender differences in work absence behavior. This, however, requires that the effect of economic incentives—and also work environment, health status and macroeconomic conditions—on work absence is measured in a first step.

Our general finding is that economic incentives, through the cost of being absent, matter for work-absence behavior. About one third of the male-female difference in work absence can be attributed to differences in economic incentives to be present at work. The remaining two thirds cannot be explained by observable characteristics. Our interpretation of this result is that most of the gender difference in work absence behavior is due to intrinsic gender behavioral differences, which supports previous findings by e.g. Paringer (1983) and Nilsson (2001). Paringer (1983) uses the observation from Sindelar (1982) that women invest more in their health, to explain more frequent female work absence spells.

The paper is organized as follows. In Section 1, we briefly describe the sickness insurance and income taxes in Sweden. Section 2 specifies the economic model and presents the estimation procedures. The data are described and analyzed non-parametrically in Section 3. Section 4 reports the results from the estimates of the econometric models and Section 5 concludes.

1. Sickness insurance and income taxes in Sweden

Sweden has a compulsory sickness insurance scheme.[3] Benefits are financed by general taxation and replace earnings due to temporary health problems that prevent the insured worker from doing his regular job. Sickness insurance is administrated by local insurance offices. Since it is very hard to judge whether a worker is able to perform his regular job, monitoring against abuse is very light during the first six days in a sickness spell. However, a certificate from a physician is required to be entitled to sickness insurance payments as of the seventh day in a spell.

The replacement rate, i.e. the share of labor earnings paid to the worker by the insurance, has changed on several occasions in recent years. In the major reform covered by our longitudinal data—on March 1, 1991—the replacement level was decreased from 90 percent of labor earnings below the social security ceiling[4] from the first day in a sickness spell, to 65 percent the first three days in a spell and 80 percent from day four to day 89.

An insured worker's economic incentives for being absent from work may also depend on income taxes. Sweden has an integrated income tax system. Taxes are paid to both the national and local governments. The national government determines the tax base for both taxes. The local tax is proportional and determined by each of Sweden's 288 local governments, although some income redistribution does take place between high- and low-income municipalities. In 1991, the local government tax rate varied between 26.9 and 33.5 percent.

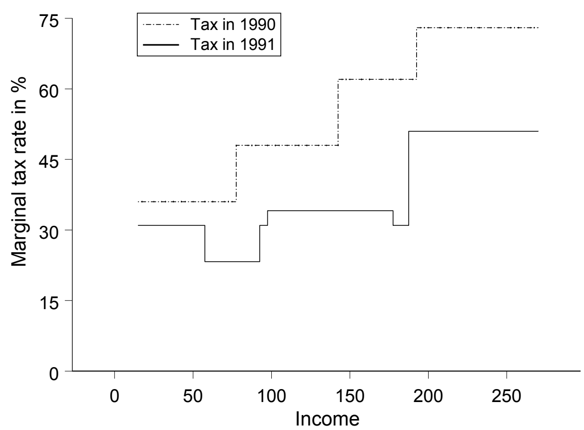
Sweden's income tax system underwent a radical change after the tax reform in 1991. The first year of our data thus covers the pre-reform system and the second year pertains to the post-reform system. This tax reform encompassed three fundamental changes. First, from being unified in the pre-reform tax system, the tax base was divided into labor and capital income. Second, the marginal tax rates were substantially reduced. Figure 1 shows the relation between tax-

[3] For a more detailed description of the sickness insurance, see Johansson and Palme (2002).

[4] In 1995, about 6.7 percent of all insured workers had labor earnings above the social security ceiling (see, National Social Insurance Board, 1997). For a description of the construction and indexation of the social insurance ceiling, see Palme and Svensson (1998).

able income and marginal tax rates under the pre- and post-reform income tax regimes, respectively. For the calculations underlying the figure, the local government tax rate is set at 31 percent. As can be seen, the highest marginal tax rate was reduced from the local government tax rate plus a 42 percent national tax rate (with a maximum set at 75 percent in a combined marginal tax rate) to a 20 percent national tax rate in addition to the local government tax. It is also evident from Figure 1 that most full-time wage earners, in the income interval between 70,000 and 170,000 Swedish kronor (SEK), did receive substantial reductions in their marginal tax rates. In the post-reform regime, the marginal tax rate decreased in some income intervals because the basic deduction was made income dependent, i.e., it rises with income in some intervals and decreases in others.

Figure 1. Marginal tax rates in the pre- and post-1991 Swedish income tax reform regimes (taxable income in thousands of SEK)



Finally, the third main component of the tax reform was a substantial increase in child and housing allowances. The child allowance, which varies with the number of children, independent of the parents' income, was increased by about one third. For example, the child allowance for the first child in a family was increased from SEK 6,720 to SEK 9,000 per year. The housing allowance is means tested. The amount is determined by the individual's earnings two years before he or she actually receives the allowance payment, and by his or her housing costs. The magnitude of the increase in the housing allowance was about the same as that for the child allowance.

2. Modeling and estimation

2.1. General specification

The effect of economic incentives on work-absence behavior has been examined in several empirical and theoretical studies (see e.g. Barmby, Orme and Treble, 1996; Barmby and Sibly, 1999; Johansson and Palme, 1996, 2002). These studies analyze different costs of absence from work. In Sweden, as in most other industrialized countries with a compulsory sickness insurance, the direct cost of being absent corresponds to the share of daily earnings not covered by the sickness insurance.

To define the cost and virtual income[5] variables, let us first define the worker's daily budget set. Let L_j represent leisure time on day j, where L_j consists of two components: contracted leisure time, t_j^l and time in work absence t_j^a (that is, $L_j = t_j^l + t_j^a$). Assume that the contracted leisure time is fixed over the time period studied (two years), i.e., $t_j^l \equiv t^l$. The daily budget constraint can then be defined as

$$x_j + (1-\delta_j)w_j t_j{}^a = w_j t^c + R_j \,,$$

where x_j is daily consumption, t^c the contracted number of daily working hours, R_j income from sources other than labor, w_j the net hourly wage and δ_j the share of the income the worker receives when absent. Assuming that the worker maximizes utility,[6] it is straightforward to obtain the following general demand function for time absent

$$\tau_j{}^a = f(t^c, c_j, \mu_j, \mathbf{s}_j, \varepsilon_j, Dur_j)\,,$$

where Dur_j denotes the duration in the present spell (in either work or work absence), $c_j = w_j(1-\delta_j)$ and $\mu_j = R_j + t^c w_j \delta_j$ are the cost and

[5] The income received when absent from work.

[6] The utility function is weakly separable in goods, services and leisure time and the maximization is conditional on the duration in the present spell.

virtual income of being absent, respectively; $\mathbf{s}_j$ is a vector of observable characteristics and ε_j captures unobservable personal characteristics and random errors.

As a local approximation, let the conditional demand function on day j in a spell of absence or work be linear, hence

$$\tau_j^{\alpha} = \boldsymbol{q}_j \boldsymbol{\alpha} + \gamma_j + \theta + \eta_j,$$

where $\boldsymbol{q}_j = (t^c, c_j, \mu_j, \boldsymbol{s}_j)$ is a row vector, $\boldsymbol{\alpha}$ a (column) parameter vector, γ_j a duration parameter, θ represents unobservables and η_j is a random error, i.e. $\varepsilon_j = \theta + \eta_j$. Assuming η_j to be complementary log-log, the probability of being absent on day j is

$$\lambda_j = 1 - \exp\left(-\exp\left(\gamma_j + \boldsymbol{q}_j \boldsymbol{\alpha} + \theta\right)\right), j = 1, \ldots, T,$$

where $T = 730$, i.e. the maximum length of a spell in our sample.

Differences in preferences for absence and difficulties in measuring secondary costs[7] of being absent are two possible causes of unobserved heterogeneity, represented by θ in the model. This heterogeneity may, in turn, be correlated with both c and μ.

Efficiency wage theory predicts that an employer may pay an employee somewhat more than the market wage in order to elicit the employee not to shirk. Some work absence may be interpreted as a form of shirking. Jobs differ in terms of the cost of absenteeism for the employer (see e.g. Weiss, 1985), that is, it may be profitable for an employer to pay some employees more in order to give them incentives which prevent them from being absent from work.

There might also be compensating wage differentials for the option of being absent from work. Jobs that enable a worker to be absent will, other things equal, have a lower wage rate.[8]

Preferences for work-absence are most likely affected by a worker's health status. It is an empirical fact that, on average, workers with bad health have a higher work-absence rate than workers without health problems. For some jobs, it is reasonable to assume that

[7] This is the cost of being absent in addition to the direct cost; such as a lower probability of being promoted and an increased probability of losing one's job and foregone on-the-job training.

[8] Allen (1981b) examines, and finds some support for, this hypothesis empirically.

workers with bad health are less productive and therefore earn less than those with a good health status.

Some differences in preferences for work absence may not primarily be driven by health differences. An individual with strong preferences for work absence will, on average, during his or her career, be absent more hours. If there are economic returns to on-the-job training, such individuals will, everything else equal, earn less.

2.2. Empirical specification and estimation

We use two different estimators: (i) the exact maximum likelihood estimator of the discrete time Cox regression model (see e.g. Kalbfleich and Prentice, 1980, Chapter 4), and (ii) the stratified partial maximum likelihood estimator (see e.g. Lancaster, 1990, Chapter 9.2.10). Both these estimators allow for state dependent work absence behavior (utilities), i.e., the absence probability on a particular day depends on whether the worker was absent the day before and for how long he or she has been in that state. The difference between the two estimators is how they consider time-invariant individual heterogeneity. In the discrete time Cox regression model, it is modeled using a rich set of covariates and in stratified estimator, it is handled as a fixed effect.

For the first estimator, the heterogeneity is made a function of observed covariates, thus $\theta_i^k = \mathbf{x}_i \boldsymbol{\varphi}^k$, $k = WA$ and W, where $\mathbf{x}_i = (\mathbf{CIV}_i$, AGE_i, $\mathbf{HEALTH}_i$, $\mathbf{WENV}_i$, $\mathbf{CONTR}_i)$; **CIV** is a row vector of indicators for marital status and the number of dependent children; AGE is the individual's age;[9] **HEALTH** is a row vector of indicator variables measuring different aspects of the individual's health status; **WENV** is a row vector of indicator variables measuring the individual's work environment; and **CONTR** is a row vector of variables measuring employer monitoring.

[9] One way of measuring differences in the cost of forgone on-the-job training, is to use the well-known result from human capital theory (see Willis, 1986) that the benefits of on-the-job training are higher if such training takes place relatively early in the worker's career, as the wage increase due to improved skills is earned for a longer period of time. The cost of work absence owing to forgone on-the-job training is thus likely to be inversely related to a worker's age. This result cannot be used empirically, however, since a worker's health is also likely to depend on age, which, in turn, affects his preferences for work absence. Therefore, it is not possible to identify the differences in costs of work absence owing to general health depreciation by age.

The employer has several means of contributing to a lower frequency of work absence. These include direct monitoring as well as pay schemes that provide incentives for the worker to be present. Our data set contains some information that can be used to measure differences in employers' level of monitoring which are contained in the **CONTR** vector. These include whether there is a time-clock at the workplace, CLOCK, whether the worker has flexible working hours, FLEX, and, finally, whether it is important to be on time, INTIME. In the Cox regression model we include, inter alia, the monthly unemployment rate in the county. If the unemployment rate is relatively high on the local labor market where the worker is active, the worker's cost of losing his job is likely to be relatively high; the search cost of finding a new job is, on average, higher in labor markets with a high unemployment rate.

For several institutional reasons, the work-absence rate differs between different days of the year. Therefore, a "**DAY**-vector" containing several different indicator variables is also included in the Cox model. Since weekends are not included in the regular work schedule for most workers, there is a clear "weekday-pattern" when work-absence spells begin and end. Therefore, a weekday factor (Monday, Tuesday,...,Sunday) and an indicator variable for Public holiday[10] are included in the specification.

There is anecdotal evidence suggesting that work absence is higher on days between public holidays and Saturdays (or Sundays if there happens to be only one day between the public holiday and the weekend). To allow for such an effect, and indeed to test if it is supported by data, we include a dummy variable, "Between holidays", which is one for days between public holidays and weekends. Finally, although an insured worker is entitled to compensation on holidays, it is an empirical fact that most workers do not use that possibility. To control for that, an indicator for the month during which most industrial workers are on vacation, "month of vacation", is included.

[10] Seven days for each year.

3. Data and descriptive statistics

3.1. Data sources and measurement

We use the 1991 Swedish Level of Living Survey (LNU). LNU is a microdata set that contains information compiled from interviews as well as official public registers for a random sample of about 6,000 individuals. This survey is described in detail in Fritzell and Lundberg (1994). Data on the dependent variable, absence from work, were obtained from the National Social Insurance Board by matching with the LNU sample.

The definition of work absence is that an individual is compensated by the compulsory sickness insurance system on a particular day. As the data were collected from registers of actual payments to insured individuals, it is likely that there will be much less measurement errors as compared to self-assessed data. However, if we define work absence as time during which an employee is absent from work without prior agreement with the employer (such as holidays), then a small fraction of work absence is not likely to be included in the sickness insurance data.[11]

We restricted the sample to blue-collar workers aged between 20 and 64 who were employed during 1991 (the year of the survey). The final sample consisted of 1,396 individuals (738 males and 658 females). The motive for restricting the population to blue-collar workers was to limit the heterogeneity arising from differences in sickness insurance schemes. Swedish white-collar workers often have negotiated schemes whose rules cannot be obtained from the available data. Table A in the Appendix provides descriptive statistics on all variables included in our analysis.

Measuring the two variables for economic incentives encompassed by the econometric model, the cost of being absent (c) and the virtual daily income from being absent (μ), involves several steps. We began by calculating the hourly real wage rate. First, we computed the income from labor a worker would have received had he or she not been absent from work during 1990 and 1991 (potential income from labor), i.e., we added the share of income not covered by sickness insurance for each day the worker was absent during the year. Data on income from labor were compiled from tax registers matched with

[11] According to one survey, the amount was 2.9 percent in 1986 (SAF, 1986).

the LNU survey. It was then straightforward to calculate the cost of being absent from work using the pre- and post-reform replacement levels in the insurance schemes, respectively. Then, we calculated and deducted income taxes from the potential income. Finally, we used the number of hours of work stated by the worker in the 1991 LNU pertaining to 1990 to obtain the hourly wage rate.[12]

We calculated virtual income as the daily income received from sickness insurance when a worker is absent from work. Moreover, we added observed labor income for the spouse if a worker is married as well as family income from capital, child and housing allowances. Data on all these components were obtained from tax registers matched with the LNU survey.

3.2. Description of spells of work and work absence

Figures 2-5 show Kaplan-Meier estimates of the survival function for work-absence spells as well as work spells by different classifications.[13] The survival function shows the probability of remaining in either work or absence for a specific time or longer. The (daily) differences in the survival function in work and absence, measure the exit rate to absence and work, respectively. When commenting the graphs, we will often use exit rates (or incidence of exit to work absence), i.e. discuss the gradient of the survival functions.

The first panel in Figure 2 displays the survival functions in work for males and females. Although the difference is very small, this panel discloses that the graph for the male sub-sample exceeds the graph for the female sub-sample. This difference reflects the fact that women have a higher incidence to work absence. The second panel in Figure 2 displays the work absence survival function for males and females. Both survival functions in this panel show a similar pattern: a steep decrease until day seven, followed by a relatively flat segment. This clear-cut pattern is due to legislation, whereby a certificate from a physician is required after day seven in a work-absence spell. Moreover, the exit rate for females is higher during spells of up to five days as compared to males. For longer spells, the survival functions are quite similar.

[12] We thus assume that the worker does not change his or her regular hours of work between 1990 and 1991.

[13] The Kaplan-Meier (Kaplan and Meier, 1958) procedure is a non-parametric estimator of the survival function in the presence of censored observations (i.e. cases for which work absence or work have not yet occurred or been recorded).

Figure 2. Kaplan-Meier non-parametric estimates of duration of work spells (panel 1) and work-absence spells (panel 2); men and women, respectively

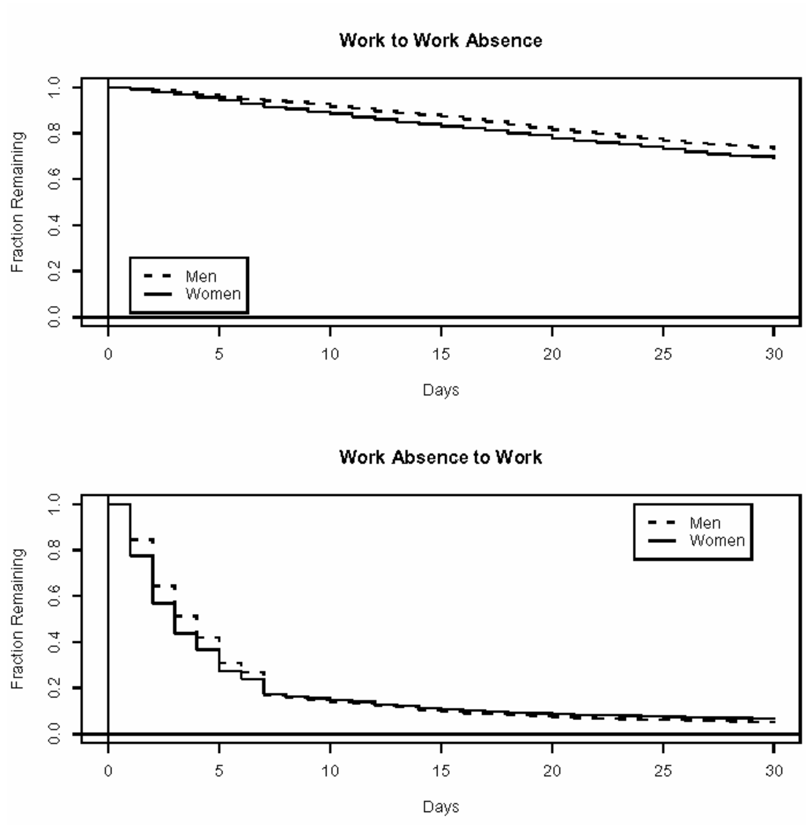


Figure 3 shows the effect of the 1991 reform of the sickness insurance system on the work-absence behavior. The first two panels in Figure 3 display the effect on survival in work for men and women, respectively. The incidence of work absence decreased markedly after the reform. It can also be seen that women changed their behavior somewhat more than men.

The third and fourth panels of Figure 3 show that the exit rate to work increases somewhat during the first five or six days for both men and women. After that, the relation is reversed; the work-absence spells tend to become longer. To some extent, these changes in the shape of the survival function correspond to the changes in economic incentives implied by the reform, in the sense that the largest decrease in the replacement level of sickness insurance, i.e., the greatest increase in the cost of being absent, pertains to the first three days of an absence spell. Both genders seem to react very similarly to the reform.

The survival functions of individuals with different health status are shown in Figure 4. Those with bad health are defined as having at least one indication of a health problem among 13 indicator variables used to characterize health differences among the individuals in the sample (see Tables A.1 and A.2 for definitions as well as descriptive statistics of these variables). About 21.1 percent of the individuals in the sample meet the definition of bad health (19.8 percent among the women and 22.4 percent among the men).

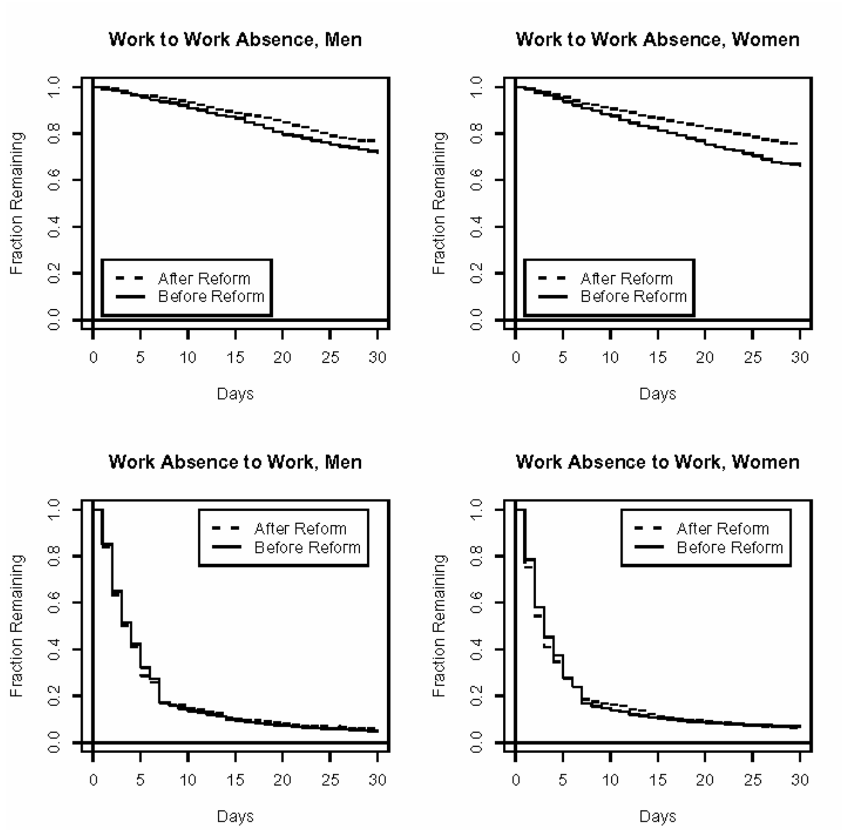
The first and second panels of Figure 4 show that workers with a bad health status have a somewhat higher incidence to work absence. The difference is very similar for men and women. The third and fourth panels indicate that the exit rates to work for individuals with good health are always higher than the exit rates for those in bad health. Men with bad health exhibit a much lower exit rate than men with good health. The difference in exit rates is smaller for women. As regards long absence spells, however, the difference between men and women is very small.

The effects of poor working conditions are explored in Figure 5. The strategy used to define bad health was also applied to poor working conditions. In the case of work environment, 97.2 percent of the sample (96.8 percent among the women and 98 percent among the men) are defined as having poor working conditions, i.e., with at least one indication of poor working conditions among the 13 indicator variables used to define individual differences in the work environment.[14]

The survival functions with respect to work spells for females and males are given in panels 1 and 2. As expected, the incidence to work absence for women working in a poor environment is larger than for those in a good environment. However, no effect was found in the male sample; the third and fourth panels of Figure 5 show that the exit rates to work are very similar for both good and poor working conditions.

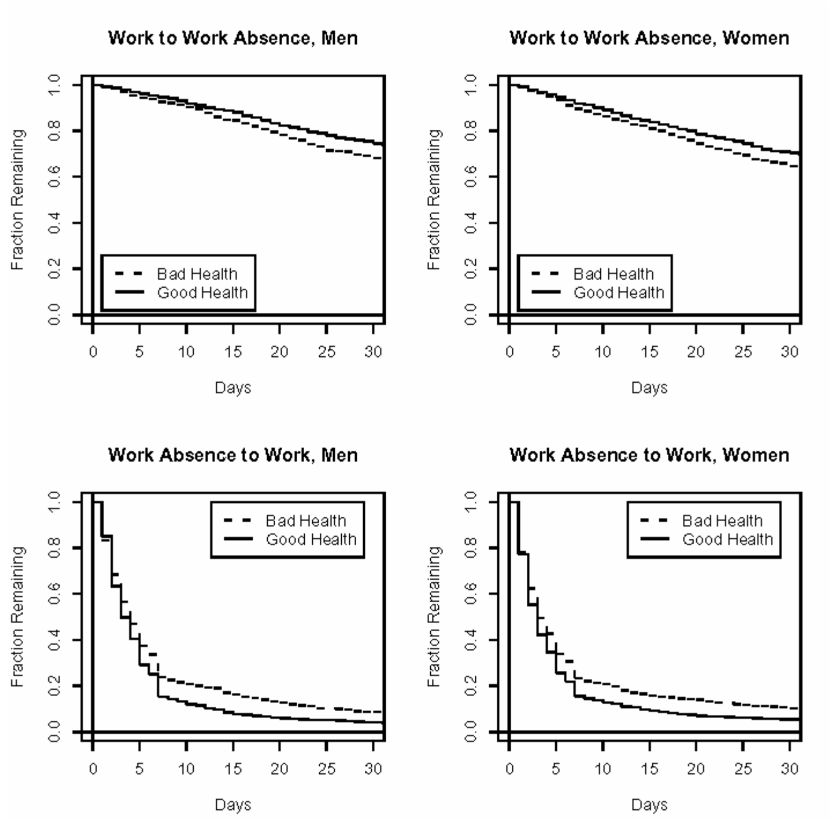
[14] Figure 5 should be interpreted with caution since only 39 individuals (21 females and 18 males) had no indication of poor working conditions.

Figure 3. Kaplan-Meier non-parametric estimates of the effect of the March 1991 reform of the sickness insurance system on work-absence behavior



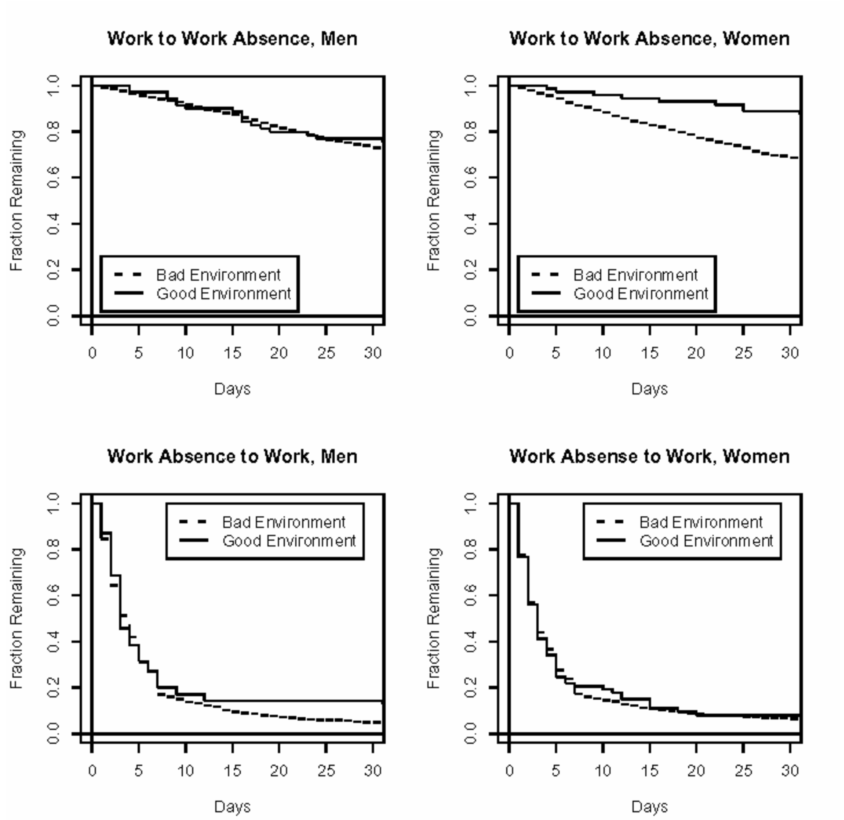
Notes: Duration of work spells for males (panel 1); duration of work spells for females (panel 2); duration of work-absence spells for males (panel 3); duration of work-absence spells for females (panel 4).

Figure 4. Kaplan-Meier non-parametric estimates of the effect of health status on work-absence behavior



Notes: Duration of work spells for males (panel 1); duration of work spells for females (panel 2); duration of work-absence spells for males (panel 3); duration of work-absence spells for females (panel 4).

Figure 5. Kaplan-Meier non-parametric estimates of the effect of work environment on work-absence behavior



Notes: Duration of work spells for males (panel 1); duration of work spells for females (panel 2); duration of work-absence spells for males (panel 3); duration of work-absence spells for females (panel 4).

4. Results

The results from the discrete time Cox regression models (henceforth: discrete time model) are shown in Tables 1 and 2. Table 1 reports the results for the incidence of work absence, and Table 2 the corresponding ones for the exit rate to work. Two different specifications were estimated: one with the full set of covariates and another with the same covariates as those used in the stratified analysis. The results from the stratified analysis, for both the work and the work absence spells, are reported in Table 3.

Table 1. Results from the discrete time Cox hazard regression model for the incidence of work absence (transition from work to absence)

	Males				Females			
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
c (cost of being absent)	-0.03	0.00	-0.03	0.00	-0.02	0.00	-0.03	0.00
μ (virtual income)	-0.06	0.00	-0.11	0.00	0.02	0.14	-0.04	0.00
Unemployment	-0.01	0.76	-0.02	0.45	-0.02	0.36	-0.03	0.19
Tuesday	-0.02	0.75	-0.02	0.76	0.10	0.11	0.10	0.11
Wednesday	-0.27	0.00	-0.27	0.00	-0.01	0.93	-0.01	0.93
Thursday	-0.63	0.00	-0.63	0.00	-0.32	0.00	-0.32	0.00
Friday	-1.97	0.00	-1.97	0.00	-1.30	0.00	-1.30	0.00
Saturday	-2.52	0.00	-2.51	0.00	-2.10	0.00	-2.10	0.00
Sunday	0.42	0.00	0.42	0.00	0.39	0.00	0.39	0.00
Public holiday	-0.21	0.05	-0.21	0.05	-0.22	0.03	-0.21	0.04
"Between holidays"	-1.06	0.00	-1.06	0.00	-0.61	0.03	-0.59	0.04
Month of vacation	-0.62	0.00	-0.60	0.00	-0.75	0.00	-0.72	0.00
t^c (contracted daily working hours)	0.00	0.78			0.01	0.04		
Unmarried	-0.10	0.11			-0.17	0.01		
Divorced	0.26	0.00			0.23	0.00		
One child	-0.13	0.04			-0.05	0.35		
Two children	-0.27	0.00			-0.17	0.01		
Three children	-0.12	0.28			-0.26	0.01		
Four children	-0.45	0.04			-0.28	0.21		
Five children	-0.38	0.46			-1.01	0.08		
Six children	-0.14	0.73						
Age	-0.01	0.00			-0.01	0.00		
DISAB	0.77	0.00			0.90	0.00		
NOISE1 (noisy environment)	-0.04	0.58			0.30	0.00		
NOISE2 (noisy environment)	0.11	0.02			0.05	0.31		
SMOKE (exposed to gas, dust or smoke)	0.06	0.22			0.28	0.00		
SHAKE (exposed to strong shaking or vibrations)	0.09	0.12			-0.12	0.42		
POISON (exposed to gas, dust or smoke)	0.04	0.41			-0.02	0.82		
LIFT (heavy lifting)	-0.13	0.01			0.14	0.01		
HARD (work is physically exhausting)	-0.01	0.80			0.01	0.86		
SWEAT (work causes daily sweating)	0.28	0.00			0.04	0.44		
EXHM (work is mentally exhausting)	-0.14	0.00			-0.01	0.77		

Table 1. Continued….

	Males				Females			
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
STRESS (work is stressful)	0.03	0.46			-0.06	0.17		
REP (work is repetitive)	0.25	0.00			0.06	0.22		
MOM (monotonous movements)	0.05	0.29			-0.06	0.19		
UBP (unpleasant body positions)	0.14	0.00			0.18	0.00		
RISK1 (SIR, work accidents)	0.00	0.01			0.00	0.30		
RISK2 (SIR, work-related diseases)	0.00	0.02			0.00	0.43		
FLEX	0.02	0.59			-0.07	0.15		
CLOCK	0.07	0.09			0.05	0.32		
INTIME	0.13	0.01			0.04	0.48		
STRUMA					0.32	0.01		
TBC (tuberculosis)	0.91	0.00			0.50	0.32		
HEART (heart problems)	0.31	0.06			0.75	0.00		
HBLOOD (high blood pressure)	0.13	0.09			0.16	0.06		
ULCER (gastric ulcer)	0.10	0.38			0.32	0.01		
HEMORR (haemorrhoids)	0.31	0.00			0.11	0.27		
PREGNANT (difficult pregnancy)					0.21	0.05		
HERNIA	-0.17	0.48			-0.17	0.72		
VAV (varicose veins)	0.35	0.00			0.08	0.31		
MENTAL (mentally ill)	0.02	0.95			-1.29	0.03		
CANCER	0.07	0.71			-0.03	0.88		
DIABETIC	0.02	0.90			0.51	0.00		
NEURO (neurological illness)	0.13	0.54			-0.62	0.05		

Table 2. Results from the discrete time Cox hazard regression model for the exit rate from absence (transition from absence to work)

	Males				Females			
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
c **(cost of being absent)**	0.01	0.19	0.01	0.22	0.00	0.85	0.00	0.54
μ **(virtual income)**	0.02	0.28	0.00	0.89	-0.03	0.02	-0.05	0.00
Unemployment	0.01	0.57	0.01	0.56	0.01	0.82	0.01	0.61
Tuesday	0.04	0.58	0.04	0.60	0.19	0.01	0.20	0.01
Wednesday	0.03	0.71	0.03	0.72	0.22	0.00	0.23	0.00
Thursday	-0.17	0.03	-0.17	0.03	0.12	0.10	0.12	0.10
Friday	1.02	0.00	1.01	0.00	1.02	0.00	1.02	0.00
Saturday	-0.95	0.00	-0.97	0.00	-0.71	0.00	-0.72	0.00
Sunday	0.30	0.00	0.30	0.00	0.40	0.00	0.40	0.00
Public holiday	-0.06	0.61	-0.10	0.38	-0.11	0.36	-0.09	0.47
"Between holidays"	0.04	0.86	-0.01	0.95	0.01	0.98	-0.01	0.95
Month of vacation	-0.21	0.01	-0.19	0.02	-0.23	0.01	-0.22	0.02
t^c **(contracted daily working hours)**	0.00	0.68			0.00	0.27		
Unmarried	1.04	0.49			-0.01	0.93		
Divorced	1.00	0.98			-0.06	0.45		
One child	-0.01	0.82			-0.04	0.41		
Two children	-0.04	0.56			-0.07	0.25		
Three children	0.16	0.12			-0.14	0.13		
Four children	0.16	0.39			-0.49	0.02		
Five children	0.53	0.25			-1.04	0.08		
Six children	-0.23	0.54						
Age	-0.01	0.00			-0.01	0.00		
Disabled	-0.59	0.00			-0.36	0.00		
Noisy environment 1	0.18	0.00			-0.07	0.37		
Noisy environment 2	0.07	0.12			-0.05	0.26		
Exposed to gas, dust or smoke	-0.03	0.45			0.02	0.62		
Exposed to strong shaking or vibrations	-0.18	0.00			-0.14	0.32		
Exposed to gas, dust or smoke	-0.04	0.41			0.22	0.01		
Heavy lifting	0.05	0.23			0.02	0.72		
Work is physically exhausting	0.01	0.87			0.01	0.76		
Work causes daily sweating	-0.07	0.11			-0.11	0.01		
Work is mentally exhausting	-0.01	0.89			0.11	0.01		
Work is stressful	0.04	0.37			-0.07	0.07		
Work is repetitive	0.03	0.47			-0.06	0.16		
Monotonous movements	-0.16	0.00			-0.05	0.26		

Table 2. Continued….

	Males				Females			
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
Unpleasant body positions	0.03	0.52			-0.07	0.11		
SIR, work accidents	0.00	0.91			0.00	0.64		
SIR, work-related diseases	0.00	0.56			0.00	0.50		
FLEX (flexible working schedule)	-0.03	0.50			-0.14	0.00		
CLOCK (use of time clock)	-0.04	0.36			-0.21	0.00		
INTIME (important to be on time)	-0.01	0.90			-0.03	0.51		
STRUMA	0.79	0.31			-0.02	0.90		
TBC (tuberculosis)	0.48	0.11			-0.46	0.36		
HEART (heart problems)	-0.20	0.21			-0.47	0.01		
HBLOOD (high blood pressure)	-0.11	0.13			-0.30	0.00		
ULCER (gastric ulcer)	-0.01	0.90			-0.11	0.36		
HEMORR (haemorrhoids)	0.12	0.21			0.08	0.38		
PREGNANT (difficult pregnancy)					-0.26	0.01		
HERNIA	-0.23	0.27			-0.71	0.07		
VAV (varicose veins)	-0.14	0.13			-0.02	0.76		
MENTAL (mentally ill)	-0.36	0.16			-0.01	0.98		
CANCER	-0.68	0.00			-0.28	0.15		
DIABETIC	-0.17	0.31			-0.31	0.03		
NEURO (neurological illness)	0.13	0.51			0.07	0.80		

Table 3. Results from the stratified analysis

	Males				Females			
	Exit from abs.		Incidence		Exit from abs.		Incidence	
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
***c* (cost of being absent)**	0.01	0.35	-0.03	0.00	0.01	0.06	-0.03	0.00
μ (virtual income)	0.00	0.95	0.00	0.92	-0.01	0.84	0.03	0.27
Unemployment	-0.04	0.29	0.00	0.95	-0.12	0.01	0.06	0.18
Tuesday	0.02	0.84	0.01	0.95	0.19	0.04	0.11	0.19
Wednesday	-0.04	0.69	-0.21	0.02	0.24	0.01	-0.13	0.14
Thursday	-0.23	0.02	-0.58	0.00	0.15	0.12	-0.33	0.00
Friday	1.27	0.00	-2.06	0.00	1.24	0.00	-1.31	0.00
Saturday	-1.14	0.00	-2.77	0.00	-0.63	0.00	-2.14	0.00
Sunday	0.03	0.77	0.42	0.00	0.27	0.01	0.36	0.00
Public holiday	-0.14	0.39	-0.20	0.14	-0.33	0.06	-0.29	0.02
“Between holidays”	-0.23	0.45	-0.54	0.16	-0.12	0.68	-0.54	0.09
Month of vacation	-0.22	0.06	-0.82	0.00	-0.23	0.06	-0.86	0.00

4.1. Time-varying covariates

The results show that the cost of absence from work has a significant negative impact on the incidence of work absence for both men and women in all three models. The magnitude of the estimates is also very similar.

The effect of cost on exit from absence is much weaker. The only significant coefficient estimate (at the 10 percent level) is for females in the stratified model. The estimate in this model is, as expected, positive.

Contrary to what is predicted by the economic model, the estimates for the virtual income variable are significantly negative in both specifications of the discrete time models for the male sub-sample. In the stratified model, however, these are insignificant, that is, the results from the discrete time models could have been caused by unobserved heterogeneity. The same pattern emerges in the female sub-sample, although the estimate for virtual income is only significant in the specification without controls for observed heterogeneity. For the hazard from absence, the virtual income variable is insignificant in all specifications except for women in the discrete time model, where the estimated coefficients are negative (as expected).

According to the discussion in Section 3, we expect a positive (negative) coefficient for the unemployment rate on the exit rate from (incidence of) work absence. The only significant parameter estimate is for the female sample in the stratified model, where—contrary to expectations—the estimate in the model for the exit rate from absence is negative.[15]

The effects of weekdays (with Monday as the reference), public holidays, "between holidays" and "month of vacation" are very similar for all estimators. The incidence to work absence is the highest for Sundays, i.e., most sickness spells begin on a Monday. Thereafter, the incidence is (almost) monotonously decreasing until Saturday, which is exactly as expected. The results for the exit rate to work show that an individual is less likely to leave a spell on a Saturday. This is because most workers do not work on Sundays.

[15] This result differs from those generally obtained on aggregate data (see e.g. Lantto and Lindblom, 1987; Dyrstad and Ose, 2002; or Arai and Skogman Thoursie, 2004. The results obtained by Bäckman, 1998, do not support an inverse relation between work absence and unemployment). However, as noted by Johansson and Palme (2002), the relation between unemployment and absence has a somewhat different interpretation when micro data are used in the empirical analysis.

The results also indicate that work-absence spells are less likely to begin during public holidays, days between work-free days ("between holidays") and during the month of vacation. The results for the "between holidays" coefficient provide no support for the anecdotal evidence that work absence is higher for such days. However, the fact that some workers use vacation days and that some employers give their employees an extra day off on days between holidays and/or work-free days may counteract an increased rate of work absence due to the abuse of the insurance schemes that may also be inherent in the data.

4.2. Time-invariant covariates

The expected effect of contracted number of hours of work, t^c, is that more contracted hours of work lead to a higher rate of work absence. This is also found in our female sub-sample: the estimate is significantly positive for the incidence of work absence. The result indicates a difference between the gender groups in this respect.

Two sets of variables were used to describe differences in family composition: indicators for being unmarried, single or divorced ("married" is the omitted category) and indicators for number of children ("no children" is the omitted category). In interpreting the negative coefficient estimates for several of the "number of children" indicators, it should be kept in mind that, in Sweden, the care of dependent children while ill is covered by a separate insurance, with a somewhat higher replacement level for most insured workers, i.e., the result can be driven by abuse of this scheme.

The coefficient estimates of the age variable are significantly negative for both men and women in the exit from absence model, indicating that older workers on average have longer work-absence spells. In the work state, the coefficient estimates for the age variable are still negative for both men and women, indicating that older workers on average have fewer work-absence spells. One interpretation of these results is that they simply reflect differences in preferences between older and younger workers. They could, however, also be related to selection over time: workers with high preferences for being absent either exit the labor force or remain in long work-absence spells, as time evolves. Workers with low preferences for being absent will then constitute a larger share of the older workers in the work state.

We used 14 different health indicators. Each of these measures a specific health problem except DISAB, which indicates whether a permanent physical handicap prevents a worker from taking all possible jobs. Descriptive statistics and a short description of each of these variables are given in Table A1 in the Appendix. The health indicators are jointly significant (at all reasonable levels of risk) for both states and genders. In addition, several health indicators are individually significant. This tells us that health status is, as expected, an important determinant of differences in preferences for absence from work.

We have included two different types of measures of work environment: 13 subjective measures of workplace characteristics and two occupation-specific measures of risk exposure (SIR—standardized incidence ratios) for work accidents and work-related diseases, respectively.

When interpreting the effects of the work environment variables on absence from work, it should be kept in mind that these results are likely to be affected by the selection of physically (or mentally) strong workers into demanding jobs—the so-called "healthy worker effect" (see e.g. Östlin, 1989). The negative estimate from the incidence of work absence model for "jobs with heavy lifting" (LIFT) and "mentally exhaustive jobs" (EXHM) for men can be interpreted as a result of selection. However, several work characteristics, such as jobs with "unpleasant body positions" (UBP) for both men and women and "contact with smoke" (SMOKE) for women, seem to increase work absence, i.e. they are significantly positive in the incidence of work absence model.

The coefficient estimates for the CLOCK and INTIME indicator variables have the opposite sign from what was expected. INTIME is significant for men in work spells and CLOCK is significant for women in work absence. A possible explanation for these results is that time clocks are primarily used when other forms of monitoring are not feasible, e.g. in large firms. These results indicate that other types of monitoring are likely to be more efficient in decreasing the rate of work absence. They might also reflect the fact that unplanned work absence may be recorded more easily when a time clock is punched. The parameter estimates may therefore indicate that the measures of work absence do not in fact include all forms of unscheduled absence from work.

4.3. Overall male-female differences

The male-female difference in work absence behavior has emerged as a "stylized fact" from empirical research on work absence. The estimated models can be used to analyze to what extent the differences in observable characteristics can explain the observed behavior. This analysis is based on the comparison of the effect of subsets of variables included in the model on the predicted mean duration of work or work absence (see Broström, Johansson and Palme, 2002, for details on estimation of the mean from a censored sample). In addition, this exercise gives a measure of the economic significance of the estimated effects, since gender differences in observed characteristics can easily be studied by the reader.

Given the parameter estimates from the discrete time model and the average covariates for males and females, we calculate the predicted mean durations in work and work absence. We then calculate counterfactual mean durations for females and males in the following manner. The covariates for the subgroup, *k*, of covariates are interchanged between females and males. The difference between the predicted mean duration and the counterfactual mean duration (from using the covariates of the opposite gender) is then estimated. This difference is denoted $\Delta^m(k)$ and $\Delta^f(k)$ for males and females, respectively. If $\Delta^q(k) < 0$, $q = m, f$, this implies an increasing exit rate to work absence or work from interchanging subgroup *k* covariates.

Male workers are predicted to have on average 11.5 days longer work spells than female workers, while only 0.3 days shorter work absence spells. Hence, the result that female workers, on average, have a higher absence rate can be attributed to more frequent, rather than longer, absence spells. We will therefore concentrate the analysis on the gender differences in the frequencies of the absence spells.

Table 4 shows the results of the comparison for six different groups of variables. The second row shows that if the females had the male mean cost of being absent, the mean duration of the work spell would increase by 3 days (from 85 to 88 days). If, on the other hand, the males had the female mean cost, the male mean duration would decrease by 4 days (from 96.5 to 92.5 days). Since the estimates of the parameters for the cost of being absent are very similar for males and females,[16] this difference is due to the average higher cost for males of being absent.

Row 3 shows that a decrease in contracted labor time for males from 38.94 to 33.92 would prolong the transition to work absence by

[16] This is true also for the results of the stratified model.

one day[17] while an increase in the contracted labor time for females from 33.92 to 38.94 would shorten the transition to work absence by 1.5 days. That is, interpreting this as a counterfactual result, the male-female difference in work absence behavior would have been even larger if female workers had had the same average number of hours of work as the male workers.

Table 4. The mean difference (in days) in hazards to work absence[a]

Group of variables	$\Delta^m(k)$	$\Delta^f(k)$
Personal characteristics	2	-2
Cost of being absent	-4	3
Contracted hours of work	1[b]	-1.5
Work environment	9	-11.5
Health status	-0.5	-0.5
Secondary cost	-0.0	-0.5

Notes: [a] When performing the experiment of using the means of the observed variables for females in the male equation $\left(\Delta^m(k)\right)$ and the mean of the male characteristics in the female equation $\left(\Delta^f(k)\right)$, respectively. [b] This parameter was not significant in the Cox regression model.

The results on work environment go in the same direction: men are, on average, exposed to inferior work environments as compared to women and using male covariates in the female equation again exaggerates the differences in work absence. One should, however, be careful in making a causal interpretation of this result. It is likely that workers with a strong health select themselves into physically demanding jobs (the so-called "healthy worker effect"). If such an effect is present, it would result in a negative bias of the causal effect of work environment on work absence.

Finally, Table 4 shows that male-female differences in health status seem to have very little effect on observed behavior.

To sum up, out of the total difference of 11.5 days in the predicted number of days in work , we found that about 4 can be explained by differences in the cost of being absent. All other observable characteristics work in the other direction, i.e., using the male characteristics in the female equation enlarges the difference. This means that most of the observed difference in male-female work absence behavior can be

[17] Note, however, that this parameter is insignificant for the male subsample.

attributed to gender differences in unobserved characteristics, i.e., intrinsic differences in work absence behavior.

5. Conclusions

Like a number of previous papers on work absence, this study supports the view that economic incentives affect work absence behavior. It is shown that differences in costs of being absent can explain about one third of the observed male-female difference in the frequency of work absence spells. This, in turn, implies that a smaller gender wage gap would decrease the differences in the observed work absence behavior between men and women.

Another interesting result is that women seem to be more sensitive to exposure to bad working conditions in their work absence behavior. A somewhat related result, which is supported in the theoretical model, is that the contracted number of hours of work affects work absence. The results of the predictions indicate that the gender differences in work absence would have been greater if women, on average, had worked the same number of hours as males.

Finally, our results also show that most of the male-female difference in work absence behavior cannot be explained by differences in the characteristics included in the estimation. Given these detailed characteristics, the background to this result is likely to be intrinsic differences in male-female work absence behavior. This implies that the compulsory sickness insurance with a premium more or less proportional to the insured income will redistribute income from men to women as compared to an insurance market where the insurer is able to price discriminate between male and female workers. This would apply even if the economic incentives to be present at work were the same for men and women.

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Appendix

Table A.1. Descriptive statistics, all individuals in the data set, males and females

Variable	Mean	Std. Dev.	Mean	Std. Dev.
	Males (n =738)		Females (n=658)	
Number of days absent 1990	27.15	58.05	32.58	65.46
Number of days absent 1991	27.40	65.25	34.19	71.99
Personal Characteristics				
MARR (married)	0.70	0.46	0.75	0.43
DIV (divorced)	0.05	0.22	0.10	0.30
AGE	39.33	11.90	41.29	11.89
DISAB (disabled)	0.03	0.16	0.03	0.16
NRCH (number of children under 16)	0.65	1.00	0.71	0.99
Economic Incentives				
c (cost of being absent 1990)	3.93	0.94	3.50	0.88
c (cost of being absent 1991)	16.09	4.27	14.90	4.47
μ (virtual income 1990 (10^2))	5.68	1.49	6.15	1.64
μ (virtual income 1991 (10^2))	4.19	1.19	4.66	1.58
t^c (contracted daily working hours)	38.94	4.11	33.92	7.51
Work Environment				
NOISE1 (noisy environment)	0.18	0.38	0.05	0.22
NOISE2 (noisy environment)	0.44	0.50	0.23	0.42
SMOKE (exposed to gas, dust or smoke)	0.35	0.48	0.17	0.38
SHAKE (exposed to strong shaking or vibrations)	0.15	0.35	0.02	0.13
POISON (exposed to gas, dust or smoke)	0.16	0.37	0.04	0.21
LIFT (heavy lifting)	0.35	0.48	0.16	0.36
HARD (work is physically exhausting)	0.59	0.49	0.61	0.49
SWEAT (work causes daily sweating)	0.38	0.49	0.29	0.45
EXHM (work is mentally exhausting)	0.32	0.47	0.47	0.50
STRESS (work is stressful)	0.60	0.49	0.68	0.47
REP (work is repetitive)	0.25	0.44	0.26	0.44
MOM (monotonous movements)	0.49	0.50	0.56	0.50
UBP (unpleasant body positions)	0.61	0.49	0.55	0.50
RISK1 (SIR, work accidents)	1623.50	1038.55	924.70	865.38
RISK2 (SIR, work-related diseases)	1871.80	1013.15	615.78	455.87

Table A1. Continued….

Variable	Mean	Std. Dev.	Mean	Std. Dev.
	Males (n =738)		Females (n=658)	
Health Status				
STRUMA	0.00	0.05	0.02	0.14
TBC (tuberculosis)	0.00	0.05	0.00	0.04
HEART (heart problems)	0.02	0.13	0.01	0.08
HBLOOD (high blood pressure)	0.08	0.27	0.07	0.25
ULCER (gastric ulcer)	0.03	0.16	0.02	0.14
HEMORR (haemorrhoids)	0.04	0.19	0.05	0.22
PREGNANT (difficult pregnancy)	0.00	--	0.93	0.25
HERNIA	0.01	0.10	0.00	0.06
VAV (varicose veins)	0.03	0.17	0.08	0.27
MENTAL (mentally ill)	0.00	0.06	0.01	0.08
CANCER	0.01	0.11	0.01	0.10
DIABETIC	0.02	0.14	0.01	0.10
NEURO (neurological illness)	0.01	0.07	0.00	0.07
Secondary cost				
Monthly county unemployment rate 1990	1.66	0.65	1.60	0.60
Monthly county unemployment rate 1991	3.18	0.75	3.10	0.72
FLEX (flexible working schedule)	0.65	0.48	0.69	0.46
CLOCK (use of time clock)	0.43	0.49	0.28	0.45
INTIME (important to be on time)	0.75	0.43	0.83	0.38